



ENVIRONMENTAL STATEMENT: 6.1 CHAPTER 8: MARINE BIODIVERSITY

Cory Decarbonisation Project

PINS Reference: EN010128

April 2025

Revision B

QUALITY CONTROL

Document Reference		6.1			
Document Owner		Cory Environmental Holdings Limited			
Revision	Date	Comments	Author	Check	Approver
Revision A	March 2024	-	JV	MH/SH	JW
Revision B	April 2025	Updated to account for errata (as requested by the Examining Authority)	RB	SH	JW

TABLE OF CONTENTS

8. MARINE BIODIVERSITY	1
8.1. Introduction	1
8.2. Policy, Legislation, and Guidance	1
8.3. Consultation and Engagement	17
8.4. Assessment Methodology and Significance Criteria	41
8.5. Study Area.....	50
8.6. Baseline Conditions and Future Baseline	52
8.7. Embedded Design, Mitigation and Enhancement Measures.....	80
8.8. Assessment of Likely Significant Impacts and Effects.....	84
8.9. Additional Design, Mitigation and Enhancement Measures	127
8.10. Monitoring	128
8.11. Residual Effects	128
8.12. Limitations and Assumptions.....	142
8.13. References.....	143

TABLE

Table 8-1: Marine Biodiversity Summary of Key Policy, Legislation, and Guidance	1
Table 8-2: Marine Biodiversity Consultation and Engagement Summary.....	18
Table 8-3: Summary of the Statutory Consultation Comments in relation to Marine Biodiversity	20
Table 8-4: Marine Biodiversity Definitions of Impact Magnitude Classes	45
Table 8-5: Marine Biodiversity Definitions of Receptor Importance and Sensitivity	46
Table 8-6: Significance of Effects Matrix	50
Table 8-7: Marine Biodiversity Zones of Influence.....	51
Table 8-8: Classifications of WFD Biological Quality Elements, Thames Middle Transitional WFD Water Body	54
Table 8-9: Intertidal Benthic Survey Results.....	57
Table 8-10: Subtidal Benthic Ecology and Sediment Survey Results.....	63
Table 8-11: Protected Fish Species Present within the Thames Estuary ”	71
Table 8-12: Environment Agency TraC Fish Survey Data from Woolwich 4-11-2022 and West Thurrock 2018.....	74

Table 8-13: Results from the Spring and Autumn Beam Trawls in 2023 showing the number of individuals of each species recorded.	76
Table 8-14: Marine Biodiversity – Summary of Residual Effects	129

8. MARINE BIODIVERSITY

8.1. INTRODUCTION

8.1.1. This chapter reports the assessment of the likely significant effects of the Proposed Scheme on marine biodiversity during construction and operation and describes:

- relevant policy, legislation and guidance;
- consultation undertaken to date;
- the methodology for assessment;
- potential effects of the construction phase; and
- potential effects of the operation phase.

8.2. POLICY, LEGISLATION, AND GUIDANCE

8.2.1. The policy, legislation, and guidance relevant to the assessment of marine biodiversity for the Proposed Scheme is detailed in **Table 8-1**.

Table 8-1: Marine Biodiversity Summary of Key Policy, Legislation, and Guidance

Policy, Legislation or Guidance	Description
Policy	
Overarching National Policy Statement (NPS) for Energy EN-1 2024¹	<p>This Overarching National Policy Statement for Energy (EN-1) is part of a suite of NPS designated by the Secretary of State of DESNZ in January 2024.</p> <p>Paragraph 4.5.1 of the policy notes that <i>“Marine Plans apply in the ‘marine area’, which is the area from mean high water springs to the seaward limit of the Exclusive Economic Zone (EEZ). The ‘marine area’ also includes the waters of any estuary, river or channel, so far as the tide flows at mean high water spring tide”</i>.</p> <p>Paragraph 4.6.2 highlights that <i>“Biodiversity net gain is an essential component of environmental net gain. Projects in England should consider and seek to incorporate improvements in natural capital, ecosystem services and the benefits they deliver when planning how to deliver biodiversity net gain”</i>.</p> <p>Although achieving biodiversity net gain is not currently an obligation for projects under the Planning Act 2008 (and not expected to be the case until at least November 2025), energy NSIP proposals should seek opportunities to contribute to and enhance the natural environment by providing net gains for</p>

Policy, Legislation or Guidance	Description
	<p>biodiversity where possible. Biodiversity net gain should be applied in conjunction with the mitigation hierarchy and does not change or replace existing environmental obligations. Within the current metric, all habitats in the intertidal zone, or above the mean low water mark, would be eligible for enhancement for biodiversity net gain.</p> <p>Marine Plans set out marine specific aspects of many of the assessment principles in noise and vibration (Section 5.12) and water quality (Section 5.16) in the NPS. The NPS goes on to confirm that individual Marine Plans should be consulted to understand marine relevant specific considerations.</p>
National Planning Policy Framework (NPPF) 2024²	<p>The NPPF sets out the Government's planning policies for England and how these should be applied. The following paragraphs relate to marine biodiversity.</p> <p>Section 15 of the NPPF incorporates policies requiring that development impacts on both terrestrial and marine biodiversity are minimised.</p> <p>Paragraph 180 in Section 15 states that <i>"planning policies and decisions should contribute to and enhance the natural and local environment by:</i></p> <ul style="list-style-type: none"> • <i>"Minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;</i> • <i>Preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and</i> • <i>Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate".</i> <p>Paragraph 185. To protect and enhance biodiversity and geodiversity, plans should:</p> <ul style="list-style-type: none"> • <i>"Identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity; wildlife corridors and stepping stones that connect them; and areas identified by</i>

Policy, Legislation or Guidance	Description
	<p><i>national and local partnerships for habitat management, enhancement, restoration or creation; and</i></p> <ul style="list-style-type: none"> <i>Promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity”.</i> <p>Paragraph 186. When determining planning applications, local planning authorities should apply the following principles:</p> <ul style="list-style-type: none"> <i>“If significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;</i> <i>Development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to improve biodiversity in and around developments should be integrated as part of their design, especially where this can secure measurable net gains for biodiversity or enhance public access to nature where this is appropriate”.</i>
The London Plan 2021³	<p>The Spatial Development Strategy for Greater London setting out a framework for how London will develop over the next 20-25 years and the Mayor’s vision for Good Growth.</p> <p>Policies G1, G6, SI14 and SI17 of the London plan are the key policies specific to marine biodiversity within Greater London:</p> <ul style="list-style-type: none"> <i>Policy G1: Green Infrastructure – “...Green infrastructure should be planned, designed and managed in an integrated way to achieve multiple benefits. Boroughs should prepare green infrastructure strategies that identify opportunities for cross-borough collaboration, ensure green infrastructure is optimised and consider green infrastructure in an integrated way as part of a network”.</i> <i>Policy G6: Biodiversity and Access to Nature – “Boroughs, in developing Development Plans should use up-to-date information about the natural environment and the relevant procedures to identify SINC and ecological corridors to identify coherent ecological network...support the protection and conservation of priority species and habitats that sit outside the SINC network, and promote opportunities for enhancing the using Biodiversity Action Plans...seek opportunities to create other habitats, or</i>

Policy, Legislation or Guidance	Description
	<p><i>features such as artificial nest sites, that are of particular relevance and benefit in an urban context...ensure designated sites of European or national nature conservation importance are clearly identified and impacts assessed in accordance with legislative requirements...Development proposals should manage impacts on biodiversity and aim to secure net biodiversity gain. This should be informed by the best available ecological information and addressed from the start of the development process”.</i></p> <ul style="list-style-type: none"> • Policy SI14: Waterways - strategic role – <i>“Development Plans and development proposals should address the strategic importance of London’s network of linked waterways, including the River Thames, and should seek to maximise their multifunctional social, economic and environmental benefits”.</i> • Policy SI17: Protecting and enhancing London’s waterways – <i>“Development Plans should support river restoration and biodiversity improvements...Development proposals along London’s canal network, docks, other rivers and water spaces (such as reservoirs, lakes and ponds) should respect their local character, environment and biodiversity...Development Plans should identify opportunities for increasing local distinctiveness and recognise these water spaces as environmental, social and economic assets”.</i>
The Bexley Local Plan 2023⁴	<p>The Local Plan, adopted on 26 April 2023, positively plans for sustainable development in the Borough. It is essential to the delivery of the Council’s other key plans and strategies, including the Bexley Plan, the Growth Strategy and the Connected Communities Strategy. The key policies relating to marine biodiversity within the Borough are:</p> <ul style="list-style-type: none"> • SP8: Green infrastructure including designated Green Belt – <i>“Bexley’s green infrastructure, including open spaces and waterways will be protected, enhanced, restored and promoted as valuable resources to provide a healthy integrated network for the benefit of nature, people and the economy. Future development must support the delivery of a high-quality, well-connected and sustainable network of open spaces”.</i>

Policy, Legislation or Guidance	Description
	<ul style="list-style-type: none"> • SP9: Protecting and Enhancing Biodiversity and Geological Assets – which “seeks to ensure that the quantity of Bexley’s biodiversity is protected and enhanced, including avoiding adverse impacts from development on species and sites of nature conservation value”; and • DP19: The River Thames and the Thames Policy Area – the policy states that: <ul style="list-style-type: none"> – “Development proposals for riverside sites should investigate the potential for full or part realigned flood defences prior to commencement of site planning, and are required to: <ul style="list-style-type: none"> ~ follow the strategies for water management set out in the TE2100 Plan and subsequent updates; ~ enhance the relationship between the development site and the Thames; and, ~ contribute to the completion of the Thames Path, a continuous public riverside footpath and cycleway, including safeguarding existing or providing new access points to the riverside path. – The Council encourages improving the efficiency and promoting the sustainability of waterborne freight movements, including waste transfer and aggregates handling, on the Thames. Viable wharves are safeguarded for such uses through a Direction by the Secretary of State (SoS). – Proposals in the Thames Policy Area should pay attention to their impacts on the ecology of the River Thames, and on its priority habitats and protected species. Ecological enhancements will be sought from all proposals; development directly adjacent to the River should look to enhance essential fish habitats and reduce the risk of invasive species. – The Council will encourage improved access to nature across the Thames Policy Area. Opportunities should be sought to link proposed and existing wildlife corridors, including the Ridgeway Link, Thames Marshes corridor, Thamesmead Link and the River Thames itself, and integrating these networks with pedestrian and cycle paths where appropriate. – Habitat creation and enhancement will be promoted. Opportunities should also be sought for related enhancements to visitor’s centres and other facilities.

Policy, Legislation or Guidance	Description
	<p><i>Habitat creation along the Thames should aim to improve the area's flood resilience and water management."</i></p> <ul style="list-style-type: none"> • DP20: Biodiversity and Geodiversity in Developments – which presents the matters that proposed development must consider, including the mitigation hierarchy, biodiversity net gain, enhancement measures and opportunities to connect and improve the wider ecological networks, and wildlife corridors. It also states that development proposals that <i>"would have a direct or indirect impact on a site designated for its nature conservation or geological interest should protect and enhance the designated site's value, and will not be permitted unless all of the following criteria are met:</i> <ul style="list-style-type: none"> – <i>There are no reasonable, less damaging, alternative solutions, locations or sites;</i> – <i>Ecological buffer zones have been incorporated into the scheme, where appropriate, to protect and enhance the designated site's intrinsic value;</i> – <i>The continuity of wildlife habitat within wildlife corridors is maintained; and</i> – <i>Access to the designated site is not compromised and where possible, access and/or interpretation is improved".</i>
<p>London Environment Strategy 2018⁵</p>	<p>The London Environment Strategy and its appendices include aims relevant to marine biodiversity.</p> <p>By 2050, through green infrastructure the strategy states that <i>"London will be the world's first National Park City, where more than half of its area is green, where the natural environment is protected, and where the network of green infrastructure is managed to benefit all Londoners"</i> and greener outcomes under the strategy will be that <i>"All Londoners should be able to enjoy the very best parks, trees and wildlife. Creating a greener city is good for everyone – it will improve people's health and quality of life, support the success of businesses and attract more visitors to London"</i>. It states these aims would be achieved through one of four strategic approaches, specifically that of <i>"green infrastructure and natural capital accounting"</i>.</p>

Policy, Legislation or Guidance	Description
	<p>Policy 5.2.1 is relevant to marine biodiversity “<i>Protect a core network of nature conservation sites and ensure a net gain in biodiversity</i>”. The relevant constituent Policy Proposals are:</p> <ul style="list-style-type: none"> • Proposal 5.2.1 “a <i>The London Plan includes policies on the protection of Sites of Importance for Nature Conservation (SINCs) and Regionally Important Geological Sites (RIGS)</i>”; • Proposal 5.2.1.b “<i>The Mayor will develop a biodiversity net gain approach for London, and promote wildlife-friendly landscaping in new developments and regeneration projects</i>”; and • Proposal 5.2.1.c “<i>The Mayor will provide guidance and support on the management and creation of priority habitats, the conservation of priority species, and the establishment of wildlife corridors</i>”. • Other relevant sections comprise Chapter 5 of the strategy covering habitat creation targets for London and Appendix 2 which contains a review of Priority habitats and Species within the London Biodiversity Action Plan.
The UK Post-2010 Biodiversity Framework 2012⁶	<p>The UK Post-2010 Biodiversity Framework covers the period from 2011 to 2020 and was developed in response to two main drivers: the Convention on Biological Diversity’s Strategic Plan for Biodiversity 2011-2020⁶, and its five strategic goals; and 20 ‘Aichi Targets’⁶. The targets set in this framework are still valid, even though the period has now elapsed. The Biodiversity Framework shows how the work of the four UK countries joins up with work at a UK level to achieve the ‘Aichi Targets’ and the aims of the EU Biodiversity Strategy. It identifies the activities required to complement each country’s biodiversity strategy, and where work in the country strategy contributes to international obligations.</p>
A Green Future: Our 25 Year Plan to Improve the Environment 2018⁷	<p>Released in 2018, the UK Government’s environment plan sets out goals for improving the environment within a 25 year timeframe. It details how the government will work with communities and businesses to achieve the goals, which include several of relevance to biodiversity including that wildlife and plants should thrive, resources from nature should be used more sustainably and efficiently, there should be mitigation and adaptation to climate change and that biosecurity should be enhanced.</p>

Policy, Legislation or Guidance	Description
Bexley Biodiversity Action Plan (BAP) 2011⁸	The Bexley BAP aims to achieve targets relevant to the London Borough of Bexley identified in both the UK and London BAP. The action plan lists habitats and species (including marine/estuarine habitat and species) within Bexley for which targets have been set to increase their range and distribution.
Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services 2011⁹	Biodiversity 2020 provides a comprehensive picture of how international and EU commitments are implemented in England and sets out the strategic direction for biodiversity policy for the next decade on land (including rivers and lakes) and at sea. This is the most up to date strategy dealing with England's Wildlife and Ecosystem services available.
South East Inshore Marine Plan 2021¹⁰	<p>The South East Inshore Marine Plan area stretches from Felixstowe in Suffolk to west of Dover in Kent and incorporates the River Thames. It will help to enhance and protect the marine environment and achieve sustainable economic growth while respecting local communities both within and adjacent to the marine plan area.</p> <p>The South East Inshore Marine Plan Marine states the following:</p> <p><i>“Proposals that may have adverse impacts on the objectives of marine protected areas must demonstrate that they will, in order of preference: avoid, minimise and mitigate adverse impacts, with due regard given to statutory advice on an ecologically coherent network.</i></p> <p><i>Proposals that enhance a marine protected area’s ability to adapt to climate change, enhancing the resilience of the marine protected area network, will be supported.</i></p> <p><i>Proposals that may have adverse impacts on an individual marine protected area’s ability to adapt to the effects of climate change, and so reduce the resilience of the marine protected area network must demonstrate that they will, in order of preference: avoid, minimise and mitigate adverse impacts.</i></p> <p><i>Proposals that enhance the distribution of priority habitats and priority species will be supported. Proposals that may have significant adverse impacts on the distribution of priority habitats and priority species must demonstrate that they will, in order of preference: avoid, minimise, mitigate and compensate for significant adverse impacts that cannot be mitigated.</i></p>

Policy, Legislation or Guidance	Description
	<p><i>Proposals that enhance or facilitate native species or habitat adaptation or connectivity, or native species migration, will be supported.</i></p> <p><i>Proposals that may cause significant adverse impacts on native species or habitat adaptation or connectivity, or native species migration, must demonstrate that they will, in order of preference: avoid, minimise, mitigate- adverse impacts so they are no longer significant and compensate for significant adverse impacts that cannot be mitigated.</i></p> <p><i>Proposals that conserve, restore or enhance coastal habitats, where important in their own right and/or for ecosystem functioning and provision of ecosystem services, will be supported. Proposals must take account of the space required for coastal habitats, where important in their own right and/or for ecosystem functioning and provision of ecosystem services, and demonstrate that they will, in order of preference: avoid, minimise, mitigate and compensate for net habitat loss.</i></p> <p><i>Proposals that reduce the risk of introduction and/or spread of invasive non-native species should be supported.</i></p> <p><i>Proposals must put in place appropriate measures to avoid or minimise significant adverse impacts that would arise through the introduction and transport of invasive non-native species,</i></p> <p><i>Proposals that may have significant adverse impacts on highly mobile species through disturbance or displacement must demonstrate that they will, in order of preference: avoid, minimise and mitigate- adverse impacts so they are no longer significant.</i></p> <p><i>Proposals that result in the generation of impulsive sound must contribute data to the UK Marine Noise Registry as per any currently agreed requirements.</i></p> <p><i>Proposals that result in the generation of impulsive or non-impulsive noise must demonstrate that they will, in order of preference: avoid, minimise and mitigate- adverse impacts on highly mobile species so they are no longer significant. If it is not possible to mitigate significant adverse impacts, proposals must state the case for proceeding.”</i></p>
The Thames River Basin District	<p>The Thames River Basin District (RBD) River Basin Management Plan describes the challenges that threaten the water environment and how these challenges can be managed.</p>

Policy, Legislation or Guidance	Description
Management Plan 2022 ¹¹	
Legislation	
Environment Act 2021¹²	The Environment Act 2021 makes provision for targets, plans and policies for improving the natural environment. The Act includes Section 99 and Schedule 15, which provide for a system of mandatory requirement for a 10% biodiversity net gain. This is expected to come into force in November 2025 through the provision of biodiversity gain statements or updates to the relevant NPS. A BNG assessment (Appendix 7-1: BNG Report (Volume 3)) is submitted for the Proposed Scheme, notwithstanding that the statutory provisions for BNG are not yet in force.
The Wildlife and Countryside Act 1981 (as amended) (WCA)¹³	<p>The primary legislation in the United Kingdom for the protection of animals, plants and habitats in the UK. This legislation covers three main areas:</p> <ul style="list-style-type: none"> • Wildlife protection, including protection of wild birds, their eggs and nests, protection of other animal and protection of plants; • Nature Conservation, Countryside and National Parks; and • Public rights of way (PRoW). <p>Various species of fish and marine animals are also protected from being killed, injured or disturbed under provisions in Schedule 5 of the WCA. All cetaceans (whales and dolphins) are protected under Schedule 5, making it is an offence to take, injure or kill these species. Disturbance in their place of rest, shelter or protection is also prohibited.</p>
The Natural Environment and Rural Communities (NERC) Act 2006¹⁴	<p>The NERC Act was designed to help achieve a rich and diverse natural environment and thriving rural communities through modernised and simplified arrangements for delivering Government policy. The NERC Act established a new independent body (Natural England) responsible for conserving, enhancing, and managing England's natural environment for the benefit of current and future generations, thereby contributing to sustainable development.</p> <p>The NERC Act made amendments to both the WCA and the Countryside and Rights of Way ('CROW') Act 2000.</p> <p>Section 40 of the NERC Act imposes a duty on public authorities <i>"In exercising its functions, have regard, so far as is</i></p>

Policy, Legislation or Guidance	Description
	<p><i>consistent with the proper exercise of those functions, to the purpose of conserving biodiversity</i>". This duty was extended by the Environment Act 2021 to refer also to the enhancement and improvement of biodiversity, going beyond the mere maintenance of biodiversity in its current state.</p> <p>Section 41 of the NERC Act requires the Secretary of State (SoS) to "<i>publish a list of the living organisms and types of habitat which in the Secretary of State's opinion are of principal importance for the purpose of conserving biodiversity</i>". These are referred to as Habitats/Species of Principal Importance.</p>
<p>The Conservation of Habitats and Species Regulations 2017 (as amended by the Conservation of Habitats and Species Regulations (Amendment) (EU Exit) Regulations 2019) ('the Habitats Regulations') 2017¹⁵</p>	<p>The Habitats Regulations, which implement the Habitats Directive (EC Directive 92/43/EEC) in the United Kingdom, and in particular Regulation 63, require the competent authority consenting a development to determine whether appropriate assessment is necessary before deciding whether to give consent, permission or other authorisation for plan or project which:</p> <ul style="list-style-type: none"> • "<i>is likely to have a significant effect on a European Site (either alone or in combination with other projects)</i>"; and • "<i>is not directly connected with or necessary to the management of that site must make an appropriate assessment of the implications of the plan or project for that site in view of that site's conservation objectives</i>". <p>In the case of the Proposed Scheme, the competent authority is the SoS.</p> <p>To enable the competent authority to determine whether an appropriate assessment is necessary a person applying for any such consent, permission or other authorisation must provide such information as the competent authority may reasonably require for this purpose.</p> <p>If a plan or project may adversely impact a European Site, Regulation 64 of the Habitats Regulations provides that the competent authority may agree to the plan or project notwithstanding that adverse assessment of the implications for the European Site only where it is satisfied that:</p> <ul style="list-style-type: none"> • there is no alternative solution to the plan or project to avoid the adverse impact; and • the plan or project must be carried out for "imperative reasons of overriding public interest" including those of a social or economic nature.

Policy, Legislation or Guidance	Description
	<p>Where the site to be adversely impacted hosts a priority natural habitat type¹⁶ or a priority species, the “imperative reasons of overriding public interest” must be either:</p> <ul style="list-style-type: none"> • <i>“reasons relating to human health, public safety or beneficial consequences of primary importance to the environment”;</i> or • <i>“any other reasons which the competent authority, having due regard to the opinion of the European Commission, considers to be imperative reasons of overriding public interest”¹⁷.</i> <p>In addition, Regulation 55 requires “<i>Licences for certain activities relating to animals or plants</i>”, namely where activities would lead to adverse effects on species identified by the Habitats Regulations.</p> <p>The Habitat Regulations have created a national site network for both terrestrial biodiversity (see Chapter 7: Terrestrial Biodiversity (Volume 1)) and marine biodiversity (this chapter), including both the inshore and offshore marine areas in the UK. This national site network includes existing Special Areas of Conservation (SAC) and Special Protection Areas (SPA), and new SAC and SPA designated under these regulations. Any references to Natura 2000 in the Conservation of Habitats and Species Regulations 2017 now refers to the new national site network.</p> <p>It is also a matter of government policy that Ramsar sites are considered in the assessment process, as described in para 181 of the National Planning Policy Framework².</p>
The Salmon and Freshwater Fisheries Act 1975 (SAFFA)¹⁸	<p>The Act covers regulation of fisheries in England and Wales and includes legislation that restricts the introduction of polluting effluents, the obstruction of fish passage (screens, dams, weirs, culverts etc.) illegal means of fishing, permitted times of legal fishing and fishing licencing (which covers electric fishing).</p> <p>Under this Act any person who causes or knowingly permits to flow, or puts or knowingly permits to be put, into any waters containing fish or into any tributaries of waters containing fish, any liquid or solid matter to such an extent as to cause the waters to be poisonous or injurious to fish or the spawning grounds, spawn or food of fish, shall be guilty of an offence.</p>

Policy, Legislation or Guidance	Description
	<p>The Act requires that fish passes are installed on new and rebuilt barriers that affect waters frequented by salmon or migratory trout.</p>
<p>The Eels (England and Wales) Regulations 2009¹⁹</p>	<p>The Eels (England and Wales) Regulations 2009 implement Council Regulation (EC) No 1100/2007 of the Council of the European Union, which required Member States to establish measures for the recovery of the stock of European eel <i>Anguilla anguilla</i>. The regulations apply to England and Wales.</p> <p>The Regulations give powers to the regulators (the Environment Agency and Natural Resources Wales) to implement recovery measures in all freshwater and estuarine waters in England and Wales. The aim of the regulations is to achieve 40% escapement of adult eels relative to escapement levels under pristine conditions. The measures, as set out in the legislation, by which this is to be achieved are to reduce fishing pressures, improve access and habitat quality and reduce the impact of impingement and entrainment.</p> <p>Under the Regulations, the regulators can serve notice to companies detailing their legal obligation to screen intakes and outfalls for eel and/or to remove or modify obstructions to eel migration. However, it is possible for companies to be granted with exemptions if the costs of works greatly exceeds the benefits. In such a situation it is likely the regulator will seek a package of more cost-effective, “<i>alternative measures</i>”.</p>
<p>The Convention on the Conservation of European Wildlife and Natural Habitats 1979 (the ‘Bern Convention’)²⁰</p>	<p>The Convention on the Conservation of European Wildlife and Natural Habitats 1979 (the ‘Bern Convention’) was transposed into UK law by the WCA¹³. The principal aims of the Bern Convention are the conservation and protection of the wild plant and animal species (and the natural habitats thereof) listed in Appendices I and II of the Convention. It also seeks to increase co-operation between governments and to regulate the exploitation of species listed in Appendix III, which includes migratory fish species, cetaceans and grey seal.</p>
<p>The Water Environment (Water Framework Directive) (England and Wales)</p>	<p>The Water Framework Directive (WFD) (2000/60/EC) establishes a framework for the management and protection of Europe’s water resources. It was implemented in England and Wales through Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (as amended). The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (as</p>

Policy, Legislation or Guidance	Description
Regulations (the 'Water Framework Regulations') 2017²¹	<p>amended) has subsequently been revoked and replaced by the Water Framework Regulations.</p> <p>The purpose of the Water Framework Regulations is to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater. All water bodies (unless artificial or heavily modified) are required to achieve 'good' ecological status unless alternate objectives are set or there are grounds for deterioration. Ecological status demonstrates the quality of the structure and function of surface water ecosystems indicated through 'quality elements'. These include hydromorphological, chemical and biological indicators (including benthic invertebrates, macroalgae, fish, phytoplankton and angiosperms).</p> <p>When considering the effect of a development or activity on a water body, it is a regulatory requirement under the Water Framework Regulations to assess if it will cause or contribute to a deterioration in status or jeopardise the water body achieving good status in the future. The Regulations lists Lower and Higher Sensitivity Habitats that is considers important features that require protection.</p> <p>Where a development is considered to cause deterioration, or where it may contribute to the failure of the water body to meet Good Ecological Status or Good Ecological Potential Status, then an assessment to demonstrate that the development is exempt under Article 4.7. This makes provision for deterioration of status, provided that certain stringent conditions are met.</p> <p>Under the Water Framework Regulations water bodies can become WFD-designated. WFD-designated water bodies each have a status. A specific WFD Assessment is presented in Appendix 11-1: Water Framework Directive Assessment (Volume 3).</p>
Conservation of Seals Act 1970²²	<p>Pinnipeds, commonly known as seals, are protected under the Conservation of Seals Act. This Act does not prohibit the killing of seals but does regulate the way in which seals can be killed. For example, there is an annual close season for grey seals extending from 1st September to 31st December and an annual close season for common seals extending from 1st June to 31st August. It is a criminal offence to wilfully kill, injure or take a seal during the close season or to attempt to do so. The Act also gives the SoS the power to make an order prohibiting the</p>

Policy, Legislation or Guidance	Description
	<p>killing, injuring or taking of seals in an area where such an order is necessary for the proper conservation of seals. This legislation is pertinent to the Proposed Scheme due to the common present of grey and harbour seal in the Thames Estuary (within in which the Proposed Scheme is located).</p>
<p>The Convention for the Protection of the Marine Environment in the North-East Atlantic 1992 (the OSPAR Convention)²³</p>	<p>The OSPAR Convention provides a comprehensive approach to addressing sources of maritime pollution and other matters affecting the marine environment. Annex V of the Convention provides a framework for governments to develop their own conservation measures. Article 2 requires parties to <i>“take all possible steps to prevent and eliminate pollution and shall take the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve marine ecosystems and, when practicable, restore marine areas which have been adversely effected”</i>.</p> <p>The OSPAR Convention includes the establishment of a list of threatened and/or declining species and habitats. This list provides an overview of the biodiversity in need of protection in the north-east Atlantic and is being used by the OSPAR Commission to guide the setting of priorities for further work. The most recent OSPAR List of Threatened and/or Declining Species and Habitats includes the following marine species: native oyster <i>Ostrea edulis</i>, Allis shad <i>Alosa alosa</i>, European eel <i>Anguilla anguilla</i>, Atlantic cod <i>Gadus morhua</i>, sea lamprey <i>Petromyzon marinus</i>, thornback ray <i>Raja clavata</i>, Atlantic salmon <i>Salmo salar</i> and harbour porpoise <i>Phocoena phocoena</i> which are listed as being under threat and/or in decline in Region II (the Greater North Sea, which includes the Thames Estuary (within which the Proposed Scheme is located)).</p>
<p>The Marine and Coastal Access Act 2009²⁴</p>	<p>Marine Conservation Zones (MCZ) are a type of marine protected area that can be designated in English, Welsh and Northern Irish territorial and offshore waters, including the Thames Estuary. There are 91 MCZ in waters around England. MCZs are areas that protect a range of nationally important, rare or threatened habitats and species. Each MCZ is established by a legal order made by DEFRA under Section 116 (1) of the Marine and Coastal Access Act.</p>

Policy, Legislation or Guidance	Description
	<p>Section 126 of the Marine and Coastal Access Act places specific duties on all public bodies relating to MCZ and decision making.</p> <p>Section 126 applies where:-</p> <ul style="list-style-type: none"> • <i>“a public authority has the function of determining an application (whenever made) for authorisation of the doing of an act, and</i> • <i>The act is capable of affecting (other than insignificantly) -</i> <ul style="list-style-type: none"> – <i>the protected features of an MCZ;</i> – <i>any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependent”.</i> <p>A Deemed Marine Licence (DML) is required if the Proposed Scheme involves activities which are licensable under Part 4 of the Marine and Coastal Access Act. This states that <i>“No person may (a) carry on a licensable marine activity, or (b) cause or permit any other person to carry on such an activity, except in accordance with a marine licence granted by the appropriate licensing authority”.</i> Licensable marine activities related to the Proposed Scheme include:</p> <ul style="list-style-type: none"> • <i>“to deposit any substance or object anywhere in the sea or on or under the sea bed from a vehicle, vessel, aircraft, marine structure or floating container which was loaded with the substance or object – (a) in any part of the United Kingdom except Scotland, or (b) in the UK marine licensing area.”</i> • <i>“to use a vehicle, vessel, aircraft, marine structure or floating container to remove any substance or object from the sea bed within the UK marine licensing area.”</i> • <i>“to carry out any form of dredging within the UK marine licensing area (whether or not involving the removal of any material from the sea or sea bed)”.</i> <p>A DML has therefore been included in the Draft DCO (Document Reference 3.1). The licensing authority (MMO) will enforce the parts of a DCO that relate to a DML and will be responsible for dealing with any breaches of any conditions of those approvals.</p>
Guidance	

Policy, Legislation or Guidance	Description
National Planning Practice Guidance (2021) ²⁵	Explains the processes and tools that can be used through the planning system in England. In relation to terrestrial biodiversity, guidance on Appropriate Assessment (i.e. the assessment of effects on sites designated under the Conservation of Habitats and Species Regulations 2017) and Environmental Impact Assessment are relevant. The guidance advises how to identify suitable mitigation and adaptation measures in the planning process. This would require the implementation of appropriate measures by the local planning authorities. The guidance particularly recommends development of brownfield sites over greenfield sites, implementation of green infrastructure networks in development, avoidance of effects on important ecological sites and species and use of appropriate mitigation where necessary.
Chartered Institute of Ecology and Environmental Management (CIEEM) Guidance 2017 ²⁶	These pieces of guidance aim to increase the quality of ecological reports supporting development applications by laying down minimum standards for what should be covered by ecologists undertaking such studies, and also defining best practice in baseline ecological reporting.

8.3. CONSULTATION AND ENGAGEMENT

- 8.3.1. **Table 8-2** provides a summary of the consultation and engagement undertaken in support of the preparation of this assessment.
- 8.3.2. **Table 8-3** provides a summary of comments provided as part of the statutory consultation process and an appropriate response.
- 8.3.3. **Appendix 4-2: Scoping Opinion Responses (Volume 3)** provides a summary of the Planning Inspectorate and consultee comments on the EIA Scoping Opinion and the Applicant's responses.

Table 8-2: Marine Biodiversity Consultation and Engagement Summary

Date and Method of Consultation	Consultee	Summary of Key Topics discussed and Key Outcomes
13th April 2023, Meeting	Environment Agency	<p>Key Topics:</p> <ul style="list-style-type: none"> • Marine Biodiversity Net Gain (BNG); • type of licenses/ scope of surveys; • marine benthic ecology (encompassing shellfish, Invasive Non-Native Species (INNS), the mudflat and river wall survey; and supporting information for a WFD and the habitat assessment); and • confirmation of approach to grab sampling for macrobenthos and fish surveys. <p>Key Outcomes:</p> <ul style="list-style-type: none"> • no concerns identified with the marine biodiversity methodology, content with sampling methodology and locations; and • agreed the BNG will focus on the intertidal area of the Proposed Scheme and not the subtidal area.
22nd September 2023	Natural England	<p>Key Topics:</p> <ul style="list-style-type: none"> • overview of the construction works within the marine environment, including the loss of intertidal and subtidal habitat. <p>Key Outcomes:</p> <ul style="list-style-type: none"> • Natural England did not provide any comments on this at the time.
1st December 2023	Environment Agency	<p>Key Topics:</p> <ul style="list-style-type: none"> • WFD Assessment; • discussion regarding sediment contaminants; • discussion of dredging periods and timings to avoid impacting migratory fish species;

Date and Method of Consultation	Consultee	Summary of Key Topics discussed and Key Outcomes
		<ul style="list-style-type: none"> discussion of piling techniques; discussion regarding vessel movements; concern raised on potential intertidal habitat loss if Belvedere Power Station Jetty (disused) removed; and concern regarding wave wash and effects on intertidal habitats. <p>Key Outcomes:</p> <ul style="list-style-type: none"> Environment Agency to provide guidance on fish migration periods. Further discussion to take place on BNG and WFD in December 2023. Environment Agency highlighted that Water injection Dredging (WID) is known to also occur elsewhere on the Thames for maintenance dredging.
13 th December	Environment Agency	<p>Key Topics:</p> <ul style="list-style-type: none"> WFD Assessment; discussion regarding water quality standards; mitigation measures; discussion of dredging methodology; discussion of avoidance periods for dredging and piling in the River Thames; and concern regarding wave wash and effects on intertidal habitats. <p>Key Outcomes:</p> <ul style="list-style-type: none"> additional confirmation and consultation with the MMO regarding sampling to be undertaken. Environment Agency to provide guidance on dredging. Environment Agency to provide comment on the WFD Screening and Scoping Report²⁷.

Date and Method of Consultation	Consultee	Summary of Key Topics discussed and Key Outcomes
14 th November	Environment Agency	<p>The Environment Agency provided the following guidance to timings of works in relation to fish species via Email:</p> <p><i>"If percussive piling is necessary in the water, piling should be carried out outside the main periods of fish migrations. In the River Thames, this is between April to September inclusive, whilst for sites close to spawning areas, this period is extended to March to September inclusive."</i></p>

Table 8-3: Summary of the Statutory Consultation Comments in relation to Marine Biodiversity

Statutory Consultee Comment	Response
London Borough of Bexley	
<p><i>"Table 8-1 refer to Chapter 7 comments in relation to Table 7-1. The same comments apply."</i></p> <p><i>"Descriptions in table 7-1 should relate to considerations for the assessment of the proposed development. For example, the description of the London Plan policy refers to what the policy says boroughs should do in their development plans, rather than saying what should be considered in the assessment of a proposal. The Council already has policies in its Local Plan which address the London Plan requirements on what boroughs should include in their development plans. Using policy G6 as an example, Parts A, and C are particularly important when in considering the principle of</i></p>	<p>The direction provided on policy these have has been noted. Table 8-1 has been updated with further information where appropriate to indicate additional relevant sections of listed policies.</p>

Statutory Consultee Comment	Response
<p><i>development on a metropolitan SINIC, as discussed in comments relating to chapter 3; however, these have not been mentioned in the table 7-1 description. Table 7-1 references biodiversity action plans, in that regard, the following are not mentioned:</i></p> <ul style="list-style-type: none"> <i>• The 2018, London Environment Strategy Chapter 5 includes Habitat creation targets for London - Species-rich woodland, Flower-rich grassland, Rivers and streams, Reedbeds. Appendix 2 has London Biodiversity Action Plan Review of Priority Species – based on 2007 figures and BAP Priority Habitats. The GIGL pages include achieve for London Species Action Plans and Habitat Action Plans, plus update to species</i> <i>• The 2019, GLA priority species list spreadsheet tool London Priority Species London City Hall), includes opportunity species where there are likely to be opportunity to provide new or enhanced areas of habitat for across London’s greenspaces or development, includes info on habitat requirements. 64 species in Bexley.</i> <i>• Published 2022, the updated List of priority habitats and species in England, Habitats and species of principal importance in England - GOV.UK (www.gov.uk). UK BAP habitats species actions and strategies. Check most recent strategy</i> 	

Statutory Consultee Comment	Response
<p><i>National Planning Practice Guidance is described in the context of EIA and AA requirements; however, no reference has been made to the Natural environment National Planning Practice Guidance.</i></p>	
Environment Agency	
<p><i>“Our preferred option would be the removal of the jetty structure in the intertidal area to allow for the restoration of BAP priority intertidal habitat. Which would greatly contribute to BNG as it restores a more natural river corridor in line with “making space for water” and Estuary Edges guidance and Thames Estuary 2100 plan (TE2100) plan.”</i></p>	<p>It is still the case that the Belvedere Power Station Jetty (disused) may be retained or demolished as part of the Proposed Scheme, further detail is provided in Chapter 3: Consideration of Alternatives (Volume 1). This chapter considers the impacts of both scenarios.</p>
<p><i>“The existing jetty structure has been noted as a viable high tide roost and fish refuge. If the applicant can demonstrate why the Jetty cannot be removed then significant enhancement to this structure to provide BNG and improved ecological niche habitat should be provided.”</i></p>	<p>Should the Belvedere Power Station Jetty (disused) (with modifications) be retained, enhancement measures are likely to be provided, further detail is provided in Section 8.9 of this chapter.</p>
<p><i>“The new Jetty should be enhanced with fish refuge structures and inclusion of timber fender to provide improved ecological substrate”.</i></p>	<p>The Proposed Jetty will include enhancements including artificial fish refuge habitat, as discussed in Section 8.7 of this chapter.</p>
<p><i>“We await the ES in due course, for full details of the proposals and their assessment. We expect the ES to contain full details and assessment of the proposed dredging (capital and maintenance) and piling works, following the completion of further work to include sediment analysis and sediment modelling. We note that relevant</i></p>	<p>The proposed dredging to be undertaken as part of the Proposed Scheme is described in Chapter 2: Site and Proposed Scheme Description (Volume 1). An assessment of the impacts of capital and maintenance dredging is presented in Section 8.8 of this chapter and assumes the backhoe dredging technique will be used</p>

Statutory Consultee Comment	Response
<p><i>project design, mitigation and enhancement measures will be identified in the ES, including an Outline Code of Construction Practice (CoCP). Details of the sediment disposal proposals will also be contained in the ES."</i></p>	<p>for both capital dredging and maintenance dredging. The dredged arisings associated with the Proposed Scheme (during both capital dredging and maintenance dredging) will be managed in accordance with relevant legislation and will be disposed of offsite (via vessel and only if dredged arisings are deemed suitable for this disposal method and conform with the permits for disposal sites). The removal of the dredged arisings will be undertaken by an appropriately licenced waste carrier. Further information about onward sediment sampling is described in Section 8.9 and Section 8.10.</p>
Port of London Authority	
<p><i>"With regard to Table 8-2 (Summary of the EIA Scoping Opinion in Relation to Marine Biodiversity), to highlight that although it is considered that the Medway Estuary MCZ is unlikely to be affected by the proposals because of the distance and lack of hydrological connection to the site. There is no mention of the Swanscombe MCZ which is hydrologically connected to the Site."</i></p> <p><i>Section 3.4.2 states that the Planning Inspectorate agrees to rule out effects on nationally designated sites apart from Medway Estuary MCZ and this potential discrepancy needs to be addressed with regard to consideration of the Swanscombe MCZ."</i></p>	<p>Within the EIA Scoping Opinion²⁷ (Section ID 3.4.2), the Planning Inspectorate agreed to all MCZ being scoped out of further assessment with the exception of the Medway Estuary MCZ, which has been included within the assessment presented in Section 8.8 of this chapter. The scoped out MCZ are not designated for mobile aquatic features such as migratory fish or marine mammals, and are located at some distance from the Site. In addition, the Swanscombe MCZ was scoped out of the assessment, due to its distance from the Site Boundary (11km downstream) and a lack of mobile receptors (such as European smelt) that have the potential to utilise the area as part of their lifecycle.</p>
<p><i>"The PEIR report in a number of places refers to UKBAP habitats, related to this it is considered that as part of the Environmental</i></p>	<p>The Habitats of Principal Importance have been considered as High importance, as described in Table 8-7 of this chapter. Intertidal</p>

Statutory Consultee Comment	Response
<p><i>Statement (ES) that it may be more appropriate to instead refer to these as Habitats of Principal Importance (section 41 habitats under NERC 2006) as these are underpinned by legislation rather than the action plan. In addition, further justification will be required as part of the forthcoming ES on why the priority habitats are currently only considered of only of regional/county importance and not considered of greater importance.”</i></p>	<p>mudflat and saltmarsh have been amended to be assessed as of National importance.</p>
<p><i>“The applicant must also confirm whether the intertidal zone will be included in the terrestrial or marine biodiversity chapters of the forthcoming ES, given the area is in an estuarine environment where the two are inextricably linked.”</i></p>	<p>The intertidal zone of the River Thames is included in the assessment presented in Section 8.8 of this chapter.</p>
Thames Water	
<p><i>“Noise and Vibration – the PEIR identifies direct, permanent, long term effects, from the operation phase, through disturbance to foraging and commuting areas for bats within Crossness LNR and associated habitats; breeding birds through disturbance to nesting and foraging areas within Crossness LNR and associated habitats; fish, through displacement and disruption of normal behaviour, as well as reptiles, terrestrial invertebrates, and water voles”</i></p>	<p>Freshwater fish have been considered within Chapter 7: Terrestrial Biodiversity (Volume 1). Impacts to Estuarine fish have been considered in this chapter.</p>

Statutory Consultee Comment	Response
Marine Management Organisation	
<p><i>“Given the extent to which the project may potentially impact marine benthic ecological receptors, the MMO considers that the information presented in the baseline assessment and impact assessment to be commensurate and fully defensible.”</i></p>	<p>No response required.</p>
<p><i>“The intertidal and subtidal surveys would have benefited from the inclusion of a greater number of sampling stations (i.e., than the six in each case) and, for the intertidal area, to have ensured that samples were taken from all habitats (if there were multiple habitats) that were evident from the walkover survey, where possible.</i></p> <p><i>However, the MMO is content that no further actions need to be taken regarding this at this time.”</i></p>	<p>No response required.</p>
<p><i>“The mitigation measures (included as those embedded in the design) presented in Section 8.7 all appear sensible and should each reduce potential ecological impacts of the project to some extent. The additional measures given in Section 8.9 also look beneficial, especially the concept of increased habitat heterogeneity (as mitigation for loss of/disturbance to intertidal habitats) through terracing and the use of ropes on pier legs for example.”</i></p>	<p>No response required.</p>
<p><i>“The MMO considers that the list of mitigation should be updated to include something along the lines of ensuring that the dredging method adopted (during capital dredging and/or maintenance</i></p>	<p>The assessment presented in Section 8.8 of this chapter has been based on backhoe dredging, as this method will result in a reduced release of suspended sediment in comparison to the other methods,</p>

Statutory Consultee Comment	Response
<i>dredging operations) will be selected, where possible, based on an approach which results in a reduced impact on suspended sediment release. However, the MMO notes that reference to this being considered is later given in Section 8.8.98, although this is not formally presented as a mitigation measure.”</i>	as described in Chapter 2: Site and Proposed Scheme Description (Volume 1) .
<i>“The MMO does not have any major concerns regarding the matters or receptors as the key ones in terms of coastal processes, namely potentially elevated suspended sediment concentrations and water column water quality, have been scoped in for both construction and operational phases. This will also include deposition within the estuary and any Marine Conservation Zones (MCZs).”</i>	An assessment of the potential effects on the Medway Estuary MCZ is included in Section 8.8 , where relevant. The sediment plume modelling has also predicted that the Swanscombe MCZ will not be impacted by any elevated suspended sediment concentrations.
<i>“Sediment quality around the proposed dredge pocket and also sediment around the site of disused Belvedere Power Station Jetty should be assessed, as disturbance into the water column could be significant depending on the dredge technique used. For instance, in Option 3 over 180,000 cubic metres (m3) of sediments will be dredged.”</i>	An assessment of the potential effects from changes to sediment quality is provided in Section 8.8 .
<i>“The MMO considers that the Outline Emergency Preparedness and Response Plan (OEPRP) should consider the release of all the various chemical into the marine environment (Section 2.6.22). Consideration for bunding should also be made.”</i>	It is not considered that bunding is appropriate for use in the marine environment due to the tidal nature of the River Thames, the Outline EPRP (Document Reference 7.11) considers the release of chemicals.
<i>“The report refers to benthic inter- and sub-tidal surveys from which some samples were collected for sediment chemistry analysis</i>	The full results of the contaminant analysis are presented in Annex C and D of Appendix 11-1: Water Framework Directive

Statutory Consultee Comment	Response
<p><i>alongside particle size. It is stated that analyses were conducted by laboratories validated by the MMO. However, other than this brief description in paragraphs 8.4.15-8.4.17, the MMO can find no corresponding resultant data or any other description of the number of samples or results of the analyses. The MMO would expect these data to be published in full in the MMO Results Template in the resulting ES. Therefore, as of the time of writing, it is not possible to substantively comment on these data."</i></p>	<p>Assessment (Volume 3) in the MMO results template. A summary is provided in Section 8.6.</p> <p>Sediment concentrations of metals and polycyclic aromatic hydrocarbons (PAH) were encountered above AL1 criteria at a number of sample locations within the intertidal and subtidal zone of the Study Area. In addition, the concentration of Mercury was identified at 4.71mg/kg, which is above the AL2 criteria (3.00 mg/kg) at one of the intertidal sampling sites. This was the only occasion of contamination exceeding AL2 and it was only at one location.</p>
<p><i>"The report lists several dredge methods which vary considerably in the extent to which they may lead to increases in suspended sediment concentrations at the dredge site and its immediate vicinity. It should be confirmed if the assessment of this impact pathway will consider the worst-case scenarios use of water injection (WID) for all 180,000m³ of material (i.e., the total anticipated worst-case volume of material that would be removed by WID). The MMO would consider this method to be worst-case for this impact pathway as none of the material dredged would be removed from the water column (as with trailer suction hopper or backhoe)."</i></p>	<p>As described in Chapter 2: Site and Proposed Scheme Description (Volume 1) the dredging method to be used will be backhoe. This is the method assessed in this ES.</p>
<p><i>"The MMO strongly recommends that, if it is decided that WID will be the primary dredge method, that engagement is undertaken with the Port of London Authority (PLA), the Environment Agency (EA) and</i></p>	<p>As described in Chapter 2: Site and Proposed Scheme Description (Volume 1) the dredging method to be used will be backhoe. This is the method assessed in this ES.</p>

Statutory Consultee Comment	Response
<i>the Zoological Society of London (ZSL) to ensure that the large volume does not lead to adverse effects on migratory fish.”</i>	
<i>“The MMO does not fully understand why “water quality and release of contaminants (marine habitats, intertidal and subtidal benthic communities, marine plants and macroalgae and fish)” is scoped into the operational phase of the works but not the construction phase. The dredging of 180,000m³ of material could potentially serve as a pathway for this impact. The MMO notes that in the Table of Scoping Opinion Responses, the opinion comments refer to contaminants “carried on board vessels”, however there does not appear to be any other scoping comments referring to other aspects of contaminants (e.g., chemical use during construction or contaminants in dredged material).”</i>	As described in Paragraph 8.4.2 , water quality and release of contaminants (marine habitats, intertidal and subtidal benthic communities, marine plants and macroalgae and fish) these have been scoped into the construction and operation phase assessment presented in Section 8.8 of this chapter.
<i>“Dredge and Disposal- the MMO also noted that in Chapter 8 (8.8.74) it states that impacts will include “changes to water and sediment quality from increased levels of suspended solids, mobilisation of sediment bound contaminants...due to maintenance dredging”. However, it appears that this does not extend to the proposed 180,000m³ of material required for capital dredging. Clarification should be provided as to whether the capital dredging is being considered separately”.</i>	A discrete assessment of the potential effects from capital dredging is presented in Section 8.8 .
<i>“There are considerable information gaps in the report to fully comprehend the scale of the dredging and possible disposal activity.</i>	Further detail with regard to the capital and maintenance dredging associated with the Proposed Scheme is provided in Chapter 2: Site

Statutory Consultee Comment	Response
<p><i>There is little to no indication as to the depth of material to be removed, when the material was most recently dredged, or any indication as to the potential contaminant levels. Even at this early stage, the MMO would have expected indicative information to be available. At the point of the ES, all of this information should be presented clearly and in details”.</i></p>	<p>and Proposed Scheme Description (Volume 1) and Appendix 11-4: Coastal Modelling Studies (Volume 3).</p>
<p><i>“In general, the PEIR is well-informed in relation to fisheries and fish ecology, however it is lacking some detail that would be expected at this stage. The relevant fish receptors have been identified, including acknowledging those with spawning and nursery grounds in the River Thames and its estuary. Fish receptors have been appropriately classified into demersal, pelagic, migratory and elasmobranchs categories. Characterisation of fish receptors also includes data from EA Transitional and Coastal waters (TRaC) fisheries monitoring surveys and a site-specific baseline beam trawl survey. This approach is appropriate; however, the potential limitations of these surveys should be acknowledged.”</i></p>	<p>The limitations of the surveys undertaken have been addressed within Appendix 8-1: Marine Baseline Surveys (Volume 3). Fish surveys within the Study Area were limited to subtidal benthic trawls due to health and safety issues. These included no safe access to the foreshore across the river wall to deploy fyke nets, and the substrate within the Study Area not being appropriate to deploy seine nets (extensive mudflats). Prior to conducting fish surveys, the project team consulted with the Environment Agency on the most appropriate methods and it was agreed that the preferred approach, to use beam trawls and historic data, was appropriate.</p>
<p><i>“It has not been discussed or acknowledged the limitations associated with the site-specific beam trawl and the EA TRaC (otter trawl) survey data. It should be noted that gear type affects catchability and therefore survey data may under or overestimate abundance, with some species potentially not appearing in the catch data. For example, a 2m beam trawl is suited to catching small and juvenile demersal fishes but will not adequately target larger fish or</i></p>	<p>The limitations of the surveys undertaken have been addressed within Appendix 8-1: Marine Baseline Surveys (Volume 3). The method undertaken for the surveys was selected to ensure compliance with WFD methodology, which states that surveys should be bi-annual (spring and autumn) or annual. Survey timings were also restricted due to avoidance of sensitive fish periods (e.g. migration). Fish surveys within the Study Area were limited to</p>

Statutory Consultee Comment	Response
<p><i>mid water and pelagic species. The seasonality of the surveys is also important to consider as survey data has only been provided for spring and autumn. The limitations and assumptions of the data presented should be acknowledged”.</i></p>	<p>subtidal benthic trawls due to health and safety issues. These included no safe access to the foreshore across the river wall to deploy fyke nets, and the substrate within the project area not being appropriate to deploy seine nets (extensive mudflats). Prior to conducting fish surveys, the project team consulted with the Environment Agency on the most appropriate methods and it was agreed that the preferred approach, to use beam trawls and historic data, was appropriate.</p>
<p><i>“Sensitive migratory periods for fish receptors that have been reported in the study area such as European smelt, European eel and Allis shad have also not been identified. For the ES, the upstream/downstream migratory periods should be described or presented (for example in a table) for all the relevant migratory species in the Thames. This should be used to identify any overlap between the migratory periods and the construction schedule, so that potential impacts to these species of conservation importance can be appropriately assessed. The ZSL has a ‘Guidance Document’ (ZSL, 2016) which has been developed with planners and developers in mind and provides some useful information on key period for Thames fish. This will allow an assessment of whether potential impacts associated with the construction of the project will coincide with sensitive migratory periods. If deemed necessary, specific works can then be scheduled so as not to coincide with these periods, reducing the potential impacts to migratory fish receptors.”</i></p>	<p>Subsequent discussions with the Environment Agency have informed this ES assessment on suitable mitigation and which periods to avoid in line with other developments on the River Thames. This includes the avoidance of activities such as piling and dredging between April and September (The Site is not within 30km of any sensitive habitats including spawning locations) to avoid sensitive periods for migratory fish species and intertidal piling at low tide (where practicable).</p>

Statutory Consultee Comment	Response
<p><i>“The MMO notes that potential impacts to fish identified for the construction and operational phases are appropriate and are as follows:</i></p> <ul style="list-style-type: none"> <i>• Loss or disturbance of habitat</i> <i>• Changes in water quality and release of contaminants</i> <i>• Noise and vibration</i> <i>• Lighting”</i> 	<p>No response required.</p>
<p><i>“Fisheries and Fish Ecology-Concerning loss of habitat as an impact in the ES, the MMO recommends that temporary loss of habitat and permanent loss of habitat are considered separately”.</i></p>	<p>The assessment of temporary and permanent habitat loss is considered in Section 8.8.</p>
<p><i>“Fisheries and Fish Ecology-the report states that the underwater noise (UWN) study will be undertaken at the ES stage focussing on acoustically sensitive species such as herring. The MMO would have expected a preliminary UWN assessment to have been presented in the PEIR using appropriate modelled data and/or literature to support it. UWN generated during percussive piling operations has the potential to cause physiological harm and affect behaviour in fish. Fish responses to noise are in-part related to the anatomy of their hearing mechanisms. The presence of a swim bladder acts as a pressure transducer, converting sound pressure to particle velocity. Those species where the swim bladder is near to or connected to the ear have increased hearing sensitivity and thus greater vulnerability</i></p>	<p>The underwater noise (UWN) assessment presented within this ES has been undertaken with consideration of the points the MMO has outlined. This assessment can be found in Appendix 6-4: Underwater Noise Assessment (Volume 3). The findings of the UWN assessment are considered in Section 8.8.</p> <p>The findings of the UWN Assessment concluded that effects on all receptors are negligible.</p>

Statutory Consultee Comment	Response
<p><i>to underwater noise impacts (Popper et al., 2014). With this in mind, the MMO has outlined some points for consideration which will help inform the UWN assessment for fish:</i></p> <p><i>i. Fish species with spawning or nursery grounds in the area, and those species that are known to migrate through the River Thames should be classified into one of four categories based on the hearing capabilities and presence/absence of a swim bladder- please refer to Popper et al (2014) for further details;</i></p> <p><i>ii. Please also refer to Popper et al. (2014) for sound exposure guidelines on noise thresholds for mortality, potential mortal injury and recoverable injury, temporary threshold shift (TTS) and behaviour responses for fish for impulsive noise (e.g., percussive piling) and continuous noise (e.g., vibro-piling).</i></p> <p><i>iii. the underwater noise assessment should be presented using appropriate unweighted metrics, supported by underwater noise modelling or by case studies of a similar nature to support conclusions made on the likelihood and significance of impacts to fish from piling;</i></p> <p><i>iv. The modelled/predicted impact ranges for underwater noise should be discussed in the context of the width of the river Thames to determine the likelihood of an acoustic 'barrier' to fish movement and migration;</i></p>	

Statutory Consultee Comment	Response
<i>v If concurrent/simultaneous piling activity is proposed, this should also be included in the modelling or considered when sourcing supporting case study information.</i>	
<i>“The timing of piling works should be provided, together with a description of the number and size of the piles, typical duration of installation (per pile), and the number of piles to be installed per day, so that any overlap in construction and dredging activities with the spawning and migratory periods of fish can be identified”.</i>	Details regarding piling are provided within Chapter 2: Site and Proposed Scheme Description (Volume 1) and with the consequent assessment presented in Appendix 6-4: Underwater Noise Assessment (Volume 3) . The findings of the UWN Assessment concluded that effects on all receptors are negligible.
<i>“Although a more complete assessment has been provided for the other impacts identified still lack depth, such as identifying which species are expected to be impacts the most and why. It should stated which fish receptors are likely to be most vulnerable and why they are likely to exhibit sensitivity to the given impact. In addition, the MMO would expect each receptor group and their respective impacts to be broken down into different sections/chapters (e.g., fish and shellfish, marine mammals etc) as this would reduce the potential for any confusion.”</i>	Section 8.8 presents the assessment of potential effects on each receptor group separately, within relevant sub-headings. Fish and marine mammals have been assessed individually for all impacts. Shellfish have not been considered within this chapter as the nearest shellfish bed is located approximately 39.6km downstream from the Site Boundary.
<i>“The mitigation and compensatory measures suggested seem generally appropriate given the nature of the anticipated works. These include minimising the impacts of artificial light, carrying out construction activities such as piling and dredging outside sensitive periods for fish receptors and the use of lower noise techniques such as vibro-piling when possible. The sensitive periods for fish receptors</i>	Consultation has been undertaken with the Environment Agency to agree main periods for fish migrations which should be avoided during the piling associated with the construction of the Proposed Scheme, further details are provided in Table 8-2 and Section 8.7 . These avoidance periods form part of the embedded mitigation for the Proposed Scheme.

Statutory Consultee Comment	Response
<p><i>have not been provided at this stage, however, the MMO notes they will be established by consultation with the EA, Natural England and PLA. The MMO would have expected this information to already have been provided in the PEIR, however consultation with the relevant conservation bodies is an appropriate approach and the MMO wish to be included within this consultation. The use of ‘soft start’ piling techniques has also been suggested to allow sufficient time for fish receptors to move away from the impacted area. It should be ensured that these follow the JNCC guidelines (JNCC, 2010).”</i></p>	
<p><i>“The MMO notes that impacts to shellfish have been scoped out, as per the below:</i></p> <p><i>“Records from the desk study and results from the intertidal and subtidal benthic surveys state that shellfish of conservation and commercial importance are unlikely to be present within Study Area of the Proposed Scheme. Furthermore, the nearest Classified Bivalve Mollusc Harvesting Area and Shellfish Waters are located approximately 39.6km downstream of the Proposed Scheme. Therefore, potential impacts to shellfish are scoped out of further assessment”.</i></p>	<p>No response required.</p>
<p><i>“Shellfisheries- the scoping out of all shellfish receptors without apparent formal consultation of an advisor or stakeholder for shellfish (as is indicated by the Table of Scoping Opinion Responses in Chapter 8) raises concern. The MMO would expect to be presented</i></p>	<p>Records from the desk study and results from the intertidal and subtidal benthic surveys stating that shellfish of conservation and commercial importance are unlikely to be present within Study Area of the Proposed Scheme. Furthermore, the nearest Classified</p>

Statutory Consultee Comment	Response
<p><i>with evidence of desk-based studies and results prior to the scoping out of shellfish. Additionally, capital dredging is proposed to be undertaken but no disposal method of the dredged material has been identified. Should a marine disposal site be used, shellfish would need to be scoped in and fully assessed for potential impacts, noting that the report states that a method of dredge disposal will be identified within the ES. As a minimum, the MMO would not expect to see shellfish scoped out until a full worst-case scenario methodology has been assessed and evidence to support the scoping out of shellfish species has been presented.”</i></p> <p><i>“In not presenting evidence to support the scoping out of shellfish species, the report does not detail the species assessed for scoping out. The MMO would expect to see a list of shellfish species considered as part of the decision-making process for scoping the receptor out.”</i></p>	<p>Bivalve Mollusc Harvesting Area and Shellfish Waters are located approximately 39.6km downstream of the Proposed Scheme. The sediment plume modelling determined that increased levels of suspended solids would be generated at a distance of up to 3.5km from the works area, thus there will be no direct impacts from dredging. Therefore, potential impacts on shellfish are scoped out of further assessment.</p> <p>Furthermore, the dredged arisings associated with the Proposed Scheme (during both capital dredging and maintenance dredging) will be managed in accordance with relevant legislation and will be disposed of offsite (via vessel and only if dredged arisings are deemed suitable for this disposal method and conform with the permits for disposal sites). The removal of the dredged arisings will be undertaken by an appropriately licenced waste carrier, thus not impacting shellfish waters.</p>
<p><i>“The MMO does not have any major concerns regarding the matters or receptors that have been scoped out in relation to UWN.”</i></p>	<p>No response required.</p>
<p><i>“It is appropriate that underwater noise and vibration during the construction phase has been scoped in for fish, marine mammals, the Medway Estuary (fish) and the river Thames and its Tidal Tributaries (fish). The primary noise generating activities that will need to be considered will be piling and dredging activities, as well</i></p>	<p>No response required.</p>

Statutory Consultee Comment	Response
<p><i>as the potential demolition of the Belvedere Power Station Jetty (disused). If the Belvedere Power Station Jetty is retained, there will be no noise or vibration impacts in relation to this jetty.”</i></p>	
<p><i>“No specific receptors have been scoped out as such. A detailed baseline description is provided in Chapter 8. Of note, the report identified that the grey seal and harbour seal are commonly observed foraging in the Beley and Greenwich area of the river Thames. Harbour porpoise have also been observed in the vicinity of the Site. The Thames Estuary supports diverse fish fauna, including demersal, pelagic, and migratory species. Migratory species include European smelt, Atlantic salmon, Brown trout, Twaite shad, lamprey and European eel.”</i></p>	<p>No response required.</p>
<p><i>“An assessment of the potential underwater noise impacts on marine receptors is limited at this stage. The PEIR confirms that noise levels and their effects on fish and marine mammals will be determined as the design progresses. An underwater noise study will be undertaken to support the marine biodiversity assessment that will be subsequently assessed in the ES chapter. This will be undertaken for fish of Regional/County to National importance (including hearing specialist species such as herring); and marine mammals of National importance (i.e., common seal, grey seal and harbour porpoise). The MMO supports this approach.”</i></p>	<p>No response required.</p>

Statutory Consultee Comment	Response
<p><i>“The PEIR appropriately identified that the potential effects on marine ecological receptors, depending on the magnitude of the impact, can range from behavioural changes, injury, hearing loss, stress, difficulty in feeding, changes in predator/prey relations, mate disruption, stranding and mortality. At the very minimum, the MMO would expect the ES to consider the potential risk of auditory injury and disturbance/displacement in marine receptors, especially the risk of an acoustic barrier across the river (which may impact migratory species that utilise the river in particular).</i></p>	<p>The chapter has considered a range of effects upon receptors, including behavioural changes, reductions in reproductive success and mortality against all the potential impact pathways. In addition, the underwater noise (UWN) assessment has been undertaken in order to address the points the MMO has outlined. This assessment can be found in Appendix 6-4: Underwater Noise Assessment (Volume 3). The findings of the UWN assessment are considered in Section 8.8. The findings of the UWN Assessment concluded that effects on all receptors are negligible.</p>
<p><i>“Underwater Noise- Details of the underwater assessment and modelling should be transparent and clearly presented in the ES. The MMO recommends applying noise exposure criteria from Popper et al. (2014) for fish species, and criteria from NMFS (2018) or Southall et al. (2019) for marine mammal species. Consideration should also be given to the timings and duration of each activity, and any potential overlap with sensitive (i.e., spawning or migration) periods.”</i></p>	<p>Further detail regarding noise exposure criteria is provided within Appendix 6-4: Underwater Noise Assessment (Volume 3).</p>
<p><i>“For operational noise, the PEIR concludes that for maintenance dredging activities, “a negligible magnitude of impact is likely. Therefore, there is likely to be a direct, temporary, long term (intermittent) and negligible, effect on fish and marine mammals (not significant). The MMO would expect dredging to be further</i></p>	<p>Further detail regarding the potential effects of noise from maintenance dredging activities is provided in Section 8.8 of this chapter.</p>

Statutory Consultee Comment	Response
<p><i>considered in the ES, with information on the proposed duration and timings of work.”</i></p>	
<p><i>The MMO will be better informed to comment on the proposed mitigation at the ES stage once an underwater noise assessment has been undertaken. However, we note that Section 8.8.27 identifies appropriate mitigation options to consider such as:</i></p> <ul style="list-style-type: none"> <i>i. The use of soft start piling to allow sufficient time for sensitive marine receptors to move away. Soft start measures may help to reduce the total number of dangerous exposures in terms of auditory injury.</i> <i>ii. Employing a marine mammal observer to ensure the area is clear of marine mammals prior to the commencement of percussive piling activities and to cease piling activities if a marine mammal moves into the works area.</i> <i>iii. Undertaking percussive piling and potentially other noisy activities outside of the key sensitive period for fish (e.g., migratory period). This will be discussed and agreed with the Environment Agency, Natural England and the Port of London Authority (PLA) prior to the commencement of any construction works.</i> 	<p>The mitigation stated in the MMO comment is included in Section 8.7.</p>
<p><i>The MMO notes that Section 8.7.3 also identified appropriate measures which will be identified in the ES, including:</i></p> <ul style="list-style-type: none"> <i>i. [As above], Any construction activity that may cause direct disturbance to the marine environment (such as piling) should not</i> 	<p>The mitigation stated in the MMO comments is included in Section 8.7.</p>

Statutory Consultee Comment	Response
<p><i>commence unless an Ecological Clerk of Works (ECoW) is present. This is to ensure sensitive species, notably marine mammals, are absent from the area.</i></p> <p><i>ii. [As above], Construction activities such as piling, and capital dredging should occur outside of sensitive periods for sensitive fish species identified within this chapter. This includes migration, spawning and nursery periods and should be clearly stated in the Outline Code of Construction Practice (OCoCP). The most appropriate timing will be agreed with the regulatory bodies.</i></p> <p><i>iii. Where practicable, low noise piling techniques (pile press in technology) or vibro-piling will be used to minimise the impact on fish and marine mammals. If this is not feasible, the ES will set out justification for any use of percussive piling methods.</i></p> <p><i>iv. Maintenance dredging should occur outside of sensitive periods for sensitive fish species. This includes migration, spawning and nursery periods and will be clearly stated in the OCoCP.</i></p>	
<p><i>“In summary, all relevant impacts (i.e., noisy activities such as piling and dredging) during the construction and operational phase have been identified in the PEIR in relation to UWN. However, an assessment of the potential underwater noise impacts on marine receptors is limited at this stage. The PEIR confirms that an underwater noise study for fish and marine mammal species will be undertaken for the ES. The MMO would expect the ES to consider the potential risk of auditory injury and disturbance/displacement in marine receptors, especially the risk of an acoustic barrier across the</i></p>	<p>A detailed assessment of noise and vibration impacts on sensitive receptors is included within Section 8.8. This chapter considers potential impacts to fish and marine mammals, including; injury, displacement, temporary barriers to migration and modifications to behaviour.</p>

Statutory Consultee Comment	Response
<i>river (which may impact migratory species that utilise the river in particular). Details of the underwater noise assessment modelling should be transparent and clearly presented in the ES.”</i>	

8.4. ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

8.4.1. The marine biodiversity assessment of the Proposed Scheme has been undertaken in line with the legislation, policy and guidance described in **Section 8.2**.

POTENTIAL SIGNIFICANT EFFECTS

8.4.2. As set out in the EIA Scoping Report²⁷ and PEIR²⁸ and following receipt of the EIA Scoping Opinion²⁹, the following effects are considered to be potentially significant and therefore have been considered further in this assessment:

- Construction Phase:
 - loss or disturbance of habitat (Medway Estuary MCZ, The River Thames and its Tidal Tributaries (SINC), marine habitats, intertidal and subtidal benthic communities, marine plants and macroalgae, fish and marine mammals);
 - change in suspended sediment levels and subsequent sediment deposition on the benthic environment (Medway Estuary MCZ, The River Thames and its Tidal Tributaries (SINC), marine habitats, subtidal and intertidal benthic communities, marine plants and macroalgae, plankton, fish and marine mammals);
 - changes in water quality and release of contaminants (Medway Estuary MCZ, The River Thames and its Tidal Tributaries (SINC) marine habitats, intertidal and subtidal benthic communities, marine plants and macroalgae, plankton fish and marine mammals);
 - noise and vibration (Medway Estuary MCZ (fish), The River Thames and its Tidal Tributaries (SINC) (fish) and marine mammals);
 - lighting (Medway Estuary MCZ, The River Thames and its Tidal Tributaries (SINC), marine habitats, intertidal and subtidal benthic communities, marine plants and macroalgae, plankton, fish and marine mammals);
 - vessel strikes (marine mammals);
 - increased wave wash (Medway Estuary MCZ, The River Thames and its Tidal Tributaries (SINC), subtidal and intertidal benthic communities, marine plants and macroalgae and fish); and
 - spread of INNS (Medway Estuary MCZ, The River Thames and its Tidal Tributaries (SINC), marine habitats, subtidal and intertidal benthic communities, marine plants and macroalgae and fish).
- Operation Phase:
 - loss or disturbance of habitat (Medway Estuary MCZ, The River Thames and its Tidal Tributaries SINC, marine habitats, intertidal and subtidal benthic communities, marine plants and macroalgae, fish and marine mammals);
 - increased suspended sediment concentrations and subsequent sediment deposition on the benthic environment (Medway Estuary MCZ, The River Thames and its Tidal Tributaries (SINC), subtidal and intertidal benthic communities, marine plants and macroalgae, fish and marine mammals);

- changes in water quality and release of contaminants (Medway Estuary MCZ, The River Thames and its Tidal Tributaries SINC, marine habitats, intertidal and subtidal benthic communities, marine plants and macroalgae, plankton, fish and marine mammals);
- noise and vibration (Medway Estuary MCZ (fish), The River Thames and its Tidal Tributaries SINC (fish), fish and marine mammals);
- lighting (Medway Estuary MCZ, The River Thames and its Tidal Tributaries (SINC), marine habitats, subtidal and intertidal benthic communities, marine plants and macroalgae, plankton fish and marine mammals);
- vessel strikes (marine mammals);
- increased wave wash (Medway Estuary MCZ, The River Thames and its Tidal Tributaries SINC, marine habitats, subtidal and intertidal benthic communities, marine plants and macroalgae and fish); and
- Spread of INNS (Medway Estuary MCZ, The River Thames and its Tidal Tributaries SINC, marine habitats, subtidal and intertidal benthic communities, marine plants and macroalgae and fish).

MATTERS SCOPED OUT

8.4.3. The following effects are scoped out of this assessment:

- Construction:
 - noise and vibration (impacts upon marine habitats, intertidal and subtidal benthic communities, marine plants and macroalgae and including those within the Medway Estuary MCZ, The River Thames and its Tidal Tributaries SINC) (excluding fish) due to these receptors not being sensitive to noise and vibration;
 - Lighting (INNS); and
 - vessel strikes (Medway Estuary MCZ, The River Thames and its Tidal Tributaries (SINC), marine, habitats, subtidal and intertidal benthic communities, marine, plants and macroalgae, fish and INNS).
- Operation:
 - noise and vibration (marine habitats, intertidal and subtidal benthic communities, marine plants and macroalgae and including those within the Medway Estuary MCZ, The River Thames and its Tidal Tributaries SINC) (excluding fish);
 - vessel strikes (Medway Estuary MCZ, The River Thames and its Tidal Tributaries (SINC), marine, habitats, subtidal and intertidal benthic communities, marine, plants and macroalgae, fish and INNS).

BASELINE DATA COLLECTION

8.4.4. The key desk-based sources of information on baseline marine biodiversity conditions are:

- Natural England's Magic map application³⁰;
- Open source 1:25,000 Ordnance Survey datasets³¹;
- Environment Agency Catchment Data Explorer³²;
- Environment Agency Ecology and Fish Data Explorer³³;
- Estuaries Edges Case Studies^{34,34};
- Zoological Society of London (ZSL) and Thames Ecology Research Programme resources^{35,36,37,38,39,40,41,42,43};
- Environment Agency Archives⁴⁴;
- London Borough of Bexley (LBB) Sites of Importance for Nature Conservation Report⁴⁵;
- available grey literature and technical reports for projects on the Thames
46,47,48,49,50,51,52,53,54,55,56,57,58,59,60;
- International Union for Conservation of Nature (IUCN) Red List⁶¹; and
- Google Earth for satellite and aerial images (accessed in 2023)⁶².

8.4.5. Marine biodiversity survey work has also been undertaken comprising:

- intertidal walkover surveys on 4th November 2022 and 17th May 2023;
- intertidal benthic macrofaunal survey on 17th May 2023 undertaken from a survey vessel due to H&S concerns;
- subtidal benthic macrofaunal surveys on 18th May and 21st September 2023;
- sediment quality surveys on 17th and 18 May 2023, as well as 21st September 2023 from a survey vessel;
- water quality survey on 21st September to provide supporting data for the sediment model; and
- fish survey carried out on 18th May 2023 and 21st September 2023.

8.4.6. The methodology for each of these surveys is detailed within **Appendix 8-1: Marine Baseline Surveys (Volume 3)**. The following figures show the survey Study Area and locations:

- **Figure 8-1: Marine Biodiversity Study Areas (Volume 2).**
- **Figure 8-2: Spring and Autumn Fish Trawl Sample Locations and Water Quality Survey Locations (Volume 2).**
- **Figure 8-3: Intertidal and Subtidal Trawl Sample Locations within the Survey Area (Volume 2).**
- **Figure 8-4: Successful and Unsuccessful Grab Sampling Locations (Volume 2).**
- **Figure 8-5: Marine Habitats (Volume 2).**

ASSESSMENT METHODOLOGY

8.4.7. The assessment presented in this chapter has been conducted in line with current good practice from CIEEM's Guidelines for Ecological Impact Assessment⁶³, in

addition to the specific methodology detailed in **Chapter 4: EIA Methodology (Volume 1)**. Each receptor has been evaluated within the geographic scale of reference and against potential impacts from the construction and operation phases of the Proposed Scheme.

- 8.4.8. A matrix approach has been used to determine the significance of adverse effects, by comparing impact magnitude against receptor value and sensitivity. This is based on the approach used for road schemes in the UK by the Design Manual for Roads and Bridges⁶⁴. This approach has been utilised as it provides an appropriate method for infrastructure EIA. Although the Proposed Scheme does not comprise a road/bridge to which the public has access, this guidance provides a robust methodology for assessing impacts to ecology, in this case, marine biodiversity and is considered suitable for this assessment.
- 8.4.9. This methodology will be used to assess both the construction and operation phases of the Proposed Scheme.
- 8.4.10. The assessment presented within this chapter considers potential impacts from the construction and operation of the Proposed Scheme alongside Riverside 1 and Riverside 2.

Significance Criteria

Magnitude

- 8.4.11. The magnitude of impact relates to the level of change compared to the baseline conditions, using the duration, timing, scale, size and frequency to determine the magnitude of the impact to each receptor. Magnitude is evaluated in accordance with the definitions set out in CIEEM's Guidelines for Ecological Impact Assessment⁶³, summarised in **Table 8-6** below.
- 8.4.12. The following characteristics will be used to assess the magnitude of the impact on marine ecological features as a result of the Proposed Scheme:
- type of impact – beneficial or adverse;
 - extent or spatial scope of the impact;
 - reversibility of impact – whether the impact is naturally reversible or reversible through mitigation measures;
 - timing and frequency of the impact, in relation to ecological changes; and
 - likely duration of the impact – short term (< 1 year), medium-term (1 - 5 years) or long term (5 or more years).

Table 8-4: Marine Biodiversity Definitions of Impact Magnitude Classes

Magnitude of Impact	Definition
High	Total loss or large alteration to key elements/features of the baseline conditions. Results in extensive temporary or permanent changes to baseline conditions such as spawning/nursery/feeding grounds and/or migratory routes.
Medium	Partial loss or alteration to one or more key elements/features of the baseline conditions.
Low	Small shift away from baseline conditions. No noticeable effects above the level of natural variation experienced.
Negligible	Very slight change from baseline conditions.

Importance and Sensitivity

- 8.4.13. When considering the impacts upon a receptor, a combination of importance and sensitivity using professional judgement has been used to determine the most appropriate value for the receptor (e.g. an internationally important receptor such as European eel, may have a low sensitivity to a certain impact and consequently will be assessed as having a low sensitivity, despite being of international importance; therefore the sensitivity has been used alongside the magnitude of impact to determine the significance of impact). As described within **Chapter 4: EIA Methodology (Volume 1)**, sensitivity is a means to measure how affected receptors/processes and/or the receiving environment is likely to respond to change. The sensitivity is assigned at the receptor/process level. In this chapter, the sensitivity assessment for marine species and habitats has been informed by the Marine Life Information Network (MarLin⁶⁵), grey literature and professional judgement. The importance of the receptor has also been considered using CIEEM criteria in terms of quality, rarity, and for habitats and species, this can be classed as International, UK/National, Regional/County, District or Local.
- 8.4.14. **Table 8-7** summarises the ecological feature conservation importance, along with a summary of sensitivity information adapted from the CIEEM's Guidelines for Ecological Impact Assessment⁶³ for habitats and species.

Table 8-5: Marine Biodiversity Definitions of Receptor Importance and Sensitivity

Importance/Sensitivity)	Criteria
International /Very High	<p>Habitats</p> <ul style="list-style-type: none"> an internationally designated site or candidate site SPA, candidate SPA, SAC, candidate SAC, Site of Community Importance (SCI), Ramsar Site or an area that would meet the published selection criteria for designation; and a viable area of a habitat type listed in Annex I of the Habitats Directive, or smaller areas of such habitat, which are essential to maintain the viability of a larger whole. <p>Species</p> <ul style="list-style-type: none"> a sustainable population of an internationally important species or species listed as occurring in 15 or fewer 10km squares in the UK (categories 1 and 2 in the UK BAP) which is listed in Annex IV of the Habitats Directive, or as being of unfavourable conservation status in Europe, of uncertain conservation status or of global conservation concern in the UK BAP; and sites supporting a spawning population of such a species or supplying a critical element of their habitat requirements. <p>Sensitivity</p> <ul style="list-style-type: none"> species present within the Study Area (defined in section 8.5) that are likely to be rare with minimal potential for substitution or unable to tolerate change.
National/ High	<p>Habitats</p> <ul style="list-style-type: none"> a nationally designated site, SSSI, NNR, Marine Nature Reserve, MCZ or a discrete area, which would meet the published selection criteria for national designation (e.g. SSSI selection guidelines); and a sustainable area of a priority habitat identified in the UK BAP, or of smaller areas of such habitat which are essential to maintain the viability of a larger whole. <p>Species</p> <ul style="list-style-type: none"> any regularly occurring/large population of a nationally important species (e.g. Red Data List⁶⁶);

Importance/Sensitivity)	Criteria
	<ul style="list-style-type: none"> • a large population of a species identified as a SPI; • a species population that would qualify for SSSI designation; • Nationally Important Marine Features; and • species that have spawning or nursery areas within the Study Area that are important nationally (e.g. may be primary spawning/nursery area for that species). <p>Sensitivity</p> <ul style="list-style-type: none"> • species present have limited potential for substitution.
<p>Regional/ County/ Medium</p>	<p>Habitats</p> <ul style="list-style-type: none"> • viable areas of key habitat identified in county/district BAPs, or smaller areas of such habitat which are essential to maintain the viability of a larger whole; • sites recognised by local authorities, e.g. Local Wildlife Sites (LWS); and • county sites that the designating authority has determined meet the published ecological selection criteria for designation. <p>Species</p> <ul style="list-style-type: none"> • a regularly occurring, locally significant number of a nationally important species; • any regularly occurring, locally significant population of a SPI or a species listed in a county/district BAP (where available); • a regularly occurring, locally significant population of a county/district important species; • sites supporting populations of internationally/nationally/regionally important species that are not threatened or rare in the region or county, and not integral to maintaining those populations; • sites/features scarce in the county or that appreciably enrich the county habitat resource; • species that are of commercial value to the fisheries which operate within the Thames; and

Importance/Sensitivity)	Criteria
	<ul style="list-style-type: none"> species that have spawning or nursery areas within the Study Area that are important regionally (i.e. species may spawn in other parts of the UK, but their key spawning area is within the Thames as the region of interest). <p>Sensitivity</p> <ul style="list-style-type: none"> species that have some ability to tolerate change and recover in the medium term.
<p>District/ Low</p>	<p>Habitats</p> <ul style="list-style-type: none"> areas of habitat that appreciably enrich the local habitat resource. <p>Species</p> <ul style="list-style-type: none"> assemblages of species that appreciably enrich the biodiversity resource within the local context; sites supporting populations of county/district important species that are not threatened or rare in the region or county and are not integral to maintaining those populations. <p>Sensitivity</p> <ul style="list-style-type: none"> species able to tolerate the effect to a large extent, with a relatively rapid rate of recovery.
<p>Local/ Negligible</p>	<p>Habitats</p> <ul style="list-style-type: none"> common and widespread habitat, not meeting any of the above criteria; and areas of heavily modified habitat or habitats of low species diversity or low value as habitat to species of nature conservation interest. <p>Species</p> <ul style="list-style-type: none"> common and widespread species, not meeting any of the above criteria; commonplace feature of little or no habitat/historical significance; loss of such a feature would not be seen as detrimental to the ecology of the area; species that are of commercial importance but do not form a key component of the assemblages within the Study Area; and the spawning/nursery area for the species are outside of the Study Area.

Importance/Sensitivity)	Criteria
	Sensitivity <ul style="list-style-type: none"> species that have a high tolerance to change and can accommodate a particular effect without the need to recover or adapt.

Significance

- 8.4.15. The overall significance of effect has been assessed using the matrix shown in **Table 8-6** which has been modified to align with **Chapter 4: EIA Methodology (Volume 1)**. This uses importance/sensitivity of the receptor and magnitude of impact to determine significance, in accordance with current good practice guidelines published by the CIEEM⁶³. Where a range of significance of effect is identified the final assessment for each effect is based upon professional judgement.
- 8.4.16. In accordance with **Chapter 4: EIA Methodology (Volume 1)** any effects with a significance level of Moderate or above will be concluded to be significant.

Table 8-6: Significance of Effects Matrix

Importance/Sensitivity	Magnitude of Impacts				
		High	Medium	Low	Negligible
	International/Very High	Major	Major to Moderate	Moderate	Negligible
	UK/National/High	Major	Major to Moderate	Moderate	Negligible
	Regional/County/Medium	Major to Moderate	Moderate	Minor to Moderate	Negligible
	District/Low	Moderate	Minor to Moderate	Minor	Negligible
	Local/Negligible	Minor	Minor	Negligible	Negligible

8.5. STUDY AREA

- 8.5.1. For the assessment of impacts during construction and operation, the initial Study Areas for potential sensitive receptors, as provided in the PEIR²⁸ are set out in **Table 8-7**. This approach is consistent with current good practice guidelines published by the CIEEM⁶³. Relevant data from further afield has also been used if the information was of value in describing the marine biodiversity baseline.
- 8.5.2. The assessment considers the likely significant effects of the Proposed Scheme on ecological features within its zone of influence (ZOI). ZOI is a term used in CIEEM guidance⁷¹ and the Study Areas relevant to this chapter have been drawn to match the ZOI(s). Consequently, ZOI has been used in this chapter alongside the term Study Area where appropriate. The Study Area has been used when describing the baseline (habitats and species), whereas ZOI has been used when discussing the potential impacts of the Proposed Scheme.

- 8.5.3. The ZOI, according to CIEEM⁷¹, will vary for different ecological species and will depend on their sensitivity to an environmental change. The ZOI for the Proposed Scheme have been determined by:
- consideration of the activities during construction and operation associated with the Proposed Scheme and the scale of the works;
 - the hydrological flows within the Thames, to determine potential upstream and downstream effects;
 - the duration and timing of the works (e.g. seasonal variations in mobile species, including migratory fish); and
 - consideration whether mobile features of a designated site, located some distance away, utilise parts of the Thames for part of their lifecycle within or in close proximity to the Site, potentially exposing them to impacts from the Proposed Scheme (e.g. European Smelt).
- 8.5.4. In accordance with CIEEM guidelines⁷¹, the ZOI should be regularly reviewed as the project evolves and more information becomes available. Consequently, the ZOI has been extended, where relevant, to account for updated information regarding the outputs of sediment modelling for dredging activities, which has become available as part of ongoing design development since the assessment presented in the PEIR²⁸. This demonstrated that suspended sediments, using the worst case scenario as comprising silt only, may extend to a distance of 3.5km upstream and downstream.
- 8.5.5. The ZOI for marine biodiversity will vary during construction and operation phases for some impacts. The worst case scenario for the ZOI is included in **Table 8-7**.
- 8.5.6. The ZOI are shown in **Figure 8-1: Marine Biodiversity Study Areas (Volume 2)**.

Table 8-7: Marine Biodiversity Zones of Influence

Receptor	Zone of Influence
Nationally Designated Sites	Within 15km of the Site Boundary, extended to 25km if there is a designated feature(s) of a particular site that is highly mobile and consequently can be present within the vicinity of the Site Boundary.
Non-statutory Designated Sites	Within 2km of the Site Boundary, extended if there is a designated feature(s) of a particular site that is highly mobile and consequently can be present within the vicinity of the Site. Extended to 3.5km to account for dredging impacts.
Thames Middle Transitional WFD Water Body Habitats and Species (excluding fish and marine mammals)	Within 250m of the Site Boundary. Extended to 3.5km to account for dredging impacts.

Receptor	Zone of Influence
Fish	Within 10km of the Site Boundary, extended for species that display high mobility, such as migratory species (ZOI for European smelt has been extended to 25km).
Marine Mammals	Within 10km of the Site Boundary.
INNS	Within 250m of the Site Boundary. Extended to 3.5km to account for dredging impacts.

SENSITIVE RECEPTORS

8.5.7. The following likely sensitive receptors have been identified:

Nationally Designated Sites

- Medway Estuary MCZ (Zone 1 & 2 Boundary).

Non-statutory Designated Sites

- The River Thames and its Tidal Tributaries Site of Importance for Nature Conservation (SINC).

Thames Middle Transitional WFD Water Body - Habitats and Species

- Intertidal mudflat habitat and their associated benthic communities;
- Intertidal saltmarsh habitat and associated benthic communities;
- Subtidal mudflat habitat and associated benthic communities;
- Marine plants and macroalgae;
- Fish;
- Marine mammals (including grey seals, harbour seals and harbour porpoises); and
- Plankton.

8.6. BASELINE CONDITIONS AND FUTURE BASELINE

DESK STUDY BASELINE

8.6.1. This marine ecology baseline was compiled using the most up to date and relevant data sets both spatially and temporally. Whilst some of the data sources are over 18 months old, they still provide a valuable insight to the marine ecology within the Study Area. Site-specific surveys have been undertaken to update this baseline information, with the results provided in **Appendix 8-1: Marine Baseline Surveys (Volume 1)**.

Nationally Designated Sites

- 8.6.2. There is one nationally designated site included in this assessment that lists marine features as a reason for its designation and has functional hydrological links to the Site. This is the Medway Estuary MCZ Zone 1 & 2 (approximately 25km southeast of the Site Boundary). The Medway Estuary MCZ is designated for the protection of the tentacled lagoon-worm *Alkmaria romijni*, smelt *Osmerus eperlanus* and eight habitats including intertidal mixed sediments, intertidal sand and muddy sand, subtidal coarse sediment, subtidal mud, subtidal sand, low energy intertidal rock, estuarine rocky habitats and peat and clay exposures.

Non-statutory Designated Sites

- 8.6.3. The River Thames and its Tidal Tributaries SINC is included in this assessment, which overlaps with the Site. This SINC, which encompasses tidally influenced areas from Dartford Marshes to Molesley (2304.92ha in London, 392.97ha of which is within the LBB), is designated by the Greater London Authority (GLA) and is adopted by all boroughs that border the Thames. It recognises a range of estuarine habitats including mud flat, shingle beach, saltmarsh, reedbeds and the river channel, as well as importance for fish species, invertebrates and wading birds⁴⁵. Similarly, the LBB Local Biodiversity Action Plan (LBAP) includes rivers and streams as a priority habitat⁸.

Thames Middle Transitional WFD Water Body Habitats and Species

- 8.6.4. The Thames Middle Transitional WFD Water Body comprises many different habitats and species. Within this section of the Thames, there is one WFD-designated water body located within the Study Area, the Thames Middle Transitional Water Body (GB530603911402).
- 8.6.5. Alongside the main Thames channel, the Thames Middle Transitional WFD Water Body also includes the tidal sections of several Thames tributaries, including the River Roding, River Lea (Lee), Deptford Creek and the River Darent. Any reference to the Thames Middle Transitional WFD Water Body within this chapter is inclusive of the tidal section of these watercourses.
- 8.6.6. The 2022 WFD ecological status of this water body was classified as Moderate overall based on the WFD classification criteria, where the lowest scoring quality element is used. Five biological quality elements are monitored in this water body, as detailed in **Table 8-8**³³.

Table 8-8: Classifications of WFD Biological Quality Elements, Thames Middle Transitional WFD Water Body

Biological Quality Element	2019 WFD Classification	2022 WFD Classification
Angiosperms	Moderate	Moderate
Saltmarsh (Sub Element)	Moderate	Moderate
Fish	Good	Good
Invertebrates	Good	Good
Infaunal Quality Index (Sub Element)	Good	Good
Macroalgae	Good	Good
Fucoid Extent (Sub Element)	Good	Good
Opportunistic Algae (Sub Element)	High	High
Phytoplankton	Good	Good

8.6.7. One WFD Higher Sensitivity Habitat, Intertidal Saltmarsh (A2.5), and one WFD Lower Sensitivity Habitat, Intertidal Soft Sediment (Sand, Mud & Mixed A2.2, A2.3, A2.4), are present within the Site³⁰.

8.6.8. Further detail on all WFD elements of the Thames Middle Transitional WFD Water Body and a specific WFD assessment of impacts on this site are provided in **Appendix 11-1: Water Framework Directive Assessment (Volume 3)**.

8.6.9. An overview of the habitats and species within the Thames Middle Transitional WFD Water Body is provided in the following sections and is shown in **Figure 8-5: Marine Habitats (Volume 2)**.

Marine Habitats

8.6.10. The Thames Middle Transitional WFD Water Body features subtidal and intertidal habitats. The subtidal substrate within the Thames Middle Transitional WFD Water Body is predominantly coarse sediment, sand and mud⁴⁵.

8.6.11. The intertidal habitat of the Thames Middle Transitional WFD Water Body includes areas of shingle, reedbeds, saltmarsh and seagrass beds. Extensive intertidal sand and mudflats are present, primarily consisting of fine, silty sediment. The mudflat fringes are known to become narrower further inland (due to coastal squeeze) and wider further downstream towards the Outer Estuary.

- 8.6.12. DEFRA's Magic³⁰ mapping application indicates the intertidal area within the Site features a narrow strip of intertidal soft sediment comprising mudflat (width of approximately 170m) and intertidal saltmarsh (width of approximately 40m)³⁰.
- 8.6.13. Intertidal mudflats are a UK Biodiversity Action Plan (UKBAP) priority habitat that is also protected as a habitat of principal importance (HPI) under Section 41 of the NERC Act¹⁴. It is also included in the OSPAR Convention as a threatened and/or declining habitat.
- 8.6.14. An area of saltmarsh was present approximately 500m to the west of the Site Boundary and this is a habitat considered to be of higher sensitivity under the WFD and a UKBAP priority habitat.
- 8.6.15. Following the two walkover site visits in November 2022 and May 2023, the surveys recorded the presence of intertidal mudflats adjacent to and underneath the Belvedere Power Station Jetty (disused) and saltmarsh 500m to the west of the Site Boundary. A band of Fucoids belonging to the order of brown algae were observed growing on the base of the river wall (flood defence) and a thin strip of salt tolerant vegetation growing above the band of Fucoids.
- 8.6.16. The section of the Thames Middle Transitional WFD Water Body is constrained on both banks by artificial flood defences. The flood defences within the Study Area are comprised of a 45-degree angle smooth concrete wall with a vertical concrete capping piece. The intertidal mudflat extends approximately 70m from the base of the wall towards the mean low water point. An area of intertidal boulders dominated by wrack *Fucus sp* and sea-lettuce *Ulva sp* was also present within the mudflat area on the right-hand (southern) bank.

Intertidal Benthic Communities

- 8.6.17. A combination of desk study and field surveys (as summarised previously in **Section 8.4** and in detail within **Appendix 8-1: Marine Baseline Surveys (Volume 3)**) have been used to compile the ecological baseline for the intertidal benthic communities within the Study Area.

Desk study results

- 8.6.18. Invertebrate species typically found within the intertidal zone of the brackish sections of the Thames Middle Transitional WFD Water Body include polychaetes (or bristle worms) (such as ragworms *Nereis spp* and the spionid *Streblospio shrubsolii*) and tubificid oligochaete worms such as *Limnodrilus hoffmeisteri*³⁵.
- 8.6.19. The macrofaunal community in the intertidal habitats at Thames Wharf (approximately 9km upstream of the Site Boundary) was surveyed in 2015^{68,69} as part of the Silvertown Tunnel works. The communities were highly impoverished with low species diversity. The assemblage featured oligochaetes, nematodes and gastropods (snails), and was dominated by *L. hoffmeisteri*. This species is commonly found in high densities in the upper Thames Estuary and at nutrient enriched locations, such as adjacent to sewage outfalls.

- 8.6.20. The Crossness Sewage Treatment Works is located approximately 230m to the west of the Site Boundary (with a discharge outfall and storm drain)⁶⁷ and therefore may have an influence on the fauna at the Site.
- 8.6.21. The macrofaunal community recorded in 2015, at an Environment Agency TraC invertebrate monitoring station approximately 8km downstream of the Site Boundary, demonstrated similar community characteristics. The sample predominantly comprised oligochaetes, with a low number of crustaceans, molluscs, and bryozoans. No protected or notable species were detected.

Field survey results

- 8.6.22. The macrofaunal benthic survey of 17th May 2023 yielded a total count of 14 taxa across five phyla (see **Table 8-9**). The intertidal benthic community was impoverished and dominated by species that are highly tolerant of disturbance such as changes in suspended solids, smothering and siltation rate changes, disturbance of the substratum and contamination and which also have a quick recovery time⁶⁸. This is likely due to the high suspended sediments present within the area, fluctuating salinities and high organic enrichment. All stations were dominated by the oligochaete worm *Baltidrilus costatus* and the ragworm *Hediste diversicolor*. Station 6 was also dominated by European mud scud *Corophium volutator*. All the species recorded from the samples in this area are common in the Thames Estuary and no protected species were recorded.
- 8.6.23. Collection of surface sediment at the same macrofaunal sites on 17th May 2023 was subject to particle size analysis (PSA) as this often influences the macrofaunal community composition. The percentages of different sediment types for each station are presented in **Table 8-11** and **Table 8-12**.
- 8.6.24. PSA results indicated that the sediment type across the intertidal sample stations mainly consisted of sand with an average composition of 56.30%, followed by silt with an average of 37.52% and clay (6.17%). No gravel was recorded within the intertidal sample stations.
- 8.6.25. Contamination was recorded within the surface sediments from the intertidal area. The full results of the contaminant analysis are presented in **Appendix 11-1: Water Framework Directive Assessment (Volume 3)**. In summary, results indicated that the surface sediments are generally contaminated within the intertidal areas. There is also point source pollution from Crossness Sewage Treatment Works. No patterns were observed within the intertidal benthic communities. Due to the impoverished nature of the benthic communities present (which is similar to other locations located along the Thames), it is not possible to draw any conclusions as to whether this is due to contamination. The methodology and ecological survey results for the site-specific surveys are presented in **Appendix 8-1: Marine Baseline Surveys (Volume 3)**.

Table 8-9: Intertidal Benthic Survey Results

Station	Sediment	No. of taxa (per m ²)	No. of individuals (per m ²)	Key Characterising Species (Number per m ² shown in brackets)
Intertidal 1	Gravel (0%) Sand (56.18%) Silt (38.56%) Clay (5.26%)	8	417	<i>Baltidrilus costatus</i> (327) <i>Copepoda</i> (1) <i>Corophium volutator</i> (9) <i>Hediste diversicolor</i> (64) <i>Manayunkia aestuarina</i> (1) <i>Peringia ulvae</i> (1) <i>Streblospio</i> (10) <i>Tubificoides pseudogaster</i> (4)
Intertidal 2	Gravel (0%) Sand (59.88%) Silt (35.01%) Clay (5.11%)	8	1,128	<i>Baltidrilus costatus</i> (552) <i>Copepoda</i> (1) <i>Corophium volutator</i> (69) <i>Hediste diversicolor</i> (299) <i>Manayunkia aestuarina</i> (50) <i>Streblospio</i> (149) Truncatelloidea (1) <i>Tubificoides pseudogaster</i> agg. (7)
Intertidal 3	Gravel (0%) Sand (56.51%) Silt (37.42%) Clay (6.07%)	6	1,951	<i>Baltidrilus costatus</i> (1316) <i>Corophium volutator</i> (87) <i>Hediste diversicolor</i> (502) <i>Manayunkia aestuarina</i> (10)

Station	Sediment	No. of taxa (per m ²)	No. of individuals (per m ²)	Key Characterising Species (Number per m ² shown in brackets)
				<i>Streblospio</i> (19) <i>Tubificoides heterochaetus</i> (17)
Intertidal 4	Gravel (0%) Sand (56.14%) Silt (37.87%) Clay (5.99%)	11	955	Amphipoda (1) <i>Baltidrilus costatus</i> (203) Copepoda (1) Corophiidae (13) <i>Corophium volutator</i> (112) <i>Cyathura carinata</i> (4) <i>Hediste diversicolor</i> (490) <i>Manayunkia aestuarina</i> (91) Nereididae (10) <i>Streblospio</i> (25) <i>Tubificoides heterochaetus</i> (5)
Intertidal 5	Gravel (0%) Sand (60.23%) Silt (34.42%) Clay (5.35%)	8	1,039	<i>Baltidrilus costatus</i> (515) <i>Corophium volutator</i> (111) <i>Cyathura carinata</i> (2) <i>Hediste diversicolor</i> (332) <i>Manayunkia aestuarina</i> (19) Nereididae (8) <i>Streblospio</i> (51) <i>Tubificoides heterochaetus</i> (1)

Station	Sediment	No. of taxa (per m ²)	No. of individuals (per m ²)	Key Characterising Species (Number per m ² shown in brackets)
Intertidal 6	Gravel (0%) Sand (48.88%) Silt (41.86%) Clay (9.27%)	9	925	<i>Baltidrilus costatus</i> (93) <i>Corophium</i> (14) <i>Corophium volutator</i> (472) <i>Cyathura carinata</i> (1) Enchytraeidae (4) <i>Hediste diversicolor</i> (326) <i>Manayunkia aestuarina</i> (5) <i>Scrobicularia plana</i> (1) <i>Streblospio</i> (9)

Subtidal Benthic Communities

Desk study results

- 8.6.26. The invertebrate species commonly found in brackish subtidal sections of the Thames Middle Transitional WFD Water Body include the amphipod shrimp *Gammarus zaddachi*, the oligochaete worm *Tubifex tubifex* and the non-native New Zealand mud snail *Potamopyrgus antipodarum*⁶⁸.
- 8.6.27. The macrofaunal communities in this location of the Thames Middle Transitional WFD Water Body tend to be characterised by low species diversity and abundances. For example, the communities found during subtidal surveys conducted at Borthwick and Thames Wharves (located approximately 10.5km and 9km, respectively, upstream of the Site Boundary) were impoverished and dominated by species such as *G. zaddachi* and the mud shrimp *Apocorophium lacustrae*, with oligochaetes, isopods, polychaetes and molluscs also recorded in low abundances. The subtidal substrate at these sites consists of cobbles and gravel, likely as a result of high scour and frequent disturbance of the bed⁶⁸.
- 8.6.28. The freshwater snails *Cochliopidae* Type A and Type B and lagoon sea slug *Tenellia adspersa* were recorded approximately 14km upstream of the Site Boundary at Enderby Wharf in 2009⁶⁸. These species are protected under Schedule 5 of the WCA and listed as a UKBAP priority species. Lagoon sea slug is also an SPI under Section 42 of the NERC Act¹⁴.
- 8.6.29. Subtidal benthic communities at Gallions Reach, approximately 4km upstream from the Site Boundary, were found to support the sea mat *Victorella* sp⁶⁹. This nationally rare bryozoan is protected under Schedule 5 of the WCA and as a SPI under Section 42 of the NERC Act.¹⁴ It is also listed in the UK BAP as a priority species. Another species of sea mat, *Einhornia crustulenta*, which is a nationally rare species⁷⁰, was also present.
- 8.6.30. *Victorella* sp was also detected in 2012 at an Environment Agency TraC benthic invertebrate monitoring station³³, located approximately 8km downstream of the Site Boundary.

Field survey results

- 8.6.31. The subtidal surveys for macrofauna on 18th May 2023 and 21st September 2023 yielded a total count of 26 taxa (see **Table 8-10**), comprising 3,560 individuals of primarily *Tubificoides pseudogaster* agg, *Streblospio* spp and *Cyathura carinata*. The macroinvertebrate community across the sites, generally exhibited low species richness. The majority of species recorded are common and widespread within the Thames. One rare/scarce species was recorded at Subtidal Point 13 (**Figure 8-3: Intertidal and Subtidal Trawl Sample Locations within the Survey Area (Volume 2)**); the amphipod crustacean *Apocorophium lacustre*. However, this species is not afforded any protection. The non-native bristleworm *Marenzelleria* was recorded at three sample stations (Subtidal Points 10, 12 and 15) and the non-native amphipod *Incisocallope aestuarius* was recorded at two sample sites (Subtidal Points 14 and 15).
- 8.6.32. Brown shrimp *Crangon crangon*, mysid shrimp *Mysid* spp and *Gammarus* spp were observed within the beam trawl transect surveys carried out on 18th May and 21st September 2023.
- 8.6.33. The subtidal samples primarily consisted of an impoverished community of species that are highly tolerant of disturbance such as changes in changes in suspended solids, changes to smothering and siltation rates, disturbance of the substratum and contamination and also have a quick recovery time⁶⁸
- 8.6.34. Collection of surface sediment at the same subtidal macrofaunal sites was analysed for PSA. The sediment type across the subtidal sample stations also mainly consisted of sand which had an average composition of 47.45%, followed by silt (35.86%), clay (11.61%) and gravel (5.08%). Of note is that the sample from Station 15 consisted primarily of gravel (44.92%) whereas the rest of the subtidal sample stations had less than one percent of gravel.
- 8.6.35. Within the proposed dredge pocket (site 10) the substrate comprised of sand (66.97%), silt (26.53%) and clay (6.12%). At the edge of the dredge pocket (site 9) the sediment was predominantly sand (94.33%) with some silt (4.13%). The sediment within the floating support platform (site 12) comprised sand (70.99%), silt (22.66%) and clay (6.25%). The substrate became coarser towards the main channel, with some of the samples bringing up large stones and pieces of debris including brick.

- 8.6.36. Contamination was recorded within the subtidal surface sediments from within and outside the dredged area. The full results of the contaminant analysis are presented in **Appendix 11-1: Water Framework Directive Assessment (Volume 3)**. In summary, results indicated that the subtidal surface sediments are generally contaminated within and outside the dredged area. There is also point source pollution from Crossness Sewage Treatment Works. No patterns were observed within the subtidal benthic communities. Due to the impoverished nature of the benthic community present within the area (which is similar to other locations located along the Thames), it is not possible to draw any conclusions as to whether the impoverished nature of the subtidal benthic communities are a result of this contamination. The methodology and ecological survey results for the site-specific surveys are presented within **Appendix 8-1: Marine Baseline Surveys (Volume 3)**.

Table 8-10: Subtidal Benthic Ecology and Sediment Survey Results

Station	Sediment Type	No. of taxa (per m ²)	No. of individuals (per m ²)	Total Biomass (g, per m ²)	Key Characterising Species (Number per m ² shown in brackets, 'P' indicates presence of taxa)
Subtidal 7	Gravel (0%) Sand (37.23%) Silt (48.88%) Clay (13.89%)	2	90	1.001	<i>Cyathura carinata</i> (20) <i>Peringia ulvae</i> (70)
Subtidal 8	Gravel (0%) Sand (16.44%) Silt (61.29%) Clay (22.26%)	3	40	0.2690	<i>Tubificoides pseudogaster</i> agg. (20) Corophiidae (10) <i>Cyathura carinata</i> (10)
Subtidal 9 (edge of dredge pocket)	Gravel (0.03%) Sand (94.33%) Silt (4.13%) Clay (1.52%)	3	40	0.0080	<i>Steblospio</i> (20) <i>Gammarus</i> (20) Araceae (P)
Subtidal 10 (within dredge pocket and location of Proposed Jetty)	Gravel (0.37%) Sand (66.97%) Silt (26.53%) Clay (6.12%)	8	680	0.2760	Enchytraeidae (30) <i>Tubificoides pseudogaster</i> agg. (130) <i>Maranzelleria</i> (10) <i>Steblospio</i> (490)

Station	Sediment Type	No. of taxa (per m ²)	No. of individuals (per m ²)	Total Biomass (g, per m ²)	Key Characterising Species (Number per m ² shown in brackets, 'P' indicates presence of taxa)
					<i>Gammarus</i> (10) <i>Peringia ulvae</i> (10) <i>Einhornia crustulenta</i> (P) Araceae (P)
Subtidal 11	Gravel (0.33%) Sand (88.68%) Silt (8.99%) Clay (2.01%)	7	340	0.4160	Enchytraeidae (10) <i>Baltidrilus costatus</i> (10) <i>Tubificoides pseudogaster agg.</i> (140) <i>Hediste diversicolor</i> (10) <i>Steblospio</i> (120) <i>Gammarus</i> (40) Corophiidae (10)
Subtidal 12	Gravel (0.10%) Sand (70.99%) Silt (22.66%) Clay (6.25%)	10	1,040	1.5720	Enchytraeidae (10) <i>Tubificoides pseudogaster agg.</i> (350) <i>Hediste diversicolor</i> (20) <i>Polydorini</i> (10) <i>Marenzelleria</i> (30) <i>Steblospio</i> (590) <i>Cyathura carinata</i> (10)

Station	Sediment Type	No. of taxa (per m ²)	No. of individuals (per m ²)	Total Biomass (g, per m ²)	Key Characterising Species (Number per m ² shown in brackets, 'P' indicates presence of taxa)
					Gastropoda (10) <i>Peringia ulvae</i> (10) Araceae (P)
Subtidal 13	Gravel (0%) Sand (22.41%) Silt (57.11%) Clay (20.48%)	9	800	0.955	<i>Hediste diversicolor</i> (10) Polydorini (50) <i>Polydora cornuta</i> (20) <i>Streblospio</i> (340) <i>Apocorophium lacustre</i> (140) <i>Corophium</i> (60) <i>Corophium volutator</i> (30) <i>Cyathura carinata</i> (150) <i>Einhornia crustulenta</i> (P)
Subtidal 14	Gravel (0%) Sand (16.66%) Silt (58.97%) Clay (24.37%)	7	200	0.064	<i>Anthoathecata</i> (P) Campanulariidae (P) <i>Balanus crenatus</i> (70) <i>Incisocalloiope aestuarius</i> (90) Corophiidae (20)

Station	Sediment Type	No. of taxa (per m ²)	No. of individuals (per m ²)	Total Biomass (g, per m ²)	Key Characterising Species (Number per m ² shown in brackets, 'P' indicates presence of taxa)
					<i>Cyathura carinata</i> (P) <i>Idotea</i> (20)
Subtidal 15	Gravel (44.92%) Sand (13.30%) Silt (34.16%) Clay(7.62%)	11	330	0.128	<i>Anthoathecata</i> (P) Campanulariidae (P) <i>Marenzelleria</i> (10) <i>Polydora</i> (10) <i>Steblospio</i> (200) Thoracica (20) <i>Incisocallope aestuarius</i> (30) <i>Idotea</i> (50) <i>Neomysis integer</i> (10) <i>Einhornia crustulenta</i> (P) Aracea (P)

Marine Plants and Macroalgae

Desk study results

- 8.6.37. A macroalgae survey was conducted in 2020 for the Thames Middle Transitional WFD Water Body, approximately 2km upstream from the Site Boundary⁷¹. Two species were detected, sea lettuce *Ulva* spp. and bladder wrack *Fucus vesiculosus*, accounting for 84% and 16% of cover, respectively. Sea lettuce is considered an opportunistic species which is often present in eutrophic areas and both species were detected growing on hard substrates. Both species are common and widespread.

Field survey results

- 8.6.38. The site visit undertaken on the 4th November 2022 and 17th May 2023 identified marine plants and algae within the intertidal regions of the Study Area. The top section of the wall is within the splash zone and has some growth of salt-tolerant terrestrial plant species. The mid-section of the wall was colonised by filamentous green algae, with a band of seaweed, comprising fucoid species, present along the base of the wall. A small area of fringing saltmarsh comprising mainly of common reed *Phragmites australis* are located to the west of the Study Area in a small embayment, located approximately 500m west of the Proposed Scheme.

Phytoplankton

- 8.6.39. Environment Agency TraC phytoplankton monitoring data for the Thames Middle Transitional WFD Water Body was available from surveys conducted in 2019 at one survey location within the Study Area³³ at NGR TQ5057580610 (the most recent TrAC data available). The assemblage was predominantly diatoms and protozoans, with no INNS detected.

Fish

- 8.6.40. The Thames Estuary supports diverse fish fauna, with over 115 species recorded in Environment Agency fish surveys³⁵. The Thames Estuary is commonly split into the inner, middle and outer, each with a characteristic fauna.
- 8.6.41. This assessment has primarily focused on protected/notable fish species. These species can be categorised by life-history and habitat preferences to include:
- Demersal (D): bottom dwelling or mid-water fish that have close associations with benthic habitats/seabed;
 - Pelagic (P): free swimming fish that inhabit the mid water column, with little association with benthic habitats/seabed;
 - Migratory (M): fish that migrate, often between seawater and freshwater habitats, as a part of their life cycle; and
 - Elasmobranchs: cartilaginous fish including sharks and rays.

- 8.6.42. A summary of regulations relevant to protected/notable fish species within the inner Thames Estuary, and their habitat preference, is summarised in **Table 8-11**. All notable species that have been recorded within the inner Thames Estuary are included in this table, however that does not assume presence in or close to the Study Area.
- 8.6.43. Recent catch data from the Environment Agency TraC monitoring surveys (4th November 2022) are presented in **Table 8-12**.
- 8.6.44. Elasmobranchs, which include sharks, rays and skates, have also been recorded in the Thames Estuary and are discussed independently in **Paragraphs 8.6.56 and 8.6.57**.

Demersal Species

- 8.6.45. The Thames Estuary provides spawning and nursery grounds for several demersal species, including cod *Gadus morhua*, whiting *Merlangus merlangus*, plaice *Pleuronectes platessa* and flounder *Platichthys flesus*⁷². High intensity spawning/nursery grounds tend to be situated in the outer Thames Estuary, approximately 42km downstream from the Site Boundary, however, these species have been recorded upstream of the Site. Flounder, in particular, is widely distributed throughout the estuary, penetrating upstream into freshwater.
- 8.6.46. Environment Agency TraC fish monitoring surveys are regularly conducted at Woolwich, approximately 5km upstream of the Proposed Scheme³³. Three sites were surveyed in 2022 with ten species recorded (see **Table 8-12**). This included several demersal species, such as Dover Sole *Solea solea*, whiting, flounder, sand goby *Pomatoschistus minutus* and red mullet *Mullus surmuletus*. Other species included red gurnard *Chelidonichthys cuculus* and Pouting *Trisopterus luscus*. Environment Agency TraC fish monitoring surveys have also been conducted at West Thurrock, approximately 13km downstream of the Site Boundary. Flounder, sand goby, red mullet and rock goby were recorded at the West Thurrock Environment Agency TraC site in 2018 (see **Table 8-14**).
- 8.6.47. Dover sole, whiting and sand goby are protected (see **Table 8-11**). Dover sole is also a commercially important species.
- 8.6.48. Short-snouted seahorse *Hippocampus hippocampus* has also been detected in Environment Agency TraC data for the middle Thames Estuary in 2011 and 2017^{33,35}. This species is also protected (see **Table 8-11**).

Pelagic Species

- 8.6.49. Pelagic marine species are commonly found in the Thames Estuary, often utilising the Thames Estuary for spawning and nursery grounds⁷².

- 8.6.50. Sea bass *Dicentrarchus labrax* and herring *Clupea harengus* were recorded at the Woolwich Environment Agency TraC fish monitoring location in 2022, in low abundance³³. Herring have also been recorded at the West Thurrock Environment Agency TraC fish monitoring location in 2018. The Environment Agency has stated that sprat is also regularly caught at the West Thurrock monitoring station and is likely to be present within the Study Area.
- 8.6.51. The Thames Estuary is an important spawning ground for herring⁷², which is a commercially protected species (see **Table 8-11**). However, no spawning grounds have been recorded as far inland as the Study Area and the salinity levels are likely at the lower limit considered suitable for herring spawning⁵⁷.

Migratory Species

- 8.6.52. Migratory fish species present in the Thames Estuary include European smelt *Osmerus eperlanus*, Atlantic salmon *Salmo salar*, brown/sea trout *Salmo trutta*, twaite shad *Alosa fallax*, river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* and European eel *Anguilla anguilla*. All these species are protected (see **Table 8-11**). Allis shad *Alosa alosa* have also been observed within the Study Area by the Environment Agency.
- 8.6.53. The Thames Estuary supports nationally important populations of European smelt^{33,35}. This species was recorded at the Woolwich Environment Agency TraC fish monitoring location in 2022 (see **Table 8-12**), with evidence that there is a spawning site located near Greenwich (approximately 10km upstream of the Site Boundary)³⁶.
- 8.6.54. European eel are recorded in high densities within the Thames Estuary, all year round, using the river as a migratory corridor. Whilst not detected in 2022, European eel these have been detected at the Woolwich (located approximately 4km upstream of the Proposed Scheme) and West Thurrock Environment Agency TraC fish monitoring location (located approximately 13km downstream of the Proposed Scheme) in previous years³³. Additionally, freshwater fish surveys and monitoring programmes have recorded European eel in the River Roding^{33,37}, which joins the Thames approximately 4km upstream from the Site Boundary. This demonstrates that eels are migrating through this section of the Thames. The Environment Agency has stated in its response to the Scoping Report²⁷ that European eel are abundant within Halfway Reach, with juvenile glass eels migrating past the Study Area during late March and adult silver eels returning to sea from October onwards.
- 8.6.55. Atlantic salmon, brown/sea trout, lamprey and twaite shad are anadromous species that migrate from marine waters through the Thames Estuary to freshwater spawning sites. None of these species have been regularly detected within the vicinity of the Site³³. However, the absence of protected/notable species in surveys does not preclude their presence, as survey methodology and timing can impact catch return. However, the Environment Agency has stated that sea trout have been captured previously within the Study Area. Therefore, a precautionary principle will be applied, with the species assumed to be present.

Elasmobranchs

- 8.6.56. The Thames Estuary is known to be home to at least five species of elasmobranchs: tope *Galeorhinus galeus*, starry smoothhound *Mustelus asterias*, spurdog *Squalus acanthias*, lesser spotted dogfish *Scyliorhinus canicula* and thornback ray *Raja clavata*^{35,37}.
- 8.6.57. These species are predominantly found in the outer Thames Estuary and are unlikely to be able to tolerate the reduced salinity within the Study Area (described in **Section 8.5**). No elasmobranch species have been recorded in recent fish monitoring within the Study Area³³.

Table 8-11: Protected Fish Species Present within the Thames Estuary ^{33,34,37}

Common Name	Latin Name	Habitat Preference ^a	IUCN Red List ^b	WCA	NERC SPI	Bern Convention Protected Fauna	Habitat Directive	MCZ Species Features of Conservation Importance	LBAP Priority Species	UK BAP Priority Species
Atlantic cod	<i>Gadus morhua</i>	D	VU	-	✓	-	-	-	-	✓
Atlantic salmon	<i>Salmo salar</i>	M	LC	-	✓	Annex III	Annex II, V	-	✓	✓
Barbel	<i>Barbus barbus</i>	FW	LC	-	-	-	Annex V	-	-	-
Brown/sea trout	<i>Salmo trutta</i>	M	LC	-	✓	-	-	-	✓	✓
European Bullhead	<i>Cottus gobio</i>	FW	LC	-	-	-	Annex II	-	-	-
Common goby	<i>Pomatoschistus microps</i>	D	LC	-	-	Annex III	-	-	-	-

^a D = Demersal, M = Marine, F = Freshwater and P = Pelagic.

^b VU = Vulnerable, LC = Least Concern, DD = Data Deficient, CR = Critically Endangered.

Common Name	Latin Name	Habitat Preference ^a	IUCN Red List ^b	WCA	NERC SPI	Bern Convention Protected Fauna	Habitat Directive	MCZ Species Features of Conservation Importance	LBAP Priority Species	UK BAP Priority Species
Dover sole	<i>Solea solea</i>	D	DD	-	✓	-	-	-	-	✓
European eel	<i>Anguilla anguilla</i>	M	CR	-	✓	-	-	-	✓	✓
European plaice	<i>Pleuronectes platessa</i>	D	LC	-	✓	-	-	-	-	✓
European smelt	<i>Osmerus eperlanus</i>	M	LC	-	✓	-	-	✓	✓	✓
Atlantic herring	<i>Clupea harengus</i>	P	LC	-	✓	-	-	-	-	✓
Long-snouted seahorse	<i>Hippocampus guttulatus</i>	D	DD	Schedule 5 ¹³	✓	-	-	✓	-	✓
River lamprey	<i>Lampetra fluviatilis</i>	M	LC	-	✓	Annex III	Annex II, V	-	✓	✓
Sand goby	<i>Pomatoschistus minutus</i>	D	LC	-	-	Annex III	-	-	-	-

Common Name	Latin Name	Habitat Preference ^a	IUCN Red List ^b	WCA	NERC SPI	Bern Convention Protected Fauna	Habitat Directive	MCZ Species Features of Conservation Importance	LBAP Priority Species	UK BAP Priority Species
Short-snouted seahorse	<i>Hippocampus hippocampus</i>	D	DD	Schedule 5	✓	Annex II	-	✓	-	✓
Twaite shad	<i>Alosa fallax</i>	M	LC	Schedule 5 ¹³	✓	Annex II, V	-	-	✓	✓
Whiting	<i>Merlangius merlangus</i>	D	LC	-	✓	-	-	-	-	✓

Table 8-12: Environment Agency TraC Fish Survey Data from Woolwich 4-11-2022 and West Thurrock 2018³³

Common Name	Latin Name	Site 1 (TQ 44683 80971) ^c	Site 2 (TQ 44679 80921) ^d	Site 3 (TQ 45430 81420) ^e	West Thurrock (TQ 6077477518)
		(Number of individuals caught)			
Red Gurnard	<i>Aspitrigla cuculus</i>	1	1	-	-
Red mullet	<i>Mullus surmuletus</i>	2	-	-	1
Pouting	<i>Trisopterus luscus</i>	1	1	1	-
European smelt	<i>Osmerus eperlanus</i>	5	7	6	-
Dover sole	<i>Solea solea</i>	67	27	16	-
Sand goby	<i>Pomatoschistus minutus</i>	9	5	9	88
Whiting	<i>Merlangius merlangus</i>	95	19	44	-
Flounder	<i>Platichthys flesus</i>	99	23	7	5
Atlantic sea bass	<i>Dicentrarchus labrax</i>	1	1	3	80
Herring	<i>Clupea harengus</i>	-	-	10	1
Sand smelt	<i>Atherina presbyter</i>	-	-	-	1

^c Site 1 (TQ 44683 80971) is located approximately 4.75km upstream of the Site Boundary.

^d Site 2 (TQ 44679 80921) is located approximately 4.75km upstream of the Site Boundary.

^e Site 3 (TQ 45430 81420) is located approximately 4km upstream of the Site Boundary.

Common Name	Latin Name	Site 1 (TQ 44683 80971) ^c	Site 2 (TQ 44679 80921) ^d	Site 3 (TQ 45430 81420) ^e	West Thurrock (TQ 6077477518)
		(Number of individuals caught)			
Thick lipped grey mullet	<i>Chelon labrosus</i>	-	-	-	4
Rock goby	<i>Gobius paganellus</i>	-	-	-	2
Common goby	<i>Pomatoschistus microps</i>	-	-	-	28

Baseline Fish Surveys

- 8.6.58. Two subtidal beam trawls were undertaken on 18th May 2023 (spring surveys) and an additional two trawls on 21st September 2023 (autumn surveys) in order to determine the fish community present within the Study Area.
- 8.6.59. Five species were recorded in the first trawl during spring; European smelt, sea bass, dover sole, flounder and transparent goby *Aphia minuta*. The second trawl in spring recorded three species; sea bass, flounder and a moribund European eel *Anguilla anguilla* in a state of decay.
- 8.6.60. Five species were recorded in trawl one during the autumn survey; European smelt, dover sole, pouting, sand goby and sprat *Sprattus sprattus*. Three species were recorded in trawl two during the autumn survey; flounder, sand goby and common goby *Pomatoschistus microps*.
- 8.6.61. During the autumn surveys, juveniles of all species were recorded. Sand goby ranged in length from 34 to 64mm and flounder ranged from 55 to 88mm demonstrating the variation in ages classes present. It should also be noted that a juvenile European smelt measuring 78mm was also present in the Spring trawl. The presence of juveniles may indicate the presence of a nursery or spawning habitat for these species.
- 8.6.62. European eel and European smelt are protected species (see **Table 8-11**). Results from these surveys are presented in **Table 8-13**.

Table 8-13: Results from the Spring and Autumn Beam Trawls in 2023 showing the number of individuals of each species recorded.

Common Name	Latin Name	Trawl No.1	Trawl No.2	Trawl No.1	Trawl No.2
		Spring		Autumn	
European smelt	<i>Osmerus eperlanus</i>	1	-	1	-
Sea bass	<i>Dicentrarchus labrax</i>	3	2	-	-
Dover sole	<i>Solea solea</i>	29	-	1	-
Transparent goby	<i>Aphia minuta</i>	1	-	-	-
Flounder	<i>Platichthys flesus</i>	2	1	-	18
European eel (decaying)	<i>Anguilla anguilla</i>	-	1	-	-
Pouting	<i>Trisopterus luscus</i>	-	-	1	-
Sand goby	<i>Pomatoschistus minutus</i>	-	-	25	42

Common Name	Latin Name	Trawl No.1	Trawl No.2	Trawl No.1	Trawl No.2
Sprat	<i>Sprattus sprattus</i>	-	-	1	-
Common goby	<i>Pomatoschistus microps</i>	-	-	-	9

Marine Mammals

Pinnipeds

- 8.6.63. There are two resident pinniped species within the Greater Thames Estuary, the grey seal *Halchoerus grypus* and harbour seal *Phoca vitulina*, with populations of approximately 3,200 and approximately 900 respectively⁷³. There are records of both species in the vicinity of the Site, however, seals are usually recorded foraging in the Outer Estuary.
- 8.6.64. The nearest haul out site for harbour seal is Gravesend, and Maplin Sands for grey seal. These are located approximately 19km and 60km downstream from the Site Boundary, respectively. However, both species are commonly observed foraging in the Bexley and Greenwich area of the Thames and have been reported as far inland as Teddington^{74,75}. Grey and harbour seals have historically been recorded, within and upstream of the Site by ZSL surveys since 2004⁷⁴. The most recent sightings in 2023, recorded three grey seals, two harbour seals within 10km of the Site Boundary, the closest being 1.3km upstream⁷⁴.
- 8.6.65. Both species are protected under the Conservation of Seals Act 1970²², the WC¹³ and are listed in Annex II of the EC Habitats Directive¹⁵. Harbour seal is also a UK BAP Priority Marine Species. The grey seal is also listed as an Appendix III species under the Bern Convention²⁰.

Harbour Porpoise

- 8.6.66. There is a significant year-round presence of harbour porpoises (*Phocoena phocoena*) in the Thames Estuary, with peaks in spring (March-April) and late summer (July-August)⁷⁶.
- 8.6.67. This species is observed in high densities in the outer Thames Estuary; however, individuals have been observed in the vicinity of the Site, being reported as far inland as Richmond⁷⁵.
- 8.6.68. The species is protected under The Marine and Coastal Access Act 2009²⁴ and the WCA¹³. It is also listed under CITES Appendix II and Annex II of the EC Habitats Directive¹⁵, and classified as a Priority Marine Species in the UK BAP. The UK also has obligations for harbour porpoise conservation as a contracting party to the OSPAR Convention²³ and the Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)⁷⁷.

Invasive Non-Native Species

- 8.6.69. INNS are widespread throughout the Thames Estuary, with many species becoming well established. Marine INNS present within the Thames Estuary include⁷⁸:
- Zebra mussel *Dreissena polymorpha*;
 - Quagga mussel *Dreissena rostriformis bugensis*;
 - Chinese mitten crab *Eriocheir sinensis*;
 - Asiatic clam *Corbicula fluminea*;
 - Slipper limpet *Crepidula fornicata*;
 - Carpet sea squirt *Didemnum vexillum*;
 - Pacific oyster *Magallana gigas*;
 - Polychaete *Boccardiella ligerica*;
 - New Zealand mudsnail *Potamopyrgus antipodarum*; and
 - Bay barnacle *Amphibalanus improvisus*.
- 8.6.70. Many of these species have been detected at Environment Agency TraC monitoring sites both upstream and downstream of the Study Area and are likely to be present within the Study Area⁷⁹.
- 8.6.71. The species presented here reflect marine and aquatic macroinvertebrate INNS present within the Thames Estuary and may occur in the vicinity of the Site. However, it must be noted that there are likely further INNS present within the Thames that are not listed within this section.

FUTURE BASELINE

Overview

- 8.6.72. Climate change is the single most prevalent natural factor when considering the future baseline of an ecosystem or species community⁸⁰. Climate change affects ecology via multiple pathways. Impacts on species are considered to include changes in distribution and abundance, the timing of seasonal events and habitat use and, as a consequence, there are likely to be changes in the composition of plant and animal communities. Habitats and ecosystems are also likely to change in character, through changes to water quality, including increasing temperatures and acidification of seawater.
- 8.6.73. With regards to the key marine biodiversity features known to be present within the Site and Study Area (as described in the previous sections), it is difficult to predict with considerable confidence their likely response to climate change. However, the following section presents known information on the medium and long term trends in the distribution and abundance of such features.

- 8.6.74. The future baseline assumes that existing commercial business within the Site, that utilises the Thames would remain at their current locations should the Proposed Scheme not proceed. These include Riverside 1, including the Middleton Jetty. Riverside 2 (at the time of writing, construction works for Riverside 2 are being undertaken) would also be operational in the future baseline, generating additional vessel traffic. Further information on vessel traffic is provided in **Chapter 19: Marine Navigation (Volume 1)**. There is also potential for other developments to affect receptors outside of the Site Boundary, where dredging is involved and there is spatial and temporal overlap during construction and operation. This will be assessed in **Chapter 21: Cumulative Effects (Volume 1)**.

Nationally Designated Sites

- 8.6.75. Rising sea levels and increasing water temperatures may result in a regime shift due to northward range expansion of 'southern species' and a retreat of 'northern species'. Increased water temperatures may also result in increased habitat viability for certain species of INNS, which may compete with, prey on or displace native benthic species. Rising sea levels may also result in an increase in the habitat available for subtidal species and a reduction for intertidal adapted species.
- 8.6.76. Rising sea level can also result in coastal squeeze, when man-made structures or human activities prevent natural habitats migrating landward in response to rising sea levels. This may cause the loss of intertidal habitats, such as saltmarsh and intertidal mudflat, which will have impact on intertidal species due to reduced or loss of habitat, as well as implications for sites designated on the basis of such habitat.

Non-statutory designated sites

- 8.6.77. Non-statutory sites are subject to the same pressures as nationally designated sites and will be subject to the impacts described in **Paragraphs 8.6.75 and 8.6.76**.

Thames Middle Transitional WFD Water Body - Habitats and Species

- 8.6.78. Coastal squeeze occurs when man-made structures or human activities prevent natural habitats migrating landward in response to rising sea levels. This may cause the loss of intertidal habitats, such as saltmarsh and intertidal mudflat, which will have impact on intertidal species due to reduced or loss of habitat.

Benthic Communities (subtidal and intertidal)

- 8.6.79. Rising sea levels and increasing water temperatures may result in a regime shift due to northward range expansion of 'southern species' and a retreat of 'northern species'. Increased water temperatures may also result in increased habitat viability for INNS, which may affect native benthic species. Rising sea levels may also result in an increase in the habitat available for subtidal species and a reduction for intertidal adapted species, where managed retreat is not possible.

Marine Plants and Macroalgae

- 8.6.80. Rising sea level and coastal squeeze have the potential to result in reduced habitat viability for saltmarsh species due to increased immersion times and increased water depths. Sea level rise may also alter the amount of habitat available for intertidal algal species and may result in increased colonisation of the river wall.

Fish

- 8.6.81. Rising sea levels and increasing water temperatures may result in a regime shift due to northward range expansion of 'southern species' and a retreat of 'northern species'. Alterations to habitat types, including coastal squeeze may also result in changes in fish community composition.

Marine Mammals

- 8.6.82. Changes to the benthic communities and fish caused by rising sea levels and increased water temperatures may have indirect impacts on marine mammals through changes in prey availability. This could result in this section of Thames Estuary no longer providing a viable habitat for these species.

Invasive Non-Native Species

- 8.6.83. The effects of climate change, including rising sea levels and increasing water temperatures, may facilitate the spread and establishment of INNS through increased habitat viability and reduced competition/predation. INNS species may also be more adaptable to changes in physical conditions such as water temperatures than native species.

8.7. EMBEDDED DESIGN, MITIGATION AND ENHANCEMENT MEASURES

- 8.7.1. This section sets out the embedded design, mitigation and enhancement measures which are relevant to marine biodiversity. The **Design Principles and Design Code (Document Reference 5.7)** are commitments which will govern the design of the Proposed Scheme during the detailed design stage. The **Design Principles and Design Code (Document Reference 5.7)** are considered to be embedded mitigation for the purposes of the assessment presented in this chapter.

CONSTRUCTION PHASE

- 8.7.2. The following design, mitigation and enhancement measures have been identified to reduce the potential impact of the construction phase of the Proposed Scheme:
- A minimised construction footprint has been identified to reduce/avoid potential habitat loss wherever practicable. This includes the Proposed Jetty and capital dredge footprint.
 - The Proposed Scheme will adhere to relevant Environmental Permits, best practice guidance and regulations, British Standards, and monitoring for the

protection of marine biodiversity features and to ensure water quality impacts are minimised.

- Works below the mean high-water springs (MHWS), such as construction of the Proposed Jetty and dredging activities, will be subject to a DML.
- Robust measures and equipment for dealing with any unexpected pollution events are outlined within the **Outline CoCP (Document Reference 7.4)**.
- All construction materials used will be safe for use in the marine environment.
- The **Outline CoCP (Document Reference 7.4)** states that where practicable, lighting should be positioned carefully, and measures implemented to minimise light spillage into the marine environment. This includes using lights with high directionality, employing controls to reduce light levels when not required (unless for safety and navigation) and determining suitable light intensity (minimum requirements for a given task and selection of those with low intensity) and tailorable spectrum. Screening may also be required in the intertidal areas.
- Any construction piling that may cause direct disturbance to the marine environment should not commence unless an Ecological Clerk of Works (ECoW) is present. This is to ensure sensitive species, notably marine mammals, are absent from the area. The ECoW will follow measures developed by JNCC and set out in the 'Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise'⁸¹. The main measures are:
 - marine mammal observations will be carried out during piling works by an ECoW will be required to carry out marine mammal observations 30 minutes prior to any piling being undertaken to ensure that there are no marine mammals within 500m (the mitigation zone) of the proposed works;
 - a soft start to piling operations will be used to ensure an incremental increase in pile power over a period of no less than 20 minutes, until a full operational piling period is achieved; should piling cease for a period longer than 10 minutes, the soft-start procedure may need to be repeated in line with the marine mammal observations;
 - if marine mammals are detected within the mitigation zone during the search, the soft start must be delayed until they have left the mitigation zone; there must be a minimum of a 20 minute delay from the time of the last detection within the mitigation zone and the commencement of the soft-start to allow for animals unavailable for detection (i.e. not re-surfacing in that time) to have moved outside of the mitigation zone). A full soft start may be undertaken after any delay due to the presence of marine mammals within the mitigation zone;
 - in situations where seals are congregating around a fixed platform within a survey area, it is best practice for the soft start to commence at a location at least 500m from the platform, where possible; and
 - if breaks of longer than 10 minutes are required, a full pre-search and soft start should be carried out before the construction works re-commence.
- Construction activities such as piling, and capital dredging should occur outside of migratory periods for sensitive fish species (April-September based upon the fact

that the closest recorded spawning location for Smelt is in the vicinity of Wandsworth bridge³⁸, which is 30km upstream of the site, and therefore the avoidance period does not need to extend into March)) as agreed with the Environment Agency. This is clearly stated in the **Outline CoCP (Document Reference 7.4)**.

- Capital dredging will be undertaken using backhoe dredging as this will reduce the amount of sediment lost and resuspended during dredging activities.
- Sediment within the dredged areas (including to dredge depth of approximately 10.5m below chart datum) should be collected and analysed for sediment bound contaminants to determine the most appropriate method of disposal of dredged material in discussion with the MMO and Centre for Environment Fisheries and Aquaculture Sciences (CEFAS), pursuant to the DML. Furthermore, it will inform subsequent additional mitigation if sediments are shown to be elevated in contaminant concentrations.
- Water quality monitoring will be able to be required during dredging and acceptable levels of suspended sediment and contaminants agreed with the MMO pursuant to the DML, following consultation with the Environment Agency.
- To reduce the requirement for dredging within the intertidal zone, a sheet piled wall will be installed at bed level to prevent potential erosion of intertidal sediment and reduce the size of the dredge pocket required.
- Where practicable, low noise piling techniques (for example pile press in technology) or vibro-piling will be used to minimise the impact on fish and marine mammals. If this is not feasible, then works will need to avoid the main migratory period for sensitive fish species (April-September). This is clearly stated in the **Outline CoCP (Document Reference 7.4)**. Generally, piling works will be considered by the MMO, pursuant to the Deemed Marine Licence in the **Draft DCO (Document Reference 3.1)**.
- Construction vessel speeds will be moderated by following standard operating procedures. Where practicable, there will be an implementation of reduced vessel speeds (3 knots) to reduce the potential for vessel strike with marine mammals and fish and to reduce the risk of any potential damage to intertidal habitats from wave wash. This is stated in the **Outline CoCP (Document Reference 7.4)**.
- The Thames is subject to the control and management of ballast water as stipulated by the MMO, therefore release from ballast water is not a vector for the spread of INNS⁸². As part of any full CoCP(s) (to be developed to be in substantial accordance with the **Outline CoCP (Document Reference 7.4)**) a Biosecurity Management Plan will be developed and implemented with standard biosecurity measures, in line with UK best practice guidance and will be discussed in liaison with the Environment Agency, Natural England, the PLA and the MMO, as appropriate. This will include the effective cleaning of all marine equipment and infrastructure (if utilised in other Water Bodies), along with preventing the release of any subsequent waste arisings back into the marine environment. Relevant guidance such as the Check, Clean, Dry campaign led by the GB Non-native Species Secretariat will also be followed. Provision of local materials will be used

where practicable, and materials should be appropriately treated to minimise the potential spread of INNS.

- Accidental fuel leaks from construction vessels will be managed as set out in the **Outline CoCP (Document Reference 7.4)**.
- All construction vessels will act in accordance with their own management/accident plans, as well as those of the Port of London Authority/Maritime Coastal Agency, thus limiting the potential for accidental fuel leaks.
- Demolition of the existing Belvedere Power Station Jetty (disused) (if undertaken) and excavation activities in the intertidal zone should, where practicable, occur during low tide to minimise the dispersion of suspended sediment (where practicable). This is stated in the **Outline CoCP (Document Reference 7.4)**.

OPERATION PHASE

8.7.3. The following design, mitigation and enhancement measures have been identified to reduce impacts from the operation phase of the Proposed Scheme, and these may include, but are not limited to:

- The use of a wastewater treatment plant for water generated during operation see **Chapter 2: Site and Proposed Scheme Description (Volume 1)**. All wastewater will be treated appropriately before being discharged into the local foul sewer.
- As described in the **Outline Drainage Strategy (Document Reference 7.2)**, a new drainage system will be implemented to use the existing ditches within the Site as a point of connection, with attenuation tanks, filter drains and ponds utilised to control the discharge quality and rate to the ditches. This drainage strategy will remove the impact pathway from surface water drainage to marine biodiversity receptors. The impacts of surface water drainage on freshwater receptors are assessed in **Chapter 7: Terrestrial Biodiversity (Volume 1)**.
- An **Outline Lighting Strategy (Document Reference 7.3)** has been developed. This includes measures to reduce impacts on marine receptors see **Chapter 2: Site and Proposed Scheme Description (Volume 1)**. These measures include, but are not limited to:
 - use of directional lighting that avoids overspill on to the River Thames;
 - lighting to be on timers and include motion sensors to reduce time it is activated.
- operational vessel speeds will be moderated by following standard operating procedures. Where practicable, there should be reduced vessel speeds in proximity of piers to reduce the potential for vessel strike with marine mammals and fish and to reduce the risk of any potential damage to intertidal habitats from wave wash. This will be included in the Operation EMP, as stated in the **Mitigation Schedule (Document Reference 7.8)** and secured by a requirement of the **Draft DCO (Document Reference 3.1)**.
- All operational vessels will act in accordance with their own management/accident plans, as well as those of the Port of London Authority/Maritime Coastal Agency, thus limiting the potential for accidental fuel leaks.

- It is expected that vessels will follow standard procedures for managing INNS in their ballast water. A Biosecurity Management Plan will be developed as part of the Operational EMP prior to the Proposed Scheme becoming operational and implemented with standard biosecurity measures, in line with UK best practice guidance, as previously described. This will be included in the Operation EMP, as stated in the **Mitigation Schedule (Document Reference 7.8)** and as secured by a requirement of the **Draft DCO (Document Reference 3.1)**.
- As a precautionary measure, maintenance dredging should avoid the main migratory periods for sensitive fish species (April to September), as highlighted by the Environment Agency (see **Table 8-2**). This will be included in the Operation EMP, as stated in the **Mitigation Schedule (Document Reference 7.8)** and as secured by a requirement of the **Draft DCO (Document Reference 3.1)**. This will be pursuant to the DML process.
- Water quality monitoring could be required during dredging and acceptable levels of suspended sediment and contaminants agreed with the Environment Agency and MMO, pursuant to the DML, following consultation with the Environment Agency.
- Prior to maintenance dredging, the dredge pockets will be analysed for sediment-bound contaminants to determine the most appropriate dredge and disposal methods, pursuant to the DML included within the **Draft DCO (Document Reference 3.1)**.
- The risk of effects arising from accidental fuel leaks from vessels will be managed through the **Outline EPRP (Document Reference 7.11)**, thus limiting the potential for accidental fuel leaks to as low as reasonably practicable (ALARP).
- Fish refuge enhancements such as the inclusion of ropes on the piles of the Proposed Jetty will be included to increase habitat complexity and mimic natural conditions.

8.8. ASSESSMENT OF LIKELY SIGNIFICANT IMPACTS AND EFFECTS

- 8.8.1. This section details the assessment of the impacts and effects of the Proposed Scheme during both the construction and operation phases, taking account of the embedded design, mitigation and enhancement measures detailed in **Section 8.7** and prior to the additional mitigation measures set out in **Section 8.9**.
- 8.8.2. The demolition or retention of the Belvedere Power Station Jetty (disused) is discussed within the assessment presented in this chapter.
- 8.8.3. The Proposed Scheme will take forward Option 3 for the Proposed Jetty location, as described in **Chapter 2: Site and Proposed Scheme Description (Volume 1)** and **Chapter 3: Consideration of Alternatives (Volume 1)**.

CONSTRUCTION PHASE

- 8.8.4. The potential likely significant effects for marine biodiversity associated with the construction phase of the Proposed Scheme are set out below.

- 8.8.5. The construction assessment presented in this chapter is appropriate for either of the construction programme options (being a single-phase or two-phase construction) set out in **Chapter 2: Site and Proposed Scheme Description (Volume 1)** and either a one or two Carbon Capture Plant design.
- 8.8.6. As set out in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**, the choice between demolition or retention of the Belvedere Power Station Jetty (disused) is being considered. For the purposes of the assessment, the worst case scenario will vary according to receptor and impacts, and this is discussed in the following sections.

Loss or Disturbance of Habitat

- 8.8.7. The changes in loss or disturbance of habitat that could potentially occur as a result of construction work include:
- loss or disturbance to subtidal habitat from the construction of the Proposed Jetty due to dredging and piling, including the installation of a submerged sheet piled wall (this may result in both temporary and long term impacts);
 - loss or disturbance to intertidal habitat from the construction of the Proposed Jetty trestles;
 - gain in additional intertidal habitat, including fish foraging and nursery habitat, but loss of potential fish refuge habitat from Belvedere Power Station Jetty (disused) if demolished; and
 - removing the potential gain in additional intertidal habitat from demolition but retaining potential fish refuge habitat from Belvedere Power Station Jetty (disused) if retained.
- 8.8.8. The habitats that will be directly disturbed by dredging and piling activities for installation of the Proposed Jetty, pierhead and all associated works (including submerged sheet pile wall) will be primarily located in the subtidal environment. A total of 45 piles will be required to form the new jetty, with up to seventeen 0.914m² piles installed to support the Proposed Jetty trestle located within the intertidal zone, as explained in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**. This option was selected to minimise the loss of the intertidal habitat. This option would remove approximately 110,000m³ of subtidal sediment during dredging. This will occur over an area of approximately 82,675.39m² equating to 0.18% of the Thames Middle Transitional WFD Water Body. However, it is only the placement of the Proposed Jetty support legs which will result in permanent loss of subtidal habitat of approximately 80m²; a much smaller area.
- 8.8.9. The technique used for dredging will be backhoe. As outlined in **Chapter 2: Site and Proposed Scheme Description (Volume 3)**, the duration of dredging will depend on various factors, but it is likely to be undertaken for 18.5 hours a day for approximately 11 weeks (over 6 months) and is therefore considered as a short term activity.

Furthermore, as set out in **Section 8.7**, dredging will take place outside of critical migratory periods for fish (April to September).

- 8.8.10. In the intertidal zone, there may be some temporary disturbance of sediment during the installation of the trestle as it traverses the intertidal habitat. The trestle completely covers an area of 1,470m², equating to 0.003% of the intertidal area in the Thames Middle Transitional WFD Water Body. It is again, however, only the support piles that will lead to long term loss and this will be over a much smaller area equating to 11.1m².
- 8.8.11. Both losses in the intertidal and subtidal areas are considered to be relatively small with large areas of habitat remaining unaffected.
- 8.8.12. The precise nature of the potential demolition activities for the Belvedere Power Station Jetty (disused) located within the intertidal zone is still to be determined. The options are either retention or full demolition. If the Belvedere Power Station Jetty (disused) (with modifications) is retained, there will be no immediate changes to intertidal habitat and potential artificial fish refuge habitat will remain. The removal of the Belvedere Power Station Jetty (disused) may result in some initial loss of sediment and associated benthic communities that have built up around the pier structures, however, this loss and disturbance is expected to be minimal. Due to the impoverished nature of the communities and their ability to rapidly recolonise following swift sediment deposition in this section of the River Thames, effects are anticipated to be small scale.
- 8.8.13. Demolition of the Belvedere Power Station Jetty (disused) also has the potential to result in a long term increase in the availability of intertidal mudflat habitat, offsetting that lost due to the construction of the trestle legs. The Belvedere Power Station Jetty (disused) covers an area of approximately 2,331m² within the intertidal zone (including deck of this jetty), which equates to approximately 0.02% of the intertidal mudflat area within the Thames Middle Transitional WFD Water Body. Thus, removal will result in a net gain of a small area of that lost through the construction of the trestle as described previously in **Paragraph 8.8.8**.
- 8.8.14. Hydrodynamic and sediment transport modelling has been undertaken and is discussed within **Chapter 11: Water Environment and Flood Risk (Volume 1)**. The HD calibration model presented in **Chapter 11: Water Environment and Flood Risk (Volume 1)**, modelled a number of scenarios (with the sheet pile in place) including with and without Belvedere Power Station Jetty (disused), and determined there will be no further erosion of the intertidal habitats if the Belvedere Power Station Jetty (disused) is removed during construction compared to if it was retained. The model predicted that sediment deposition within the subtidal area would be the most likely result, as opposed to erosion from changes to tidal flows caused by the construction of the Proposed Jetty. The model also predicted that the removal of the Belvedere Power Station Jetty (disused) may result in additional deposition and a potential expansion of intertidal habitat within the Study Area.

- 8.8.15. Mitigation and enhancement measures to be employed for the Proposed Scheme are described in **Section 8.7** of this chapter. Consequently, considering many of the factors described previously (e.g. minimising footprint of development), a negligible to low magnitude is anticipated for habitat loss and disturbance. The potential effects are summarised in the following paragraphs.

Statutory Sites (Medway Estuary MCZ)

- 8.8.16. The Medway Estuary MCZ Zone 1 & 2 sites is of National importance. This MCZ is located approximately 25km downstream and southeast of the Site Boundary, thus there will be no direct effect of habitat loss/disturbance within the MCZ, due to the distance of the MCZ from the Site Boundary. Sediment plume modelling for the capital dredging operation has identified that suspended sediment levels above the background level will only be detectable up to 3.5km from the dredge site at low levels ~0.4mg/l, therefore there will be no direct impact on habitats within the MCZ.
- 8.8.17. However, there is potential for an indirect effect on supporting habitat for the qualifying feature, European smelt, beyond the boundary of the MCZ. European smelt is sensitive to habitat loss and disturbance to spawning areas as well as barriers to migration⁸³. Disturbance and habitat loss may result in a change to behaviour and cause European smelt to move away from the area of disturbance. It should be noted that spawning grounds for European smelt are not located within the Study Area⁴⁰, although the Site is used as a nursery and foraging ground for juveniles and adult smelt, therefore the sensitivity of smelt to loss and disturbance of habitat is considered to be low.
- 8.8.18. Construction works have the potential to result in both temporary (dredging and construction footprint) and permanent (jetty legs and sheet pile wall) long term loss and disturbance of mainly subtidal habitat but with some small loss of intertidal foraging and nursery habitat. Across the intertidal area, the worst case scenario for the Belvedere Power Station Jetty (disused) (with modifications) is considered to be retention, as it would remove the potential for a gain in natural mudflat habitat, albeit retaining possible artificial fish refuge habitat across a fairly homogenous mudflat area. As fish are capable of moving elsewhere, with large subtidal and intertidal areas remaining intact for fish to utilise and due to the reasons set out above, along with proposed mitigation, a negligible magnitude is anticipated. Therefore, there is likely to be an indirect, temporary (dredging) and permanent (footprint of the Proposed Jetty) and long term **Negligible (Not Significant)** effect on the MCZ.

Non-Statutory Sites (River Thames and its Tidal Tributaries SINC)

- 8.8.19. The River Thames and its Tidal Tributaries SINC are of Regional/County importance, designated for various habitats (mudflats, saltmarsh and the river channel) and fish species. The sensitivity of mudflats, river channel and fish species to habitat loss and disturbance is low due to the species composition and ability of fish to move elsewhere, within the Thames Middle Transitional WFD Water Body. Saltmarsh is highly sensitive to habitat loss, due to pressures such as coastal squeeze. There will

be direct loss and disturbance of subtidal habitat from the construction of the Proposed Jetty, sheet pile wall and dredging activities, albeit over a relatively small area. Within the intertidal zone there will be an even smaller area affected by the installation of the trestle legs as described previously in **Paragraph 8.8.8**. There will be no direct loss of saltmarsh habitat due to the construction of the Proposed Jetty.

- 8.8.20. Across the intertidal area, there is potential for an increase in the available intertidal habitat if the Belvedere Power Station Jetty (disused) is demolished which will be beneficial for intertidal mudflat habitat, offsetting the loss resulting from the trestle legs and increasing fish foraging and nursery area. There will, however, also be some initial disturbance to potential fish foraging and nursery habitat, as well as loss of artificial fish refuge habitat, although this is anticipated to be minimal. Consequently, either option (retention or demolition) has its associated benefits and disadvantages and will result in only small scale changes. For the purposes of this assessment, the worst case scenario for the SINC is considered to be the retainment of the Belvedere Power Station Jetty (disused) (with modifications). This is based on the reasons outlined previously and the current national trend and future predictions in the long term loss of intertidal mudflats, albeit there will be retainment of an artificial fish refuge habitat within a locally homogenous intertidal location. Consequently, a negligible magnitude is anticipated based on the scale of the Proposed Scheme within the Thames Middle Transitional WFD Water Body. Therefore, there are likely to be direct (habitats) and indirect (species); temporary and short term (dredging/construction activities); and permanent, long term (presence of the Proposed Jetty) **Negligible (Not Significant)** effects on the SINC.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

- 8.8.21. The intertidal mudflat and saltmarsh habitats, along with their associated benthic communities, are considered to be of National importance. As described in the baseline of this chapter, the intertidal benthic community is impoverished, with high recoverability, capable of rapid recolonisation and therefore has a low sensitivity to habitat loss and disturbance. As set out above (see **Paragraphs 8.8.8 to 8.8.15**) there will be a small loss/disturbance of intertidal mudflat from the construction of the trestle of the Proposed Jetty and associated works. Considering the low sensitivity of these habitats and the relatively small area that will be affected, a negligible magnitude of impact from construction related activities is anticipated on these habitats. If Belvedere Power Station Jetty (disused) is removed, there is also the potential for beneficial effects with an increase in the immediate availability of intertidal mudflat. Adopting the worst case scenario of retaining the Belvedere Power Station Jetty (disused) (with modifications), there is likely to be a direct, temporary and short term (dredging/construction activities) and permanent and long term (presence of the Proposed Jetty), **Negligible (Not Significant)** effect on intertidal habitats.

- 8.8.22. The saltmarsh community is located approximately 500m upstream from the Proposed Jetty and Belvedere Power Station Jetty (disused), in a sheltered embayment. Saltmarsh has a high sensitivity to habitat loss and disturbance. The output of the HD calibration model indicates there will be no change to the current scour or sedimentation conditions impacting the saltmarsh habitat (with either demolition or retention of the Belvedere Power Station Jetty (disused)). In addition, the sediment transport model indicates that suspended sediment from dredging activities is unlikely to be deposited on the saltmarsh, thus the magnitude of change is expected to be negligible for Saltmarsh. Thus, there is likely to be an indirect, temporary, short term (dredging and construction activities) and permanent, long term (from the presence of the Proposed Jetty) **Negligible (Not Significant)**, effect on saltmarsh habitats.
- 8.8.23. The subtidal habitat and its associated benthic communities are considered to be of Local importance, based upon the impoverished nature of the benthic community present. Due to the high recovery rate of communities and the absence of any species of conservation importance, this receptor is considered to have a low sensitivity to habitat loss and disturbance. The subtidal habitat within the Study Area also provides a nursery and foraging habitat for fish species such as flounder, bass and European smelt which is discussed in more detail in the subsequent **Paragraph 8.8.25 to 8.8.26**. The area of subtidal habitats affected by the construction of the Proposed Jetty and dredged area is relatively small in comparison to the wider subtidal habitat present in the River Thames. The magnitude is considered to be low based on the small shift from baseline conditions. Therefore, there is likely to be a direct, short term and temporary (dredging/construction activities); and permanent, long term (presence of the Proposed Jetty) **Negligible (Not Significant)**, effect on subtidal benthic communities.

Marine Plants and Macroalgae

- 8.8.24. Marine plants and macroalgae (excluding saltmarsh) within the Study Area are regarded as of Local importance based on the low conservation value of the species and communities present within the intertidal area. The plant and macroalgae species present are considered to have a low sensitivity to habitat disturbance and in addition are primarily located along the River wall and attached to hard substrates. There may be some direct impacts on these receptors during construction and demolition activities, however, the magnitude of impact is considered to be negligible based upon the small scale of change relative to the Thames Middle Transitional WFD Water Body. Therefore, there is likely to be indirect and direct, temporary, short term (dredging/construction activities); as well as permanent, long term (presence of the Proposed Jetty), **Negligible (Not Significant)** effect on marine plants and macroalgae.

Fish

- 8.8.25. The importance of the fish likely to occur within the Study Area of the Proposed Scheme ranges from Regional/County to National. The Regional/County importance is due to the presence of species of primarily low conservation priority but high commercial value within the Study Area, which include sea bass and dover sole. In addition to being commercially important, these species also provide an ecological function in providing food for other species including European eel and European smelt, bird species and marine mammals. The European eel and European smelt are considered to be of National importance within the Study Area as these are Species of Principal Importance. The European smelt is also a feature of the Medway Estuary MCZ and the European eel is a critically endangered IUCN Red List species, which is decreasing in number across most of its range. In addition to European eel and European smelt, this section of the Thames is also used as a migration corridor for a number of nationally important fish species including Atlantic Salmon, brown/sea trout and lamprey species. The species present within the Study Area are considered to have a low sensitivity to habitat loss and disturbance, as they are adapted to the existing challenging conditions in the Thames Middle Transitional WFD Water Body (variations in salinity and sediment loads) and are highly mobile, thus are able to utilise habitat outside of the zone of influence of the Proposed Scheme.
- 8.8.26. The potential effects on fish and the value of this surrounding area as a supporting habitat as a nursery or foraging areas were described previously in **Paragraph 8.8.18 to 8.8.21**. However, the area affected is relatively small in comparison to the intertidal and subtidal habitat available in the Thames Middle Transitional WFD Water Body. The magnitude of impact is considered to be negligible, even with the retention of the Belvedere Power Station Jetty (disused) (with modifications) due to the inclusion of relevant embedded mitigation (e.g. avoiding sensitive period for fish migration), short duration of the dredging works and the small area of impact. In addition, fish species are highly mobile, able to avoid areas of disturbance, and due to the size of the Thames Middle Transitional WFD Water Body, can utilise other areas of the Thames. Consequently, there is likely to be a direct, permanent, long term (presence of the Proposed Jetty); and indirect, short term, temporary (dredging/construction activities) **Negligible (Not Significant)** effect on fish species of Regional/County importance. For those species of National importance, including European eel, European smelt, Atlantic salmon, brown/sea trout and lamprey sp. there is likely to be an indirect, short term, temporary (dredging/construction activities); and direct, permanent, long term (presence of the Proposed Jetty) **Negligible (Not Significant)** effect.

Marine Mammals

- 8.8.27. Marine mammals (grey seals, harbour seals and harbour porpoises) are of National importance due to their conservation status. Marine mammals are considered to have a low sensitivity to habitat loss and disturbance due to their highly mobile nature. Their scarcity in the mid-estuary, highly mobile nature and ability to readily utilise other areas of the estuary means the small loss/disturbance of foraging habitat (in comparison to the large subtidal habitat available within the Thames Middle Transitional WFD Water Body) is anticipated to be of negligible magnitude, even with the retention of the Belvedere Power Station Jetty (disused) (with modifications). Therefore, there is likely to be an indirect, short term, temporary (dredging/construction activity); and direct, permanent, long term (presence of the Proposed Jetty), **Negligible (Not Significant)**, effect on marine mammals.

Change in Suspended Sediment Levels and Subsequent Sediment Deposition on the Benthic Environment

- 8.8.28. The changes in water and sediment quality that could potentially occur as a result of construction works are presented in **Chapter 11: Water Environment and Flood Risk (Volume 1)** and **Chapter 17: Ground Conditions and Soils (Volume 1)**. These include but are not limited to changes to water and sediment quality resulting from:
- increased levels of suspended solids and their subsequent re-deposition, due to dredging, piling and potential demolition operations.
- 8.8.29. The majority of suspended sediment and deposition will occur as a result of dredging activity and consequently, this is the main focus of this assessment. As detailed in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**, the chosen dredging technique will be backhoe which is considered to have less of an impact than other proposed techniques such as Water Injection Dredging (WID). In the past maintenance WID was carried out at the nearby Middleton Jetty. The location of capital dredging for the Proposed Jetty is within an area which is highly turbid with elevated levels of suspended sediment and subsequent deposition, hence it is referred to as the 'mud reaches' due to the accumulation of sediment. The Thames is also recognised as highly turbid and the Environment Agency has referred to suspended sediments levels of 1600mg/l at the river bed and 1300mg/l at mid depth⁴⁴.
- 8.8.30. During the subtidal water quality survey undertaken on 21st September 2023 to obtain some supporting data for the model, suspended sediment levels recorded varied between 29.3 and 236 mg/l, additional details on water quality, including contaminants are included in **Chapter 11: Water Environment and Flood Risk (Volume 1)**. Measurements collected downstream at Tilbury showed suspended sediment concentration for silt material close to 2,000mg/l illustrating the highly turbid nature of the system. Therefore, the increase of up to 10mg/l in excess suspended sediment concentration (as predicted by the sediment transport model) and the limited extent of

dredge plume is not considered significant and within the natural variability of the River Thames.

- 8.8.31. The subtidal survey of surface sediment within the dredge pocket also showed the majority of sediment to comprise sand (70-80%), with some unsuccessful grab attempts closer to the channel, within the dredge pocket, due to the coarser nature of the substrate.
- 8.8.32. Sediment transport modelling has been undertaken to determine the potential for suspended solids to be transported during capital dredging operations. The dredging model was calibrated using the backhoe dredging method and is detailed in **Chapter 11: Water Environment and Flood Risk (Volume 1)**. Modelling was undertaken individually for sand and silt, despite the majority of surface sediment comprising sand. This was to account for potential unknown patches of silt that may be present, but not picked up during the subtidal survey. Taking the worst case scenario, which focused on silt only, the model determined that the majority of suspended solids would be at levels 3-3.5mg/l above baseline silt levels and the majority would fall out of suspension within 300m of the dredging location. The model predicted that the sediment plume would extend 3.5km upstream and downstream of the dredge location). However, beyond 300m the suspended sediment was calculated to be only 0.4mg/l above baseline conditions. In contrast, the modelling of sand showed that the majority of material would fall out of suspension within 50m after suspension. The resulting layer of sediment on the river bed would be less than 1mm for both scenarios and after each 18.5 hour dredge window, the deposited material quickly falls within normal background levels. Therefore, it is highly likely that the levels modelled for suspension and deposition are within the natural range of the Thames Estuary.

Statutory Sites (Medway Estuary MCZ)

- 8.8.33. The Medway Estuary MCZ (National importance) is located 25km downstream of the Study Area, therefore it is unlikely there will be any direct impacts upon this protected area. European smelt, a qualifying feature of the Medway Estuary MCZ, is known to use the Site as a foraging and nursery area, with some juveniles also recorded in the area. The potential effects include changes to their habitat and prey species (albeit they are omnivorous, therefore capable of a varied diet) within the Site. There is also the potential for a change in their distribution as they move away from elevated levels of suspended sediment, although adults are considered to be more adept at this than juveniles. Juveniles are also known to be very sensitive to poor water quality⁸³. European smelt is sensitive to changes in water quality, however, the population within the Thames Estuary is adapted to highly sedimented conditions and thus has a low sensitivity to increases in suspended solids. However, as this area of the Thames is already highly turbid and the predicted increase in sediment concentration and deposition is very low, the habitats and species present within this area are anticipated to be already tolerant to naturally higher levels of suspended sediment

and sediment deposition. This, in combination with the relatively localised area of impact and mitigation, the magnitude of the impact is considered to be negligible. The duration of the capital dredge is likely to be 11 weeks within a six month period, therefore there is likely to be an indirect, temporary, short term **Negligible (Not Significant)** effect on qualifying features of the Medway Estuary MCZ.

Non-Statutory Sites (River Thames and its Tidal Tributaries SINC)

- 8.8.34. The River Thames and its Tidal Tributaries SINC (Intertidal habitats, invertebrates, river channel and fish) are of Regional/county importance. The species and habitats comprising the SINC are adapted to the highly turbid nature of the Thames Middle Transitional WFD Water Body and thus are considered to have low sensitivity to increased suspended solids. The section of the SINC falls within the Thames Middle Transitional WFD Water Body, which has high levels of suspended solids. The modelling results suggest that increases in suspended solids and sediment deposition from the capital dredging will likely be within natural variation, fairly localised, and short term in nature (the duration of the regime is likely to be 11 weeks within a six month window). As the habitats and species within this section of the SINC will already be tolerant to far higher levels of suspended solids and sediment deposition than those resulting from the works, the magnitude of change is considered to be negligible. Therefore, there is likely to be an indirect, temporary, short term **Negligible (Not Significant)** effect on the River Thames and its Tidal Tributaries SINC.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

- 8.8.35. The intertidal benthic habitats and species located within the Site are considered to be of National importance. The intertidal mudflat benthic communities have been described in **Paragraph 8.6.22** and comprise species that are described as impoverished and tolerant to changes in environmental conditions, including changes to levels of suspended sediment and subsequent deposition, along with rapid recoverability. Therefore, it is assumed that these benthic habitats and species will not be significantly impacted in the long term by the capital dredging regime or intertidal activities, as the species living in the mudflat are already adapted to conditions with high sediment concentrations and deposition. Consequently, due to the existing background levels and mitigation, the magnitude of the impact is considered to be negligible. For the saltmarsh habitat, the sediment dispersal modelling reported in **Chapter 11: Water Environment and Flood Risk (Volume 1)** predicts that the saltmarsh present within the Study Area will not be impacted by sediment dispersal from dredging activities. The duration of the capital dredge is likely to be up to 11 weeks within a six month period, therefore there is likely to be an indirect, temporary, short term **Negligible (Not Significant)** effect on the benthic environment.
- 8.8.36. The subtidal benthic habitats and species located within the Site are considered to be of Local importance and have been described in **Paragraph 8.6.31** and **Appendix 8-1: Marine Baseline Surveys** and comprise of species that are described as impoverished and tolerant to changes in environmental conditions, including changes

to levels of suspended sediment and subsequent deposition. Therefore, it is assumed the benthic habitats and species have a low sensitivity to changes in suspended solids and sediment deposition and will not be adversely impacted long term by the capital dredging. The increase in levels of suspended solids is within natural variation with the Thames Middle Transitional WFD Water Body and, therefore the magnitude of change is anticipated to be negligible. The duration of the capital dredge is likely to be 11 weeks within a period of six months, therefore is likely to be an indirect temporary, short term **Negligible (Not Significant)** effect on the benthic environment.

Marine Plants and Macroalgae

- 8.8.37. The marine plant and macroalgae species (excluding saltmarsh) that inhabit this section of the Thames Middle Transitional WFD Water Body are considered to be of Local importance, widespread and are adapted to the existing conditions, which are highly turbid in nature, thus being low sensitivity to changes in suspended solids. These species are found at the margins of the river attached to the river wall, in shallow water where light is able to penetrate. Based upon the modelling results and intertidal activities, these marginal areas are unlikely to be significantly impacted by increased levels of suspended solids or sediment deposition and therefore a negligible magnitude of impact is expected. The likely 11 week capital dredge duration within a six month window is likely to therefore have an indirect temporary, short term **Negligible (Not Significant)** effect on marine plants and macroalgae.

Plankton

- 8.8.38. The plankton species located within the Site are considered to be of Local importance based on the species present. The Thames Middle Transitional WFD Water Body is highly turbid and the plankton species found here are adapted to these conditions and therefore are deemed to be of low sensitivity to changes in suspended solids. The sediment plume modelling predicted that increases in suspended solids would be limited to 3.5km from the dredging activity and attain concentrations of 0.4 mg/l and therefore a negligible magnitude of impact is expected. Based upon this, there is likely to be an indirect, short term, temporary **Negligible (Not Significant)** effect upon plankton.

Fish

- 8.8.39. The importance of the fish likely to occur within the Study Area ranges from Regional/County to National. Deposition on foraging and nursery habitat, may increase foraging times and reduce prey availability, Fish are mobile receptors, with the ability to avoid areas of increased sediment concentrations. The fish species present within the Study Area are adapted to the highly sedimented conditions within the Thames Middle Transitional WFD Water Body, therefore their sensitivity to increases in suspended solids is considered to be low. The timing of dredging activities to avoid migration periods for Atlantic salmon, brown/sea trout, European eel and lamprey species, will reduce the potential for impacts on these species. The rapid dispersal of any mobilised sediments, the size of the Thames Middle Transitional

WFD Water Body and the proposed mitigation has the potential to reduce the magnitude of impact for increased sediment concentrations to a negligible magnitude. Therefore, there is likely to be a temporary, indirect, short term, **Negligible (Not Significant)** effect on fish species.

Marine Mammals

- 8.8.40. Marine mammals (grey seals, harbour seals and harbour porpoises) are of National importance due to their conservation status. Seals and other marine mammals often reside in highly turbid areas and are adapted to these conditions, indicating a low sensitivity to increases in changes in suspended solids⁸⁴. Their scarcity in the mid-estuary, highly mobile nature and ability to readily utilise other areas of the estuary plus the small, localised change in suspended sediment levels means the disturbance to foraging behaviour will be of negligible magnitude. Therefore, the probable 11 week duration within a six month window for the capital dredge regime is likely to have an indirect, temporary, short term impact of **Negligible (Not Significant)** effect on marine mammals.

Changes in Water Quality and Release of Contaminants

- 8.8.41. The changes in water and sediment quality that could potentially occur as a result of construction works are presented in **Chapter 11: Water Environment and Flood Risk (Volume 1)**; **Chapter 17: Ground Conditions and Soils (Volume 1)** and **Appendix 11-1: Water Framework Directive Assessment (Volume 3)**. In this chapter, the following impacts have been considered:
- mobilisation of sediment-bound contaminants and their subsequent re-deposition, due to dredging, piling and potential demolition operations; and
 - accidental release of contaminants, due to potential fuel leaks from vessels.
- 8.8.42. The potential for land based construction activities to have an impact on the marine biodiversity receptors has also been considered, however, as the River Thames is separated by the elevated sea wall in this location, there is no direct impact pathway from land based activities. The potential for surface water run-off reaching the Thames is addressed in **Chapter 7: Terrestrial Biodiversity (Volume 1)**, which details embedded mitigation in the Outline Drainage Strategy therefore this has not been assessed further in this chapter.
- 8.8.43. The Thames Middle Transitional WFD Water Body has a history of heavy industry which has resulted in the river and its sediments accumulating contaminants. These contaminants include heavy metals, PAH, organic compounds and inorganic compounds which are covered in more detail in **Chapter 17: Ground Conditions and Soils (Volume 1)**. In addition to sediment bound contaminants, the Thames is also impacted by waterborne contaminants from the numerous sewage treatment works and storm drains that discharge into the river. These waterborne contaminants range from organic matter to pathogens and pharmaceuticals. Further, there is a strong tidal flow in this section of the Thames (with predicted flows of 1.4-1.6m per

second on spring tides), which results in high levels of mixing and dilution of contaminants.

- 8.8.44. Grab surveys undertaken within the Study Area were analysed for the presence of sediment bound contaminants in surface sediments. This was undertaken to support the macrofaunal data analysis. A summary of the analysis of surface sediments is described in **Appendix 8-1: Marine Baseline Surveys (Volume 3)** and in more detail within **Chapter 17: Ground Conditions and Soils (Volume 1)** and **Appendix 11-1: Water Framework Directive Assessment (Volume 3)**. Many samples comprised of contaminants that exceeded CEFAS action level (AL) 1, however, only one priority substance above CEFAS AL 2 (Mercury at Subtidal Point 13).
- 8.8.45. The dredged arisings will be managed in accordance with relevant legislation and will be disposed of offsite (via vessel and only if dredged arisings are deemed suitable for this disposal method and conform with the permits for disposal sites). The removal of the dredged arisings will be undertaken by an appropriately licenced waste carrier.
- 8.8.46. Change in water and sediment quality due to accidental fuel leaks is assessed as part of this chapter. The **Outline EPRP (Document Reference 7.11)**, as well as a fuel leak/pollution response plan for the Port of London Authority/Maritime Coastal Agency, limits the potential risk for accidental fuel leaks and minimises adverse effects with a response plan in place. The potential risk will also be managed through the **Outline CoCP (Document Reference 7.4)**.
- 8.8.47. In the absence of contaminant data at the dredge depth, a precautionary medium magnitude of impact is currently derived for most receptors.

Statutory Sites (Medway Estuary MCZ)

- 8.8.48. The Medway Estuary MCZ, Zone 1 & 2 are considered to be of National importance. The distance between the Site and the Medway Estuary MCZ is 25km, therefore construction activities resulting in changes to water quality including the release of sediment bound contaminants, and accidental fuel leaks, with embedded mitigation, are unlikely to result in direct impacts to the MCZ. This is due to the sediment transport model predicting that sediment plumes generated by dredging activity will be marginally above background levels out to a distance of approximately 3.5km using the worst case scenario of purely silt present in the dredge pocket. However, European smelt, a qualifying feature of the MCZ have been recorded within the Site Boundary, which is utilised as part of the wider Thames as a foraging and nursery area. The release of contaminants through activities such as dredging and accidental pollution has the potential to impact this species. Exposure to contaminants such as heavy metals including mercury has the potential to result in a number of impacts to fish species including, mortality, organ failure, reduction in growth rates, and reduction in reproductive fitness^{85,86}. European smelt are known to be sensitive to changes in water quality, particularly increases in heavy metal concentrations⁸³, with larval stages being the most sensitive. The Study Area is not located within any known spawning grounds for European smelt, therefore smelt eggs and larvae are unlikely to be

located within the Study Area. Adult and juvenile European smelt have a higher tolerance to changes to water quality than larvae, therefore they are considered to be of medium sensitivity for this assessment.

- 8.8.49. In addition, the use of backhoe dredging (limiting the amount of mobilised sediment), proposed mitigation (including avoiding migratory periods), along with the mobile nature of this species (with no confinement due to the works) and the likelihood that they will avoid the vicinity of construction works due to noise, will reduce their potential exposure to contaminants remobilised by dredging and thereby adverse effects on smelt. Based upon this, the magnitude is considered to be medium. Therefore, there is likely to be an indirect, temporary, short term, **Moderate Adverse (Significant)** effect upon Medway Estuary MCZ prior to the introduction of additional mitigation measures.

Non-Statutory Sites (River Thames and its Tidal Tributaries SINC)

- 8.8.50. The River Thames and its Tidal Tributaries SINC (intertidal habitats, river channel, fish, invertebrate species) are considered to be of Regional/County importance. The species and habitats present are considered to be of medium sensitivity to changes in water quality from releases of sediment bound contaminants, as well as accidental fuel leaks. The tidal nature of this section of the Thames results in strong mixing factors that will rapidly dilute and disperse any contaminants released during dredging, other construction activities and accidental pollution. The majority of potential impacts from dredging resulting in reduced water and sediment quality are likely to be restricted to within 300m upstream and downstream of the Study Area, with less than 1mm of sediment deposited on the river bed; consequently, only a small section of the SINC will be impacted. It is anticipated that most of the contaminants will adhere to the finer sediment particles, although it is acknowledged, that some contaminants will be in the bioavailable form which has the potential to be dispersed further afield; however, this is also likely to be subjected to strong tidal mixing as explained previously. Considering the short duration of the main construction activities, along with the mobile nature of fish which are not confined due to the works, is anticipated to have at worst a medium magnitude of impact. Therefore, there is likely to be an indirect temporary, short term, **Moderate Adverse (Significant)** effect on the River Thames and its Tidal Tributaries SINC prior to the introduction of additional mitigation.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

- 8.8.51. The intertidal mudflat and saltmarsh and its associated benthic communities are considered to be of National importance. The intertidal mudflat macrofaunal community within the Study Area is dominated by opportunistic species which are highly resistant to disturbance. However, the release and subsequent increase in bioavailability of heavy metals and other contaminants has the potential to result in the mortality of only a few less tolerant species. Therefore, the intertidal and saltmarsh habitats to changes in water quality and release of contaminants are considered to be of medium sensitivity. Due to many of the reasons highlighted previously in **Paragraph 8.8.50**, along with the temporary and short duration of the works also has the potential to allow communities to recolonise following construction. The dredge plume modelling also predicts that suspended solids and sediments will be retained within the main body of the Thames and will not interact directly with saltmarsh habitats. Based upon this the magnitude of impact is likely to be medium for intertidal mudflat and low for saltmarsh. Therefore, there is likely to be an indirect, temporary, short term and **Moderate Adverse (Significant)** effect upon intertidal mudflat and saltmarsh habitats prior to the introduction of additional mitigation.
- 8.8.52. The subtidal habitats within the Study Area are considered to be of Local value, The macrofaunal community within the Study Area is dominated by opportunistic species and therefore highly resistant to disturbance in the form of increased sedimentation. However, the release and subsequent increase in bioavailability of heavy metals and other contaminants has the potential to result in the mortality of only a few less tolerant species. Therefore, the sensitivity of subtidal habitats to changes in water quality and release of contaminants is considered to be of low sensitivity. The temporary and short duration of the works, alongside the mixing factor within the Thames Middle Transitional WFD Water Body has the potential to allow communities to recolonise following construction. Based upon this the magnitude of impact is likely to be medium. Therefore, there is likely to be an indirect, temporary, short term, **Minor Adverse (Not Significant)** impact on subtidal habitats.

Marine Plants and Macroalgae

- 8.8.53. Marine plants and macroalgae (excluding saltmarsh) recorded within the Study Area are assessed as being of Local importance. In addition, the species present are considered to be of low sensitivity to changes in water quality and release of contaminants. This is due to macroalgae having a number of defence strategies to aid the reduction of stress or damage related to heavy metal contamination, including cellular exclusion mechanisms, synthesis of metal chelating compounds, complexation with ligands. These strategies limit the capture of metals and allow algae to survive in environments containing high levels of metals⁸⁷. The tidal nature of this section of the Thames and strong mixing factors have the potential to dilute and disperse any contaminants released during dredging and other construction activities. Furthermore, considering the likely small scale potential for mobilisation of contaminant bound

sediments, with the adoption of the backhoe dredger, location of marine plants and macroalgae along the river margins (outside of the sediment plumes) along with the implementation of the proposed embedded mitigation, the magnitude of impact is considered to be low. Therefore, there is likely to be an indirect, temporary, short term and **Negligible (Not Significant)** effect on Marine plants and macroalgae.

Plankton

- 8.8.54. Phytoplankton and zooplankton recorded within the Study Area are assessed as being of Local importance. The species present are considered to be of low sensitivity to changes in water quality and release of contaminants. Based on the rapid dispersion and dilution of any contaminants released during dredging and other construction activities, the magnitude of impact is considered to be low. Therefore, there is likely to be an indirect, temporary, short term, **Negligible (Not Significant)** effect on phytoplankton and zooplankton.

Fish

- 8.8.55. Fish species recorded within the Study Area range from Regional/County importance (Flounder, Atlantic seabass, Atlantic Herring etc) to National importance (European eel, Atlantic salmon, brown/sea trout, allis shad, lamprey species). These species are considered to be of medium sensitivity to changes in water quality and release of contaminants. Potential impacts to fish from contaminants are discussed in **Paragraph 8.8.49**. It should be noted that fish are mobile receptors and, therefore can avoid areas of reduced water quality, albeit some life stages may be more susceptible, with subsequent year classes adversely affected. Considering the anticipated rapid dispersal and dilution of mobilised contaminants within this fairly large and dynamic water body, the proposed embedded mitigation and short duration of the works are likely to minimise the potential magnitude of impact, which is likely to be low. Therefore, there is likely to be an indirect, temporary, short term, **Moderate Adverse (Significant)** effect upon fish species prior to the introduction of additional mitigation.

Marine Mammals

- 8.8.56. Marine mammals recorded within the Study Area are of National importance. Marine mammals are considered to be of low sensitivity to changes in water quality, however, are of a moderate sensitivity to the release of contaminants. Prolonged exposure to heavy metals, through uptake from prey species such as fish, can result in immunosuppression and impairments to reproductive success⁸⁸. The highly mobile nature of marine mammals, low numbers and their spatial distribution within the Thames Estuary as a whole mean that they are able to avoid areas of poor water quality. The main foraging areas for marine mammals are also located within the outer Thames Estuary, therefore reducing the potential of consuming prey impacted by release of sediment bound contaminants by the Proposed Scheme. In addition, mammals are likely to avoid the vicinity of construction works due to noise, which reduces their potential exposure to contaminants remobilised by dredging. Based

upon this the magnitude of impact to marine mammals is likely to be negligible. Therefore, there is likely to be an indirect, temporary, short term **Negligible (Not Significant)** effect on marine mammals.

Noise and Vibration

- 8.8.57. The noise and vibration effects that could occur as a result of construction works are presented in **Chapter 6: Noise and Vibration (Volume 1)**. These include noise and vibration generated from:
- impact piling;
 - vibro-piling;
 - capital dredging;
 - vessel movement; and
 - demolition of the Belvedere Power Station Jetty (disused) if undertaken.
- 8.8.58. An underwater noise assessment is provided within **Appendix 6-4: Underwater Noise Assessment (Volume 3)** that has been undertaken in support of this marine biodiversity assessment. This focused on fish (adults and juveniles, eggs and larvae) and species with and without swim bladders, including European seabass (*dicentrarchus labrax*), European flounder, European smelt, pouting, goby (*gobiidae*) and various herring species; and marine mammals: common seal, grey seal and harbour porpoise.
- 8.8.59. The potential effects of underwater noise on marine ecological receptors vary considerably, depending on the noise level and the physiology of the species experiencing the noise. These can range from mortality, injury or permanent hearing loss to temporary impairment of audition and a variety of behavioural changes.
- 8.8.60. The underwater noise assessment for the various construction activities has been discussed in detail in **Appendix 6-4: Underwater Noise Assessment (Volume 3)**. The assessment has used a precautionary approach to assess each noise source and its potential impact on fish and marine mammals.
- 8.8.61. Within **Chapter 6: Noise and Vibration (Volume 1)**, it has been assumed that the Belvedere Power Station Jetty (disused) will be demolished as part of the Proposed Scheme as a worst case scenario. Should the Belvedere Power Station Jetty (disused) (with modifications) be retained, any adverse impacts would be less than presented.
- 8.8.62. The precise nature of the potential demolition activities for the Belvedere Power Station Jetty (disused) located within the intertidal zone is described in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**. It is known that the demolition would involve a waste removal vessel and jack-up barge (vessel movement) and pile removal (vibro-piling). It is anticipated that subsequent adverse impacts would be less than those generated by construction piling activity.

Fish (including Medway Estuary MCZ and River Thames and its Tidal Tributaries SINC)

- 8.8.63. Within the underwater noise assessment, fish are split into four categories:
- no swim bladder;
 - swim bladder not involved in hearing;
 - swim bladder involved in hearing; and
 - eggs and larvae.
- 8.8.64. The impacts and impact range at which fish hearing response thresholds are reached are discussed in detail in **Appendix 6-4: Underwater Noise Assessment (Volume 3)**, however a summary of the worst case potential impacts upon fish is presented below:
- impact piling has the potential to generate noise levels that will result in mortality to fish with a swim bladder within 15m, recoverable injury within 44m and changes to behaviour within 390m (cumulative exposure over 48 hours);
 - vibro-piling has the potential to result in recoverable injury at 24m for fish with a swim bladder involved in hearing (cumulative exposure over a 12 hour working day); and
 - capital dredging has the potential to result in recoverable injury to fish at 10m and changes to behaviour at 47m (cumulative exposure over a 12 hour working day).
- 8.8.65. These values have been calculated in the absence of any mitigation, such as seasonal timing (avoiding fish migration periods) and intertidal piling at low tide (where practicable). In addition, the cumulative exposure assumes continuous exposure of fish to piling over a 24 hour test period, which is highly unlikely to take place in reality.
- 8.8.66. In general, adult fish not in the immediate vicinity of noise generating activity are able to vacate the area and avoid physical injury. However, larvae and spawn are not highly mobile and are therefore more likely to incur injuries from the sound energy in the immediate vicinity of the sound source, including damage to their hearing, kidneys, hearts and swim bladders. Such effects are unlikely to happen outside of the immediate vicinity (see **Appendix 6-4: Underwater Noise Assessment (Volume 3)** for detail) of even the highest energy sound sources.
- 8.8.67. For subtidal impact piling, Temporary Threshold Shift (TTS) effects are anticipated to occur across most of the width of the River Thames during low tide. Therefore, potentially creating a partial temporary barrier to fish movements.
- 8.8.68. The assessment concluded that impact piling would have the most detrimental impact on fish. Any fish that remain within the predicted TTS effects zone at the time of percussive piling will be exposed to impact piling noise 4% of the time during any 12 hour working day.

- 8.8.69. For vibro-piling, the onset of TTS in fish where swim bladders are primarily used as a pressure detection mechanism would take place if the fish were within 24m from the vibro-piling activity for a full 12 hour working day. Given the mobility of fish, any individuals that might be present within this impact range would be expected to easily move away and avoid impacts.
- 8.8.70. Overall, there is considered to be a low risk of any injury in fish as a result of the underwater noise generated by dredging and vessel movements. The level of exposure will depend on the position of the fish with respect to the source, the propagation conditions, and the individual's behaviour over time. However, it is unlikely that a fish would remain in the vicinity of a dredger for extended periods. Behavioural responses are anticipated to be spatially negligible in scale and fish will be able to move away and avoid the source of the noise as required.
- 8.8.71. It is also important to consider the location of the proposed construction activities and existing ambient noise. The area in which construction will take place already experiences regular vessel operations and maintenance dredging. Consequently, fish are likely to be habituated to a certain level of anthropogenic background noise.
- 8.8.72. In the absence of mitigation, noise and vibration could result in impacts to fish including; mortality, injury and disturbance to fish migration. With appropriate embedded mitigation as set out in section 8.7, such as soft start, avoiding sensitive periods for fish species (April to September), intertidal piling at low tide (where practicable), and considering fish are not confined in any way due to the works, the potential impacts to fish species can be significantly reduced (sound generation can typically be reduced by ~14 dB dependent upon conditions⁸⁹). Therefore, the magnitude is considered to be negligible.
- 8.8.73. Based upon this, there is likely to be a direct, temporary short term **Negligible (Not Significant)** effect upon the Medway Estuary MCZ (European Smelt).
- 8.8.74. There is likely to be a direct, temporary short term **Negligible (Not Significant)** effect upon the River Thames and its Tidal Tributaries SINC.
- 8.8.75. There is likely to be a direct, temporary short term **Negligible (Not Significant)** effect upon fish species within the Thames.

Marine Mammals

- 8.8.76. Harbour seals, grey seals and harbour porpoises are considered to be of National importance. Harbour and grey seals exhibit a similar response to noise, with avoidance behaviour occurring at noise levels of 200 dB re 1 μ Pa, with harbour porpoise being more sensitive and exhibiting behavioural responses at sound levels of 155 dB re 1 μ Pa⁸⁴.
- 8.8.77. The impacts and impact range at which marine mammals auditory thresholds are reached are discussed in detail in **Appendix 6-4: Underwater Noise Assessment (Volume 3)**.

- 8.8.78. The results indicate that if any marine mammals present in the River Thames were to remain stationary within the cumulative distances (see **Appendix 6-4: Underwater Noise Assessment (Volume 3)** for detail) from the source of piling over a 24 hour period, it could result in temporary and/or permanent hearing injury. However, it is considered highly unlikely that any individual marine mammal will stay within this 'injury zone' during the vibro-piling operations.
- 8.8.79. The effects of piling noise on marine mammals also needs to be considered in terms of the duration of exposure. Impact piling activity will take place over a four month period, the duration of proposed vibro-piling activity is unknown at this stage. However, piling will not take place continuously as there will be periods of downtime, pile positioning, and associated set up. Furthermore, the piling will only be taking place during a working day, and not 24 hours a day.
- 8.8.80. For dredging, it is also worth considering the existing ambient noise context. The area in which the construction will take place already experiences regular vessel operations and maintenance dredging. Consequently, marine mammals are likely to be habituated to a certain level of anthropogenic background noise.
- 8.8.81. In the absence of mitigation, piling activity could result in impacts to marine mammals including; permanent hearing loss, temporary hearing loss and behavioural changes. With appropriate embedded mitigation, as described in **Section 8.7**, risks of injury to marine mammals due to piling noise will be minimised. Undertaking piling at low tide in the intertidal (where practicable) has the potential to minimise travel distances of noise and therefore impacts marine mammal behaviour. Additionally, the presence of a marine mammal ECoW will minimise the likelihood of marine mammal presence within the vicinity of the piling works, as operations will cease if they are observed. Therefore, the impact is considered to be of negligible magnitude. These species are considered to be of low sensitivity to noise and vibration. Based upon this there is likely to be a direct, temporary, short term **Negligible (Not Significant)** effect on marine mammals from piling activities.

Lighting

- 8.8.82. The changes in lighting that could occur as a result of construction works include:
- lighting used for construction of the Proposed Jetty; and
 - lighting used during demolition of the Belvedere Power Station Jetty (disused) if undertaken. There will be no additional impacts if this jetty is retained.
- 8.8.83. Details of construction are provided in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**. Mitigation has been developed in the form of the **Outline Code of Construction Practice (Document Reference 7.4)** which includes measures to minimise lighting impacts to designated areas, habitats and species. Mitigation included within the **Outline CoCP (Document Reference 7.4)** includes:
- only installing lighting where absolutely necessary;

- careful siting of lighting locations on infrastructure; and
- incorporating measures to minimise light spillage into the marine environment, thereby using lights with high directionality and employing controls to reduce light levels, when not required (unless for safety and navigation).

8.8.84. The potential range of effects from artificial lighting on marine ecological receptors varies according to species and life stage but can lead to a wide range of behavioural changes. These can include:

- photopositive (attracted to light) responses;
- photonegative (repelled by light) responses;
- disorientation;
- changes in diel vertical migration for feeding and avoiding predation (e.g., in zooplankton and fish); and
- subsequent indirect alterations in predator/prey interactions; disturbance of migratory patterns.

8.8.85. For some works, it may be difficult to avoid some artificial light falling on the marine environment, especially if the Belvedere Power Station Jetty (disused) is demolished, which would require work to be undertaken within the intertidal zone. However, mitigation such as the use of screening could be employed. In the current baseline conditions, there is already a considerable amount of light affecting the River Thames from vessels, bankside works and buildings, which also affects marine ecological receptors. The receiving environment is also highly turbid, meaning light penetration through the water is low and the potential for adverse effects is reduced. With the implementation of appropriate embedded mitigation and considering the small aerial extent of the potential impact, the magnitude of the effect is anticipated to be localised and negligible. The assessment of the significance of light impacts on marine ecological receptors is provided in the following paragraphs.

Statutory Sites (Medway Estuary MCZ)

8.8.86. Due to the anticipated localised effect of lighting and the location of Medway Estuary MCZ Zone 1 & 2 (National importance), approximately 25km downstream of the Site Boundary, there will be no direct adverse effects of lighting on the many of the features of importance within the MCZ. However, for European smelt, which utilise the wider River Thames, there is potential for an indirect effect on this MCZ, however, it should be noted juvenile and adult smelt have a low sensitivity to changes in light regime. The Thames already have a lot of light pollution, and the turbidity of the water will reduce light penetration, therefore the magnitude of change is anticipated to be negligible. With the implementation of the proposed mitigation, there is likely to be an indirect, temporary, short term, and **Negligible (Not Significant)**, effect on this MCZ.

Non-Statutory Sites (River Thames and its Tidal Tributaries SINC)

8.8.87. For the River Thames and Its Tidal Tributaries SINC (intertidal habitats, river channel, fish,) which is of Regional/County importance, the sensitivity to changes in light

regime is considered to be low. The magnitude of lighting is considered to be negligible for the reasons set out above in **Paragraphs 8.8.84 to 8.8.86**. Thus, there are likely to be direct and indirect, temporary, short term and **Negligible (Not Significant)** effects on the SINC.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

- 8.8.88. For marine habitats, including saltmarsh and intertidal mudflats of National importance, the magnitude of impact is considered to be negligible, in addition, these habitats have a low sensitivity to changes in light regime. Furthermore, as the saltmarsh is located approximately 500m away from the Proposed Scheme, this habitat is outside of the ZOI for works associated with the Proposed Jetty. Therefore, there is likely to be a direct, temporary, short term and **Negligible (Not Significant)** effect on intertidal habitats.
- 8.8.89. The subtidal habitats located within the Study Area are classed as being of Local importance, with the magnitude of impact considered to be negligible, in addition, these habitats have a low sensitivity to changes in light regime. The high turbidity of the water will reduce the potential for light penetration, this coupled with an absence of light sensitive species, and the existing level of light pollution within this part of the River Thames is likely to reduce the potential impacts of light spill on subtidal habitats. Therefore, there is likely to be a direct, temporary, short term and **Negligible (Not Significant)**, effect on subtidal habitats.

Marine Plants and Macroalgae

- 8.8.90. Marine plants and macroalgae (excluding saltmarsh) are considered to be of Local importance and widespread within the Thames Middle Transitional WFD Water Body. These species have a low sensitivity to changes in light regime. Within the Site, marine plants and macroalgae are restricted to the river margins and areas of hard substrate. No subtidal marine plants were observed or recorded within the surveys, potentially due to the highly turbid nature of the River Thames and reduced light penetration. The effects of lighting can increase the duration of daylight hours, however, with the implementation of the proposed embedded mitigation and given that the effects will only be localised, a negligible magnitude is anticipated. Therefore, there is likely to be a direct, temporary, short term and **Negligible (Not Significant)**, effect on these receptors.

Plankton

- 8.8.91. Phytoplankton and zooplankton are considered to be of Local importance, with a medium sensitivity to changes in light regime. They are known to be photopositive (attracted to light) and this can alter zooplankton's behaviour and result in increased concentrations in close proximity to illuminated areas. Consequently, lighting may result in subsequent increased predation by fish. However, due to the proposed embedded mitigation, localised effects and turbid waters, a negligible magnitude is

anticipated. Therefore, there is likely to be a direct and indirect, temporary, short term, and **Negligible (Not Significant)** effect on these receptors.

Fish

- 8.8.92. Fish range from being of Regional/County (medium) to National importance as set out in **Paragraph 8.8.25**. The fish species recorded within the Study Area are considered to be of medium sensitivity to changes in light regime. The importance of the surrounding area for supporting fish and as a potential nursery area was also previously described in **Paragraph 8.8.16** and **Paragraph 8.8.21**. There is potential for some fish to move towards illuminated areas and to subsequently experience increased predation from marine mammals and birds. Considering, however, the existing background illumination levels within the River Thames, the highly turbid nature of the Thames, proposed mitigation, current baseline and likely localised impact, a magnitude of negligible is anticipated. Therefore, there are likely to be direct and indirect, short term, temporary and **Negligible (Not Significant)** effects on fish.

Marine Mammals

- 8.8.93. For marine mammals of National importance, which have a low sensitivity to changes in light regime, there is potential for light to locally attract fish and subsequently lead to increased predation by marine mammals. However, due to the proposed mitigation, scarcity of marine mammals in the mid-estuary and other factors outlined previously, the magnitude of impact is anticipated to be negligible. Therefore, there is likely to be an indirect, temporary, short term and **Negligible (Not Significant)** effect on marine mammals.

Vessel Strikes

- 8.8.94. During construction, there will be an increase in vessel numbers within the Study Area from:
- dredging activities;
 - construction of the Proposed Jetty; and
 - potential demolition of the Belvedere Power Station Jetty (disused) (this would not occur if this jetty is retained).
- 8.8.95. As detailed in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**, there may be several vessel movements to and from the Proposed Jetty per day during the construction phase. The number of vessel movements will depend on the construction activities being undertaken at that point in time. The preliminary Navigation Risk Assessment (pNRA) (see **Appendix 19-1: Preliminary Navigation Risk Assessment (Volume 3)**) shows vessel traffic is lower in the Study Area in comparison to the rest of the tidal Thames. Vessels that currently pass the area consist primarily of tugs, barges and commercial shipping. The speed of vessels previously passing through the Study Area has ranged from 3-13 knots.

Consequently, the number of extra construction vessels in the Study Area will represent an incremental increase in existing traffic.

- 8.8.96. It is likely that during construction activities, vessels will be operating at low speeds (below 3 kts), this will be managed through the **Outline CoCP (Document Reference 7.4)**. To put this in context, speed limits do not apply in the mid-estuary downstream of Margerethness and are 12 kts between Margerethness and Wandsworth. The slow operating speeds of construction vessels enable sufficient time for marine mammals to move away from the disturbance, enhanced by their highly manoeuvrable abilities. Furthermore, as large areas remain unaffected by construction activities, there is sufficient space for marine mammals to pass by unimpeded or reside. A magnitude of negligible is therefore derived for this activity.

Marine Mammals

- 8.8.97. Marine mammals (grey seals, harbour seals and harbour porpoises) are of National importance, with a high sensitivity to impacts from vessel strikes. The magnitude of impact, however, is negligible due to the short term nature of construction, the anticipated low number of vessel movements and slow speeds as described in **Paragraphs 8.8.41 to 8.8.42**. Therefore, there is likely to be a direct, temporary, short term and **Negligible (Not Significant)**, effect of vessel movements on marine mammals.

Increased Wave Wash

- 8.8.98. The movement of vessels through water has the potential to affect various receptors both through the generation of waves and propeller-induced turbidity in the water column. The potential impacts of vessel movements and vessel wash include:
- intertidal erosion of habitats within rivers and estuarine environments;
 - resuspension of sediments; and
 - aeration of the water column.
- 8.8.99. As described previously, the findings of **Appendix 19-1: Preliminary Navigation Risk Assessment (Volume 3)** recorded lower vessel traffic in the Study Area compared to the rest of the tidal Thames. Vessels that currently pass the area consist primarily of tugs, barges and commercial shipping. The recorded speed of vessels passing through the Study Area ranged from 3-13 knots. Vessels used during construction will be travelling at a slower speed (below 3 knots). Even though there will be an increase in the number of vessels moving within the Study Area during the construction period, there is unlikely to be an increase in wave wash due to the slower operating speeds of the construction vessels. In addition, to reduce the potential erosion of intertidal habitat, a sheet pile wall is being constructed at the edge of the dredge pocket to stabilise the sediment and reduce the potential extent of dredge area impacts. Consequently, a negligible magnitude of impacts is derived for wave wash.

Statutory Sites (Medway Estuary MCZ)

- 8.8.100. The Medway Estuary MCZ Zone 1 & 2 is of National importance. European smelt may rely on habitats within the Study Area. Due to the reasons set out in **Paragraph 8.8.11**, including the 25km distance of the MCZ from the Site Boundary, a negligible magnitude of impact is anticipated. Thus, a likely indirect, temporary, short term and **Negligible (Not Significant)**, effect is anticipated on this MCZ.

Non-Statutory Sites (River Thames and its Tidal Tributaries SINC)

- 8.8.101. The River Thames and its Tidal Tributaries SINC (intertidal habitats, river channel and fish) is of Regional/County importance, with a low sensitivity to impacts from wave wash. The magnitude of impact from wave wash is assessed as negligible (see **Paragraph 8.8.99**). Thus, there are likely to be direct (habitats) and indirect (species), temporary, short term and **Negligible (Not Significant)** effects on the SINC.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

- 8.8.102. Intertidal habitats (i.e. mudflat and saltmarsh) are assessed as Nationally important, with low sensitivity to impacts from wave wash. Due to the reasons set out in **Paragraph 8.8.13**, the impoverished nature of the infaunal community and the location of the saltmarsh (approximately 500m upstream of the Site Boundary) in a small, sheltered embayment, the magnitude of impact is assessed as negligible. Therefore, a likely direct (habitats) and indirect (species), temporary, short term and **Negligible (Not Significant)** effect on the intertidal mudflat, saltmarsh and subtidal habitat.
- 8.8.103. Subtidal habitats are assessed as being of Local importance within the Site, with a low sensitivity to impacts from wave wash. This section of the Thames Middle Transitional WFD Water Body is highly turbid and the potential increase in turbidity from wave was minimal. In addition, the subtidal benthic community is impoverished and adapted to turbid conditions, therefore the magnitude of impact is assessed as negligible. Therefore, a likely indirect (habitats) and indirect (species), temporary, short term, **Negligible (Not Significant)** effect is anticipated for subtidal habitats.

Marine Plants and Macroalgae

- 8.8.104. For marine plants and macroalgae of Local importance (excluding saltmarsh communities), the species present are considered to have a low sensitivity to impacts from wave wash. This is due to the marine plants within the Site colonising hard substrates that are not impacted by wave wash. In addition, fucoids are extremely flexible and are able to alter their position in the water column to become more streamlined. This allows them to reduce the relative velocity between them and surrounding water, reducing drag and lift, and mechanical stress^{90,91}. The magnitude of impact is assessed as negligible based upon resuspended sediment from wave wash likely to be localised, and due to the highly turbid nature of the Thames, which are unlikely to produce any impacts to plant species. Consequently, there is likely to

be a direct, temporary, short term and **Negligible (Not Significant)** effect on marine plants and macroalgae.

Fish

- 8.8.105. Fish are assessed as being of Regional/County to National importance, depending on species, as set out in **Paragraph 8.8.25**. The fish species present have a low sensitivity to impacts from wave wash. For the reasons outlined in **Paragraph 8.8.55**, there will be a negligible magnitude of impact on habitats that may support fish. Therefore, there is likely to be an indirect, temporary, short term and **Negligible (Not Significant)** effect on fish.

Marine Mammals

- 8.8.106. Marine mammals (grey seals, harbour seals and harbour porpoises) are considered to be of National importance and with a low sensitivity to impacts from wave wash. As there will be a negligible magnitude on all habitats that may support marine mammals, there is likely to be an indirect, temporary, short term and **Negligible (Not Significant)** effect on marine mammals.

Spread of INNS

- 8.8.107. There is the potential for the introduction and spread of INNS within the marine environment as a result of construction activities. These include:
- introduction of new vessels, equipment and infrastructure into the River Thames from other Water Bodies during construction of the Proposed Jetty and potential demolition of Belvedere Power Station Jetty (disused)^f;
 - increased vessel movements during construction for the Proposed Jetty and potential demolition of the Belvedere Power Station Jetty(disused)^f; and
 - creation of opportunities for organisms to settle or spread through habitat creation or disturbance.
- 8.8.108. These activities have the potential to increase the risk of spread of INNS in the marine environment. The potential pathway for INNS from other Water Bodies to enter the River Thames is potentially via pre-existing biofouling of vessels, equipment and infrastructure. The Thames is subject to control and management of ballast water as stipulated by the MMO, therefore release from ballast water is not a vector for the spread of INNS⁹². The introduction and spread of INNS can also occur indirectly by creating opportunities for organisms to settle or spread through habitat creation or disturbance due to out-competing native species. Provision of local materials should be used where practicable, and materials should be appropriately assessed and treated to minimise the potential spread of INNS.

^f Vessel traffic would be slightly reduced if the Belvedere Power Station Jetty (disused) (with modifications) is to be retained.

8.8.109. There are already numerous INNS in the Thames, regarded as one of the most heavily invaded river systems in the world and monitored for their presence⁷⁸. It is expected that vessels will follow standard best practices for managing INNS in their ballast water. A Biosecurity Management Plan will be developed as part of the full CoCP(s) (prior to construction) and implemented with standard biosecurity measures. It will also identify the supply route of vessels, equipment and infrastructure for the works and determine appropriate action. This will promote the effective cleaning of all marine equipment and infrastructure (if utilised in other Water Bodies), along with preventing the release of any subsequent waste arisings back into the marine environment. The PLA provides further guidance on Invasive Non-Native Species and relevant principles to follow⁹³.

8.8.110. With appropriate and effective mitigation and management measures in place and considering the current status of INNS within the Thames, it is anticipated that the magnitude of impact is likely to be **Negligible**.

Statutory Sites (Medway Estuary MCZ)

8.8.111. The Medway Estuary MCZ Zone 1 & 2 is of National importance, however distance from the Study Area means it is unlikely to be directly impacted through the introduction of INNS. European smelt, a mobile receptor of the MCZ may rely on habitats within the Study Area as foraging and nursery habitat. However, the INNS species likely to be introduced are invertebrates and are unlikely to form a threat to smelt, therefore the sensitivity to the Spread of INNS is likely to be low. Due to the reasons previously set out in **Paragraphs 8.8.107 to 8.8.110**, a negligible magnitude of impact is anticipated. Thus, a likely indirect, permanent, long term and **Negligible (Not Significant)** effect is anticipated on this MCZ.

Non-Statutory Sites (River Thames and its Tidal Tributaries SINC)

8.8.112. The River Thames and its Tidal Tributaries SINC (intertidal habitats, river channel, fish and invertebrates) is of Regional/County importance. The habitats are already heavily colonised by INNS species, thus the sensitivity to INNS is likely to be low. With the embedded mitigation in place, the magnitude of impact is assessed as negligible (see **Paragraphs 8.8.107 to 8.8.110**). Thus, there is likely to be an indirect, permanent, long term and **Negligible (Not Significant)** effect on the SINC.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

8.8.113. The intertidal mudflat and saltmarsh and its associated benthic communities are considered to be of National importance. The introduction of INNS could alter community composition, however, the already impoverished nature of the community and high adaptability, reduce the potential risks resulting in a low sensitivity to the spread of INNS. The majority of INNS are invertebrate species, which would not impact habitats (Chinese mitten crab being an exception) but would interact with other native species. The conditions within the Study Area (reduced salinities), would result in only tolerant INNS species becoming established. The magnitude of impact is

assessed as negligible (see **Paragraphs 8.8.107 to 8.8.110**). Therefore, there is likely to be an indirect, permanent, long term **and Negligible (Not Significant)** effect on intertidal habitats and communities.

- 8.8.114. Subtidal habitat and its associated benthic communities are considered to be of Local importance, which is based upon the impoverished nature of the benthic community present, the absence of any species of conservation importance and the high recovery rate of communities. The introduction of INNS could alter community composition, however, the already impoverished nature of the community and its high adaptability, reduce the potential risks. In addition, the subtidal habitats are considered to be of low sensitivity to the spread of INNS. The magnitude of impact is considered to be negligible (see **Paragraphs 8.8.107 to 8.8.110**). Therefore, there is likely to be an indirect, permanent, long term, **Negligible (Not Significant)** effect on subtidal benthic communities.

Marine Plants and Macroalgae

- 8.8.115. For marine plants and macroalgae of Local importance (excluding saltmarsh communities), the sensitivity to INNS is likely to be low, in addition, the magnitude of impact is assessed as negligible. Consequently, there is likely to be an indirect, permanent, long term and **Negligible (Not Significant)** effect on marine plants and macroalgae.

Fish

- 8.8.116. Fish are of Regional/County to National importance depending on species, as set out in **Paragraph 8.8.25**. The sensitivity of fish species to INNS is likely to be low, based on the species present and the likely species of INNS that could be introduced (mainly invertebrates). For the reasons outlined in **Paragraphs 8.8.107 to 8.8.110**, there will be a negligible magnitude of impact on habitats that may support fish. Therefore, there is likely to be an indirect, permanent, long term and **Negligible (Not Significant)**, effect on fish species.

OPERATION PHASE

- 8.8.117. The potential likely significant effects on marine biodiversity associated with the operation phase of the Proposed Scheme are set out in the following sections.

Loss or Disturbance of Habitat

- 8.8.118. There is potential for loss or disturbance of habitat during operation of the Proposed project due to:
- disturbance to the subtidal habitat due to periodic maintenance dredging of the Proposed Jetty; and
 - loss of intertidal and subtidal habitat due to the presence of the Proposed Jetty and associated infrastructure.

- 8.8.119. The long term loss of subtidal habitat and intertidal habitat from the construction of the Proposed Jetty and the potential gain of intertidal habitat due to the removal of the Belvedere Power Station Jetty (disused) has been previously assessed as part of the construction phase in **Paragraphs 8.8.21 to 8.8.23** and therefore is not assessed here, despite the loss continuing during the lifetime of the Proposed Scheme. Consequently, this section focuses on maintenance dredging activities.
- 8.8.120. As the Proposed Scheme is located within an area which is known for being highly turbid, with high levels of suspended sediment and bed mobility, there is potential for some natural backfilling of dredged areas to occur following the initial capital dredging, with average sedimentation rates, over the dredge pocket, likely to range between approximately 0.5 and 1m per year.
- 8.8.121. The proposed method of maintenance dredging is backhoe dredging. The sediment transport modelling has made the assumption that maintenance dredging will require up to 10,000m³ of material to be removed to keep the berth pocket operational. This material will be removed by a backhoe dredger and is likely to occur over seven days at 18.5 hours a day. For many of the reasons highlighted previously in the construction assessment for capital dredging in relation to the surrounding ecology, it is considered that maintenance dredging occurring over a smaller area, extracting less material, along with embedded mitigation, the magnitude of impact is anticipated to be negligible.

Statutory Sites (Medway Estuary MCZ)

- 8.8.122. The Medway Estuary MCZ Zone 1 & 2 sites are a protected area of National importance. There will be no direct effects on the MCZ due to its location being approximately 25km downstream. Thus, there is only potential for indirect effects on this designation via the European smelt (which has a low sensitivity to habitat disturbance for juvenile and adult smelt). Based on the impact being of a negligible magnitude and many of the reasons highlighted in **Paragraph 8.8.16 to 8.8.18**, there is likely to be an indirect, long term intermittent and **Negligible (Not Significant)** effect on the MCZ.

Non-Statutory Sites (River Thames and its Tidal Tributaries SINC)

- 8.8.123. The River Thames and its Tidal Tributaries SINC (intertidal habitats, river channel, fish) is of Regional/County importance, designated for various habitats (mudflats, saltmarsh and river channel) and fish species. The sensitivity of these habitats and species to habitat loss and disturbance from dredging is low, due to the reasons outlined in **Paragraph 8.8.19**. The magnitude of impact is anticipated to be negligible. Therefore, there is likely to be a direct (habitats) and indirect (species), long term and intermittent **Negligible (Not Significant)** effect on the SINC.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

- 8.8.124. Intertidal mudflat of National importance is of low sensitivity to habitat disturbance based on the impoverished species composition and adaptability to habitat

disturbance. Saltmarsh is of national importance and highly sensitive to habitat loss. Both Intertidal mudflats and saltmarsh are unlikely to be adversely affected by maintenance dredging, as this will take place in the subtidal environment. Due to some of the reasons highlighted in **Paragraph 8.8.21** including the already impoverished nature and high recoverability of the benthic communities present and the presence of saltmarsh in a sheltered location, a negligible magnitude of impact is anticipated. Therefore, there is likely to be an indirect, long term and intermittent **Negligible (Not Significant)** effect on intertidal habitats.

- 8.8.125. Subtidal habitat of Local importance features impoverished communities with a high level of recoverability, and thus low sensitivity to habitat disturbance. Because of this, and other reasons discussed previously (see **Paragraph 8.8.23**), the magnitude of impact is negligible. Therefore, there is likely to be a direct, long term intermittent and **Negligible (Not Significant)** effect on subtidal habitat and its associated benthic communities.

Marine Plants and Macroalgae

- 8.8.126. Marine plants and macroalgae (excluding saltmarsh) are regarded as being of Local importance as they are commonly occurring species, in addition, these species are considered to be of low sensitivity to habitat disturbance. These species are also located within the marginal areas of the intertidal zone, growing on the river wall. As maintenance dredging will take place in the subtidal zone, the magnitude of impact is assessed as negligible, as it is unlikely there will be habitat loss. Therefore, there is likely to be an indirect, long term and intermittent **Negligible (Not Significant)** effect on marine plants and macroalgae.

Fish

- 8.8.127. For the assessment of effects on fish as presented in **Paragraph 8.8.25**, the importance of these receptors ranges from Regional/County to National importance, depending on species. The species present are of low sensitivity to habitat disturbance. As only a small area of potential foraging and nursery area will be affected and there is sufficient available habitat outside of the dredge pocket for fish to utilise, along with the proposed mitigation, the magnitude is considered to be negligible. For many of the reasons highlighted previously in the construction phase (**Paragraphs 8.8.25 to 8.8.26**) it is anticipated there will be an indirect, long term and intermittent **Negligible (Not Significant)** effect on European eel and European smelt (as well as other fish species of National and Regional/County importance) from habitat disturbance during operational activities.

Marine Mammals

- 8.8.128. Marine mammals (grey seals, harbour seals and harbour porpoises) are assessed to be of National importance, with a low sensitivity to habitat disturbance. Due to the small scale of habitat loss, the ability of marine mammals to readily utilise other areas and scarcity in the Study Area (**Paragraph 8.8.27**), the magnitude of impact is

negligible. Therefore, there is likely to be an indirect, long term intermittent and **Negligible (Not Significant)** effect on marine mammals.

Increased Suspended Sediment Concentrations and Subsequent Sediment Deposition

- 8.8.129. There is potential for a deterioration in water quality due to increased suspended sediment concentrations and subsequent sediment deposition during the operation of the Proposed Scheme. This will be due to disturbance to the subtidal habitat due to periodic maintenance dredging of the Proposed Jetty.
- 8.8.130. Changes in suspended sediment concentrations and subsequent sediment deposition, derived from maintenance dredging (using a backhoe dredger) was simulated in the sediment transport model. The model identified that the majority of dredged material would be deposited within 300m of the dredging activity, with low concentrations of sediment (~0.4mg per litre above background levels) being transported up to approximately 3.5km from dredging operations.
- 8.8.131. The potential impacts of capital dredging on marine receptors were previously discussed in **Paragraphs 8.8.24 to 8.8.34**, which concluded a negligible magnitude for this impact due to the localised nature and short duration of the activity, combined with existing high turbidity of the River Thames, with species and habitats adapted to the highly turbid conditions. In addition, maintenance dredging will take place for a shorter duration for each dredging event, than for capital dredging, albeit over a longer time period, thus reducing the potential impact upon ecological receptors. However, maintenance dredging may be undertaken frequently throughout the lifetime of the Proposed Scheme, although propeller wash from berthed vessels, may mobilise sediment and reduce the required frequency of dredging. It will also occur over a smaller area, which will require less material to be excavated than capital dredging. Consequently, with the implementation of all the relevant mitigation as described in **Section 8.7**, the magnitude of impact is still anticipated to be negligible.

Statutory Sites (Medway Estuary MCZ)

- 8.8.132. Direct impacts on the Medway Estuary MCZ Zone 1 & 2, of National importance, are unlikely, due to its distance of approximately 25km downstream. Impacts to mobile qualifying features such as European Smelt, could occur during maintenance dredging, however, the mobile nature of this species (low sensitivity to increases in suspended solids), the localised and short term nature of each dredge event, albeit over a long time frame, mitigation (timings of works) and reasons set out in **Paragraph 8.8.33** the magnitude of impact is likely to be negligible. Therefore, there is likely to be an indirect, long term, intermittent **Negligible (Not Significant)** effect on European smelt.

Non-Statutory sites (River Thames and its Tidal Tributaries SINC)

- 8.8.133. The River Thames and its Tidal Tributaries SINC (intertidal habitats, river channel, fish) is assessed as being of Regional/County importance for habitats and fish. The species and habitats present within the Site are of low sensitivity to increase in suspended solids as they are adapted to highly turbid conditions and therefore resilient to changes in suspended solids, with fish species able to avoid areas of increased turbidity. This coupled with the short term nature of each dredge event, albeit over a long time frame and due to the reasons set out previously the magnitude of impact is likely to be negligible. Therefore, there is likely to be an indirect, long term, intermittent **Negligible (Not Significant)** effect to all receptors.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

- 8.8.134. The intertidal mudflat and saltmarsh and its associated benthic communities are considered to be of National importance. The intertidal mudflat community was identified as impoverished, resistant to changes in sedimentation, with high recoverability, thus of low sensitivity to changes in suspended solids. The saltmarsh habitat is sheltered in a bay out of the main flow and subsequent suspended sediment deposition. This coupled with the short term nature of each dredge event and reasons set out in **Paragraph 8.8.51**, the magnitude of impact is likely to be negligible. Therefore, there is likely to be an indirect (habitats) and indirect (species), long term, intermittent **Negligible (Not Significant)** effect on these receptors.
- 8.8.135. Subtidal habitat and associated benthic communities are assessed as Locally important, with a low sensitivity to increased sedimentation based upon the impoverished nature of the community, absence of any infaunal species of conservation importance and recoverability. This coupled with the short term nature of each dredging event and reasons set out in **Paragraph 8.8.52**, the magnitude of impact is likely to be negligible. Therefore, there is likely to be an indirect, long term, intermittent **Negligible (Not Significant)** effect on these receptors.

Marine plants and macroalgae

- 8.8.136. The importance of marine plants and macroalgae (excluding saltmarsh) is Local. Within the Site, marine plants and macroalgae are located on the River Thames edges and hard substrates. No marine plants were observed within the subtidal areas during the surveys, although the water is highly turbid. The species present are adapted to turbid conditions and thus of low sensitivity to changes in suspended sediments. The results of the sediment transport model predicted that sediment would disperse within the main river channel, along with the short term nature of each dredging event and reasons set out in **Paragraph 8.8.53**, the magnitude of impact is likely to be negligible. Therefore, there is likely to be an indirect, long term, intermittent **Negligible (Not Significant)** effect on these receptors.

Fish

8.8.137. Fish species that utilise the Site are considered to be of Regional/County and National importance, as presented in **Paragraph 8.8.25**. The fish species present within the Thames Middle Transitional WFD Water Body are considered to have a low sensitivity to elevated levels of suspended solid as they are adapted to the already highly turbid conditions of the Thames Middle Transitional WFD Water Body. Fish are highly mobile receptors and can avoid areas of increased sedimentation. In addition, the species utilising this section of the Thames Middle Transitional WFD Water Body are adapted to highly turbid conditions and are thus not sensitive to elevated suspended sediments. Furthermore, the increases in suspended solids are within natural variation. Dredging will also be undertaken outside of the migration period for fish species including European eel, Atlantic Salmon, brown/sea trout and lamprey species, thus not providing a barrier to migration. This coupled with the short term nature of each dredging event and the reasons set out in **Paragraph 8.8.55**, the magnitude of impact is likely to be negligible. Therefore, there is likely to be an indirect, long term, intermittent **Negligible (Not Significant)** effect on these receptors.

Marine mammals

8.8.138. Marine mammals, which are known to utilise the Site are classed as of National importance. Seals and other marine mammals often reside in highly turbid areas and are adapted to these conditions, indicating a low sensitivity to increases in changes in suspended solids, therefore changes to these conditions are unlikely to impact these species⁸⁴. Marine mammals are highly mobile and can avoid areas of poor water quality and increased sedimentation. In addition, they are not sensitive to increased suspended solids⁸⁹. This coupled with the short term nature of each dredge event and the reasons set out in **Paragraph 8.8.56**, the magnitude of impact is likely to be negligible. Therefore, there is likely to be an indirect long term, intermittent **Negligible (Not Significant)** effect to these receptors.

Changes in Water Quality and Release of Contaminants

- 8.8.139. The changes in water and sediment quality that could potentially occur as a result of the operation phase of the Proposed Scheme are presented in **Chapter 11: Water Environment and Flood Risk (Volume 1)** and **Chapter 17: Ground Conditions and Soils (Volume 1)**. These include but are not limited to:
- changes to water and sediment quality due to mobilisation of sediment bound contaminants and their subsequent re-deposition from maintenance dredging; and
 - changes in water quality due to accidental fuel leaks (from moored vessels).
- 8.8.140. Grab surveys undertaken within the intertidal and subtidal sections of the River Thames in the Study Area were analysed for the presence of sediment bound contaminants in surface sediments. Laboratory analysis recorded a number of contaminants exceeding CEFAS AL1. The full list and impacts on water quality are

discussed in **Chapter 17: Ground Conditions and Soils (Volume 1)** and **Appendix 11-1: Water Framework Directive Assessment (Volume 3)**. As per **Paragraph 8.8.44**, contaminants were found to exceed CEFAS AL1, with mercury exceeding AL2 at one location within the subtidal zone. Similarly, to capital dredging maintenance dredging will adopt the backhoe dredging method. The dredged arisings will be managed in accordance with relevant legislation and will be disposed of offsite (via vessel and only if dredged arisings are deemed suitable for this disposal method and conform with the permits for disposal sites). The removal of the dredged arisings will be undertaken by an appropriately licenced waste carrier. A separate vessel or barge will be used to transport the dredged material to the designated deposition location.

- 8.8.141. The risk of effects arising from accidental fuel leaks from vessels during the operation phase is addressed in **Section 8.7**. Consequently, a negligible magnitude of impact is envisaged.
- 8.8.142. An assessment has been undertaken on the same receptors as those identified for the construction phase in **Paragraphs 8.8.48 to 8.8.56** and based on the backhoe methodology. The volume of material removed for maintenance dredging is likely to be significantly less than during capital dredging. This has the potential to result in significantly fewer releases of sediment bound contaminants and their subsequent deposition. In addition, sediment bound contaminants released during maintenance dredging will not be in the water column in perpetuity and will settle out of suspension, on cessation of dredging activities.

Statutory Sites (Medway Estuary MCZ)

- 8.8.143. Medway Estuary MCZ, Zone 1 & 2 are considered to be of National importance. The potential impacts of changes to water and sediment quality derived from construction activities have been discussed in **Paragraph 8.8.48**. The reduced volumes of material, coupled with the distance of this designation from the Site (approximately 25km), means that only European smelt (a qualifying feature) has the potential to be within the area impacted by dredging and any accidental fuel spills. European smelt is considered to have a medium sensitivity to changes in water quality for the reasons set out in **Paragraph 8.8.48**. Therefore, the magnitude of impact is considered to be negligible, however, a low magnitude is derived due to some uncertainty in future contamination level at the time the maintenance dredging is carried out. Therefore, there is likely to be an indirect, long term, intermittent, **Moderate Adverse (Significant)** effect on the Medway Estuary MCZ, prior to the introduction of additional mitigation measures. If contaminant levels are shown to be reduced and within acceptable levels at the time of maintenance dredging, then the subsequent effect will be reduced.

Non-Statutory Sites (River Thames and its Tidal Tributaries SINC)

- 8.8.144. River Thames and its Tidal Tributaries SINC (intertidal habitats, river channel, fish and invertebrates) is considered to be of Regional/Count importance. The qualifying habitats and species of the SINC are considered to have a medium sensitivity to

changes to water quality. The potential impacts from changes to water and sediment quality derived from construction activities have been discussed in **Paragraph 8.8.50**. The reduced volume of dredged material required for maintenance dredging is likely to result in reduced impacts to this receptor. The magnitude of impact is considered to be negligible, however, a low magnitude is derived. Therefore, there is likely to be an indirect, long term, intermittent, **Moderate Adverse (Significant)** effect upon the River Thames and its Tidal Tributaries SINC, prior to the introduction of additional mitigation measures. If contaminant levels are shown to be reduced and within acceptable levels at the time of maintenance dredging, then the subsequent effect will be reduced.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

- 8.8.145. Intertidal habitats within the Study Area are considered to be of National importance, with a medium sensitivity to changes in water quality. The potential impacts from changes to water and sediment quality derived from construction activities have been discussed in **Paragraph 8.8.51**. The reduced volumes of dredged material required for maintenance dredging is likely to result in reduced impacts to mudflat and saltmarsh habitats. Therefore, the magnitude of impact is considered to be negligible. Therefore, there is likely to be an indirect long term, intermittent **Negligible (Not Significant)**. If contaminant levels are shown to be reduced and within acceptable levels at the time of maintenance dredging, then the subsequent effect will be reduced.
- 8.8.146. Subtidal habitats within the Study Area are considered to be of Local importance, with a medium sensitivity to changes in water quality and release of contaminants. The potential impacts from changes to water and sediment quality derived from construction activities have been discussed in **Paragraph 8.8.52**. The reduced volumes of dredged material required for maintenance dredging, is likely to result in reduced impacts to this receptor. Therefore, the magnitude of impact is considered to be negligible, however, a low magnitude is derived due to some uncertainty in future contamination level at the time the maintenance dredging is carried out. Therefore, there is likely to be an indirect long term, intermittent and **Negligible (Not Significant)** effect upon subtidal habitats. If contaminant levels are shown to be reduced and within acceptable levels at the time of maintenance dredging, then the subsequent effect will be reduced.

Marine Plants and Macroalgae

- 8.8.147. Marine plants and macroalgae within the Study Area are considered to be of Local importance, with a low sensitivity to changes in water quality and release of contaminants. The potential impacts from changes to water and sediment quality derived from construction activities have been discussed in **Paragraph 8.8.53**. The reduced volumes of dredged material required for maintenance dredging are likely to result in reduced impacts on this receptor. Considering the location of these receptors, the magnitude of impact is considered to be negligible resulting in an

indirect long term, intermittent and **Negligible (Not Significant)** effect on marine plants and macroalgae.

Plankton

- 8.8.148. Phytoplankton and zooplankton species recorded within the Study Area are considered to be of local importance, with a low sensitivity to changes in water quality and release of contaminants. The potential impacts of changes to water and sediment quality derived from construction activities have been discussed in **Paragraph 8.8.54**. The reduced volumes of dredged material required for maintenance dredging are likely to result in reduced impacts to this receptor, therefore, the magnitude of impact is considered to be negligible resulting in an indirect, long term, intermittent **Negligible (Not Significant)** effect upon phytoplankton and zooplankton.

Fish

- 8.8.149. Fish species identified within the Study Area are considered to range between Regional/County and National importance, as described in **Paragraph 8.8.25**. The fish species within the Study Area are considered to have a medium sensitivity to changes in water quality and release of contaminants. The potential impacts of changes to water and sediment quality derived from construction activities have been discussed in **Paragraph 8.8.55**. The reduced volumes of dredged material required for maintenance dredging are likely to result in reduced impacts to this receptor. Therefore, the magnitude of impact is considered to be negligible, however, a low is derived due to some uncertainty in future contamination level at the time the maintenance dredging is carried out. Therefore, there is likely to be an indirect, long term, intermittent **Moderate Adverse (Significant)** effect on fish, prior to the introduction of additional mitigation measures.

Marine Mammals

- 8.8.150. Marine mammals recorded within the Study Area are considered to be of National importance. Marine mammals are considered to be of low sensitivity to changes in water quality and of moderate sensitivity to release of contaminants. The potential impacts of changes to water and sediment quality derived from construction activities have been discussed in **Paragraph 8.8.56**. The reduced volumes of dredged material required for maintenance dredging are likely to result in reduced impacts on this receptor, along with the high manoeuvrability of this species and no restrictions on movement due to the Proposed Scheme. Therefore, the magnitude of impact is considered to be negligible. Therefore, there is likely to be an indirect, long term, intermittent and **Negligible (Not Significant)** effect on marine mammals.

Noise and Vibration

- 8.8.151. The changes in noise and vibration that could occur as a result of operational activities associated with the Proposed Scheme are presented in **Chapter 6: Noise and Vibration (Volume 1)**. These include noise and vibration generated from:

- maintenance dredging; and
- operational vessel movements.

- 8.8.152. The requirement for maintenance dredging is not clear at this stage, however, it is likely to be less than capital dredging. In terms of underwater noise impacts, there is already existing vessel activity in the Study Area and the wider River Thames (see **Paragraph 8.8.57**). Routine maintenance dredging also takes place at several locations within the Thames Middle Transitional WFD Water Body.
- 8.8.153. Potential effects of noise and vibration on fish and marine mammals were previously described for construction (see **Paragraphs 8.8.59 to 8.8.79**). As operational vessels and dredging vessels will be operating at slow speeds, fish and marine mammals are likely to exhibit avoidance behaviours when in proximity. There may also be some habituation to existing vessel activity and associated noise and vibration. In addition, maintenance dredging will take place for a shorter duration for each dredging event, than for capital dredging, albeit over a longer time period, thus reducing the potential impact upon ecological receptors. However, maintenance dredging may be undertaken frequently throughout the lifetime of the Proposed Scheme, although propeller wash from berthed vessels, may mobilise sediment and reduce the required frequency of dredging.
- 8.8.154. The reduced footprint required for maintenance dredging as well as the small increase in vessel traffic means much of the surrounding area will remain undisturbed. Fish and marine mammals will therefore not experience spatial constraints due to maintenance activity and therefore a negligible magnitude of impact is anticipated.
- 8.8.155. An assessment of noise from maintenance dredging on sensitive receptors is provided in the following paragraphs.

Statutory Sites (Medway Estuary MCZ)

- 8.8.156. For the Medway Estuary MCZ Zone 1 & 2 of National importance, there will be no direct effect on the Medway Estuary MCZ Zone 1 & 2, due to the approximate 25km downstream distance from the Site Boundary, thus has a low sensitivity to noise and vibration. For European smelt, that may utilise habitats within the Study Area, a negligible magnitude of impact is predicted due to the reasons highlighted in **Paragraph 8.8.70**. Thus, a likely indirect, temporary, long term intermittent and **Negligible (Not Significant)** effect is anticipated on the MCZ and its features.

Non-Statutory Sites (River Thames and its Tidal Tributaries SINC)

- 8.8.157. The River Thames and its Tidal Tributaries SINC are assessed as being of Regional/County importance. For fish receptors, the magnitude of impact is assessed as negligible due to the reasons highlighted in **Paragraph 8.8.70** in addition these species have a low sensitivity to noise and vibration. Therefore, there is a likely to be a direct, temporary, long term intermittent and **Negligible (Not Significant)** effect on this non-statutory designated site and its features.

Fish

- 8.8.158. For fish of Regional/County and National importance, as described in **Paragraph 8.8.25**, these species have a low sensitivity to noise and vibration. For many of the reasons highlighted previously, including undertaking dredging operation outside of the migratory period, a negligible magnitude is anticipated. Therefore, there is likely to be a direct, temporary, long term intermittent and **Negligible (Not Significant)** effect on fish.

Marine Mammals

- 8.8.159. For marine mammals (grey seals, harbour seals and harbour porpoise) which are of National importance, noise disturbance from maintenance dredging and operational vessel traffic, is likely to be reduced, due to the existing level of activity within this section of the Thames and the low levels of noise generated by these activities. The sensitivity to changes to Noise and Vibration are considered medium. Based upon this the magnitude of impact is considered to be negligible. Therefore, there is likely to be a direct, temporary, long term intermittent and **Negligible (Not Significant)** effect on marine mammals.

Lighting

- 8.8.160. Any new lighting for the Proposed Scheme will comply with the relevant design standards and mitigation measures set out in embedded mitigation (see **Section 8.7**). An **Outline Lighting Strategy (Document Reference 7.3)** has been produced for the Proposed Scheme which details how it will minimise lighting impacts to designated areas, habitats and species. The strategy proposes to reduce impacts to the marine environment through the use of directional lighting on the jetty in the form of bollard and pole arrangements. In addition, the operational non-navigational lighting on the Proposed Jetty will only be engaged during operational activities i.e. loading, unloading of vessels and routine maintenance, which will be controlled by a combination of hard wired switches and movement sensors. This will reduce the potential for light pollution outside of operational activities.
- 8.8.161. The potential range of effects on marine ecological receptors was described previously (see **Paragraph 8.8.84**). There are differences, in that operational lighting will be long term. Nevertheless, there is already a considerable amount of light affecting the wider River Thames and its marine ecological receptors. The high turbidity means that light penetration through the water will be low. This, combined with the limited aerial extent of any light spill means the magnitude of impact is likely to be localised and negligible.

Statutory Sites (Medway Estuary MCZ)

- 8.8.162. The Medway and Estuary MCZ Zone 1 & 2, of National importance, is located 25km downstream of the Site Boundary. There will therefore be no direct effects of operational lighting on the many of the features of importance within the MCZ. However, there is the potential for effects on European smelt which range widely in

the Thames, including within the Site, thus resulting in an indirect impact to the MCZ, however it should be noted juvenile and adult smelt have a low sensitivity to changes in light regime. The Thames already has a lot of light pollution, and the turbidity of the water will reduce light penetration, therefore the magnitude of change is anticipated to be negligible with the implementation of the proposed embedded mitigation there is likely to be an indirect, long term and **Negligible (Not Significant)** effect on the MCZ.

Non-Statutory Sites (River Thames and its Tidal Tributaries SINC)

- 8.8.163. The River Thames and its Tidal Tributaries SINC are assessed as being of Regional importance for habitats and fish, the sensitivity to changes in light regime is considered to be low. The magnitude of impact resulting from lighting is considered to be negligible due to the highly turbid nature of the Thames, embedded mitigation set out within the lighting strategy and attenuation of light within the water column. Thus, there is likely to be a direct and indirect, long term, **Negligible (Not Significant)** effect on this SINC.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

- 8.8.164. Marine habitats, including saltmarsh and intertidal mudflats, are assessed as being of National importance and these habitats have a low sensitivity to changes in light regime. Due to the impoverished nature of the associated benthic communities that are predominantly infaunal, the effects of light will be minimal. Furthermore, as the saltmarsh is located approximately 500m away from the Proposed Jetty, this habitat is likely to be outside of the ZOI for lighting impacts, with the proposed embedded mitigation in place a negligible magnitude of impact is anticipated. Therefore, there is likely to be a direct, temporary, long term and **Negligible (Not Significant)** effect of light on intertidal habitats.
- 8.8.165. Subtidal mudflats within the Site are considered to be of Local importance and these habitats have a low sensitivity to changes in light regime. Due to the impoverished nature of the associated benthic communities that are predominantly infaunal, turbidity of the water reduces light penetration and embedded mitigation, effects of light will be minimal and as such a negligible magnitude of impact is anticipated. Therefore, there is likely to be a direct, temporary, long term and **Negligible (Not Significant)** effect of light on subtidal habitats.

Marine Plants and Macroalgae

- 8.8.166. The importance of marine plants and macroalgae (excluding saltmarsh) is Local. These species have a low sensitivity to changes in light regime. The effects of lighting may increase effective light hours and therefore influence plant growth through changes to photoperiod. However, with the implementation of proposed embedded mitigation and likely localised effects within the subtidal habitat, a negligible magnitude of impact is anticipated. Therefore, there is likely to be a direct, temporary, long term and **Negligible (Not Significant)** effect on these receptors.

Plankton

- 8.8.167. The importance of phytoplankton and zooplankton is considered to be Local, with a medium sensitivity to changes in light regime. Behavioural response to light and predation was described previously with respect to the construction phase (see **Paragraphs 8.8.32 and 8.8.38**). With the implementation of the proposed embedded mitigation, a negligible magnitude is anticipated. Therefore, there are likely to be direct and indirect, temporary, long term and **Negligible (Not Significant)** effects on these receptors.

Fish

- 8.8.168. Fish range from Regional to National importance, as described in **Paragraph 8.8.25**, depending on species. Fish within the Study Area are considered to have a medium sensitivity to light, with some species being attracted and others repelled by light. Due to the current lighting baseline across the wider Thames, proposed mitigation and likely localised effects, the magnitude of impact is assessed as negligible. Therefore, there are likely to be both direct (on fish) and indirect (on prey items), long term and **Negligible (Not Significant)** effects on fish.

Marine Mammals

- 8.8.169. Similarly, for marine mammals, which are of National importance and have a low sensitivity to changes in light regime, a likely negligible magnitude of impact is anticipated. Therefore, there is likely to be an indirect, temporary, long term and **Negligible (Not Significant)** effect on grey seals, harbour seals and harbour porpoises.

Vessel Strikes

- 8.8.170. There is the potential for an increase in vessel strikes as a result of increased operational activities associated with an increase in vessel numbers due to the operation of the Proposed Jetty and routine maintenance dredging.
- 8.8.171. As outlined in **Chapter 2: Site and Proposed Scheme Description (Volume 1)**, based on a preliminary operational capacity assessment, up to five marine vessels will call at the Proposed Jetty each week to collect and transport LCO₂ to meet the annual throughput. In order to accommodate changes in vessel types, the Proposed Jetty will be designed to accommodate marine vessels with a capacity of up to 15,000m³ per vessel, which would result in a lower number of calls per week than the five previously referenced. There will also be up to ten tug movements from the rear of the Proposed Jetty structure. Vessels will be travelling at speeds slower than those already passing the Site and are likely to be approximately 3 knots. Therefore, the magnitude of the change is assessed as negligible due to the slow operating speed of the vessels (see **Paragraph 8.8.96**).

Marine Mammals

- 8.8.172. Marine mammals (grey seals, harbour seals and harbour porpoises) are of National importance, with a high sensitivity to impacts from vessel strikes. Marine mammals are readily able to avoid vessels within the area, especially boats travelling at slow speeds. Furthermore, as there will be no spatial constraint as result of operational shipping, the potential for adverse effects is minimised. Consequently, for marine mammals (grey seals, harbour seals and harbour porpoises) of National importance a direct, long term and **Negligible (Not Significant)** effect is anticipated.

Increased Wave Wash

- 8.8.173. During the operation of the Proposed Scheme, vessels will be travelling at slow speeds (typically below 3 knots) for dredging operations as well as delivery and collection of LCO₂. Consequently, there is no predicted change in the level of wave wash, therefore a negligible magnitude of impact is anticipated. The effects of wave wash include:
- erosion of habitats;
 - resuspension of suspended solids; and
 - increased aeration of water column.

Statutory Sites (Medway Estuary MCZ)

- 8.8.174. Direct impacts on the Medway Estuary MCZ Zone 1 & 2, of National importance, are unlikely due to its distance approximately 25km downstream. European smelt, a qualifying feature of the MCZ may be indirectly impacted through changes to foraging and nursery habitat, however this species has a low sensitivity to increased wave wash due to the small size of the area in comparison to the wider Thames. Mitigation such as reduced vessels speeds will also reduce the potential for impacts, as such the magnitude of impact is likely to be negligible. Therefore, there will be only an indirect, long term and **Negligible (Not Significant)** effect on the MCZ.

Non-Statutory Sites (River Thames and its Tidal Tributaries SINC)

- 8.8.175. The River Thames and its Tidal Tributaries SINC (intertidal habitat, river channel, fish, invertebrates and birds) is assessed as being of Regional/County importance, with a low sensitivity to impacts from wave wash. Wave wash has the potential to impact the qualifying habitats and species. However, for the reasons highlighted previously in **Paragraph 8.8.101** (low vessel speeds, impoverished communities etc), the magnitude of impact is likely to be negligible. Thus, there is potential for a likely direct (habitats), and indirect (species), long term and **Negligible (Not Significant)** effect on the SINC.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

- 8.8.176. The intertidal mudflat and its associated benthic communities are considered to be of National importance with a low sensitivity to impacts from wave wash. Saltmarsh is considered to be of National importance with a medium sensitivity to impacts from

wave wash. The low speeds and impoverished nature of the infaunal mudflat community and high recoverability, reduces potential adverse effects of wave wash, in the form of increased suspended sediments and erosion which are anticipated to be negligible. In addition, the saltmarsh is located within a protected bay located approximately 500m to the west of the Site Boundary, which will reduce impacts from erosion caused by wave wash. The effects on intertidal habitats (mudflat and saltmarsh) are likely to be a direct (habitats) and indirect (species), long term and **Negligible (Not Significant)** effect.

- 8.8.177. Subtidal habitat and associated benthic communities are assessed as Locally important with low sensitivity to impacts from wave wash, based upon the impoverished nature of the community and the absence of any infaunal species of conservation importance. The magnitude of impact is assessed to be negligible due to the reasons outlined in **Paragraph 8.8.103**. Thus, a likely direct (habitats) and indirect (species), long term and **Negligible (Not Significant)** effect on subtidal habitat and associated infaunal benthic communities.

Marine Plants and Macroalgae

- 8.8.178. For marine plants and macroalgae of Local importance (excluding saltmarsh communities) in addition, the species present are considered to have a low sensitivity to impacts from wave wash, the magnitude of impact is assessed to be negligible as described in **Paragraph 8.8.104**. Consequently, there is likely to be a direct, long term and **Negligible (Not Significant)** effect on marine plants and macroalgae.

Fish

- 8.8.179. The fish species present range from Regional to National Importance and have a low sensitivity to impacts from wave wash, as described in **Paragraph 8.8.25**. The magnitude of impact is negligible both on habitats that may support fish (see **Paragraph 8.8.105**) and the fish themselves. Therefore, there is likely to be indirect, long term and **Negligible (Not Significant)** effects on fish.

Marine Mammals

- 8.8.180. Marine mammals (grey seals, harbour seals and harbour porpoises) are considered to be of National importance, with a low sensitivity to impacts from wave wash. As there will be a negligible effect on all habitats, there is likely to be an indirect, long term and **Negligible (Not Significant)** effect on marine mammals.

Spread of INNS

- 8.8.181. There is a potential risk of the spread of aquatic INNS as a result of operational activities, including the introduction of new vessels for transportation of LCO₂ from the Proposed Jetty and increased vessel movements for maintenance dredging. However, this is reduced by the requirement for all vessels using the Thames to comply with MMO ballast water regulations⁹². This reduces the potential vectors for

the spread of INNS from ballast water, however, it does not remove the spread from biofouling species on the hulls of vessels.

- 8.8.182. **Paragraphs 8.8.107 to 8.8.109** set out information on potential pathways for marine INNS and their current status in the River Thames. The Biosecurity Management Plan will be developed as part of the Operational EMP, pursuant to the **Mitigation Schedule (Document Reference 7.8)**, prior to the Proposed Scheme becoming operational and implemented with standard biosecurity measures, in line with UK best practice guidance, as previously described. This in conjunction with standard ballast water management that is required of operators will reduce the risk of increasing the rate of spread of INNS. Therefore, the magnitude of the impact of INNS is assessed to be negligible.

Statutory Sites (Medway Estuary MCZ)

- 8.8.183. The Medway Estuary MCZ Zone 1 & 2 is of National importance. European smelt may rely on habitats within the Study Area. Due to the reasons previously set out in **Paragraphs 8.8.107 to 8.8.110**, MCZ has a low sensitivity to the spread of INNS and a negligible magnitude of impact is anticipated. Thus, a likely indirect, permanent, long term and **Negligible** effect is anticipated on this MCZ (**Not Significant**).

Non-Statutory sites (River Thames and its Tidal Tributaries SINC)

- 8.8.184. The River Thames and its Tidal Tributaries SINC (intertidal habitat, river channel, fish, invertebrates and birds) are assessed as being of Regional/County importance for habitats and fish. The habitats are already heavily colonised by INNS species, thus the sensitivity to INNS is likely to be low. The Thames is known to be one of the most invaded river systems in the world and these have been colonised by a wide range of non-native species. This coupled with the proposed mitigation including ballast water management and an INNS management plan, the magnitude of impact is likely to be negligible. Therefore, there is likely to be an indirect, permanent, long term, and **Negligible (Not Significant)** effect on non-statutory sites.

Marine habitats and Associated Intertidal and Subtidal Benthic Communities

- 8.8.185. The intertidal mudflat and saltmarsh and its associated benthic communities are considered to be of National importance, with a low sensitivity to the spread of INNS. The magnitude of impact is assessed as negligible (see **Paragraphs 8.8.107 to 8.8.110**). Therefore, there is likely to be an indirect, permanent, long term and **Negligible (Not Significant)** effect on intertidal habitats.
- 8.8.186. Subtidal habitats and associated benthic communities are assessed as Locally important, based on the impoverished nature of the community and absence of any infaunal species of conservation importance. In addition, the subtidal habitats are considered to be of low sensitivity to the spread of INNS. The magnitude of impact is considered to be negligible (see **Paragraphs 8.8.107 to 8.8.110**). Therefore, there is likely to be an indirect, permanent, long term, **Negligible (Not Significant)** effect on subtidal benthic communities.

Marine plants and macroalgae

- 8.8.187. For marine plants and macroalgae of Local importance (excluding saltmarsh communities), the sensitivity to INNS is likely to be low, in addition the magnitude of impact is assessed as negligible. Consequently, there is likely to be an indirect, permanent, long term and **Negligible (Not Significant)** effect on marine plants and macroalgae.

Fish

- 8.8.188. Fish species that utilise the Site are considered to be of Regional/County and National importance. The sensitivity of fish species to INNS is likely to be low, based upon the species present and the likely species of INNS that could be introduced (mainly invertebrates). The Thames is known to be one of the most invaded river systems in the world and colonised by a wide range of non-native species. The majority of these invasive species are invertebrates, that have the potential to provide additional food resources for fish species. This coupled with the proposed mitigation including ballast water management and an INNS Management Plan, the magnitude of impact is likely to be Negligible. Therefore, there is likely to be an indirect, permanent, long term and **Negligible (Not Significant)** effect on fish species.

8.9. ADDITIONAL DESIGN, MITIGATION AND ENHANCEMENT MEASURES

- 8.9.1. The additional design, mitigation and enhancement measures being considered by the Applicant to further mitigate the impacts from the Proposed Scheme are listed below.
- As described in **Appendix 11-1: Water Framework Directive Assessment (Volume 3)** sediment sampling at depth will be undertaken to inform detailed design. Information gathered through this sampling will inform subsequent additional mitigation if sediments are shown to be elevated in contaminant concentrations. Should contamination be identified which is considered to pose a risk to sensitive receptors then appropriate measures will be undertaken. Potential measures could include dredging for a reduced time period each day; use of a closed grab for dredging; dredging on a certain phase of the tide; and avoidance of very elevated levels at depth. A silt curtain will also be considered; however, it may be impractical in this location due to tidal flows. Sediment sampling will follow standard MMO guidelines⁸² and will be undertaken pursuant to the terms of the Deemed Marine Licence contained in the **Draft DCO (Document Reference 3.1)**.
 - Potential measures to reduce impacts from contaminated sediment could include:
 - dredging for a reduced time period each day;
 - use of a closed grab for dredging;
 - dredging on a certain phase of the tide; and avoidance of very elevated levels at depth; and

- Use of a silt curtain if practical in this location recognising the influence of tidal flows.
- All of these matters will be pursuant to discharges of the conditions of the DML within the **Draft DCO (Document Reference 3.1)**.
- The Proposed Scheme will adhere to the principles described in **Appendix 7-1: Biodiversity Net Gain Report (Volume 3)**.

8.10. MONITORING

- 8.10.1. Monitoring to determine the potential presence of INNS would aid the implementation of an Biosecurity Management Plan (secured as part of the Operational EMP). This would be undertaken post-construction and would comprise marine intertidal and benthic surveys, to determine whether operational activities are contributing to the spread of INNS.
- 8.10.2. As the Study Area is a highly depositional area, there is potential for contaminated sediments to be subsequently deposited in dredged berths in the future. Consequently, subtidal sediment sampling and analysis will be required from within and to the full depth of the dredge pocket, prior to operational dredging. This will also determine the appropriate disposal route and support of ongoing maintenance dredging operations. These matters will be able to be considered pursuant to discharges of the conditions of the DML in the **Draft DCO (Document Reference 3.1)**.
- 8.10.3. Water quality monitoring may also be required during dredging operations (capital and maintenance) to ensure no exceedance of maximum allowable limits. This is likely to be decided following completion of contaminant analysis of the sediment within the dredge pocket, down to total dredge depth. These matters will be able to be considered pursuant to discharges of the conditions of the DML in the **Draft DCO (Document Reference 3.1)**.

8.11. RESIDUAL EFFECTS

- 8.11.1. **Table 8-14** below summarises the residual effects associated with the Proposed Scheme, as assessed at this stage of the EIA. Effects have not been included where a significance has not been determined due to insufficient information available. This includes effects from noise and vibration and changes in water quality.

Table 8-14: Marine Biodiversity – Summary of Residual Effects

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
Construction Phase				
Loss or disturbance of habitat⁹	Medway Estuary MCZ	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	River Thames and its Tidal Tributaries SINC	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	Marine habitats and associated intertidal and subtidal communities	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	Marine plants and Macroalgae	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	Fish	Negligible (Not Significant)	None required, however enhancements listed in Section 8.9 . Including the potential creation of additional habitat through tidal terracing on the	Negligible (Not Significant)

⁹ This includes the potential removal or retention of the Belvedere Power Station Jetty (disused) (with modifications).

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
			existing river wall and the addition of ecological enhancements e.g., the inclusion of rope on pier legs to mimic algae and marine plants. These enhancement measures could be applied to the Proposed Jetty structure.	
	Marine mammals	Negligible (Not Significant)	None required.	Negligible (Not Significant)
Change in suspended sediment levels and subsequent sediment deposition	Medway Estuary MCZ, River Thames and its Tidal Tributaries SINCR, marine habitats and associated intertidal and subtidal communities, marine plants and macroalgae, plankton, fish	Negligible (Not Significant)	None required	Negligible (Not Significant)

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
	and marine mammals			
Changes in water quality and release of contaminants	Medway Estuary MCZ, River Thames and its Tidal Tributaries SINC	Moderate Adverse (Significant)	As described in Appendix 11-1: Water Framework Directive Assessment (Volume 3) sediment sampling at depth will be undertaken to inform detailed design. Information gathered through this sampling will inform subsequent additional mitigation if sediments are shown to be elevated in contaminant concentrations. Should contamination be identified which is considered to pose a risk to sensitive receptors then appropriate measures will be undertaken. Potential measures could include dredging for a reduced time period each day; use of a closed grab for dredging; dredging on a certain phase of the tide; and avoidance of very elevated levels at depth. A silt curtain will also be considered; however, it may be impractical in this location due to tidal flows. Sediment sampling will follow standard MMO guidelines ⁸² and will be undertaken pursuant to the terms of the Deemed Marine Licence contained in the Draft DCO (Document Reference 3.1) .	Minor Adverse (Not Significant)
	Marine habitats and associated intertidal and subtidal communities	Minor Adverse (Not Significant) and Moderate Adverse (Significant)		
	Marine plants and	Negligible (Not Significant)	None Required	Negligible (Not Significant)

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
	macroalgae and plankton			
	Fish	Moderate Adverse (Significant)	As described in Appendix 11-1: Water Framework Directive Assessment (Volume 3) sediment sampling at depth will be undertaken to inform detailed design. Information gathered through this sampling will inform subsequent additional mitigation if sediments are shown to be elevated in contaminant concentrations. Should contamination be identified which is considered to pose a risk to sensitive receptors then appropriate measures will be undertaken. Potential measures could include dredging for a reduced time period each day; use of a closed grab for dredging; dredging on a certain phase of the tide; and avoidance of very elevated levels at depth. A silt curtain will also be considered; however, it may be impractical in this location due to tidal flows. Sediment sampling will follow standard MMO guidelines ⁸² and will be undertaken pursuant to the terms of the Deemed Marine Licence contained in the Draft DCO (Document Reference 3.1) .	Minor Adverse (Not Significant)

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
	Marine mammals	Negligible (Not Significant)	None Required	Negligible (Not Significant)
Noise and Vibration⁹	Medway Estuary MCZ, River Thames and its Tidal Tributaries SINC, fish, marine mammals	Negligible (Not Significant)	None Required	Negligible (Not Significant)
Lighting⁹	Medway Estuary MCZ, River Thames and its Tidal Tributaries SINC, marine habitats and associated intertidal and subtidal communities, marine plants and macroalgae,	Negligible (Not Significant)	None required.	Negligible (Not Significant)

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
	plankton, fish and marine mammals			
Vessel Strike⁹	Marine Mammals	Negligible (Not Significant)	None required.	Negligible (Not Significant)
Increased wave wash	Medway Estuary MCZ, River Thames and its Tidal Tributaries SINCC, marine habitats and associated intertidal and subtidal communities, marine plants and macroalgae, fish and marine mammals	Negligible (Not Significant)	None required.	Negligible (Not Significant)
Spread of INNS⁹	Medway Estuary MCZ	Negligible (Not Significant)	None required.	Negligible (Not Significant)

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
	River Thames and its Tidal Tributaries SINC	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	Marine habitats and associated intertidal and subtidal communities	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	Marine plants and macroalgae	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	Fish	Negligible (Not Significant)	None required.	Negligible (Not Significant)
Operation Phase				
Loss or disturbance of habitat	Medway Estuary MCZ	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	River Thames and its Tidal Tributaries SINC	Negligible (Not Significant)	None required.	Negligible (Not Significant)

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
	Marine habitats and associated intertidal and subtidal communities	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	Marine plants and macroalgae	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	Fish	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	Marine mammals	Negligible (Not Significant)	None required.	Negligible (Not Significant)
Changes in suspended sediment concentrations and subsequent sediment deposition	Medway Estuary MCZ, River Thames and its Tidal Tributaries SINC, marine habitats and associated intertidal and subtidal communities,	Negligible (Not Significant)	None required.	Negligible (Not Significant)

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
	marine plants and macroalgae, fish and marine mammals			
Water quality and release of contaminants	Medway Estuary MCZ, River Thames and its Tidal Tributaries SINC	Moderate Adverse (Significant)	As described in Appendix 11-1: Water Framework Directive Assessment (Volume 3) sediment sampling at depth will be undertaken to inform detailed design. Information gathered through this sampling will inform subsequent additional mitigation if sediments are shown to be elevated in contaminant concentrations. Should contamination be identified which is considered to pose a risk to sensitive receptors then appropriate measures will be undertaken. Potential measures could include dredging for a reduced time period each day; use of a closed grab for dredging; dredging on a certain phase of the tide; and avoidance of very elevated levels at depth. A silt curtain will also be considered; however, it may be impractical in this location due to tidal flows. Sediment sampling will follow standard MMO guidelines ⁸² and will be undertaken pursuant to the terms of	Negligible (Not Significant)

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
			the Deemed Marine Licence contained in the Draft DCO (Document Reference 3.1) .	
	Marine habitats and associated intertidal and subtidal communities, marine plants and macroalgae and plankton	Negligible (Not Significant)	None required.	Negligible (Not Significant)
	Fish	Moderate Adverse (Significant)	As described in Appendix 11-1: Water Framework Directive Assessment (Volume 3) sediment sampling at depth will be undertaken to inform detailed design. Information gathered through this sampling will inform subsequent additional mitigation if sediments are shown to be elevated in contaminant concentrations. Should contamination be identified which is considered to pose a risk to sensitive receptors then appropriate measures will be undertaken. Potential measures could include dredging for a reduced time period each day; use of a closed grab for dredging; dredging on a certain phase of the tide; and avoidance of very elevated	Negligible (Not Significant)

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
			levels at depth. A silt curtain will also be considered; however, it may be impractical in this location due to tidal flows. Sediment sampling will follow standard MMO guidelines ⁸² and will be undertaken pursuant to the terms of the Deemed Marine Licence contained in the Draft DCO (Document Reference 3.1) .	
	Marine mammals	Negligible (Not Significant)	None required.	Negligible (Not Significant)
Noise and vibration	Medway Estuary MCZ, River Thames and its Tidal Tributaries SINC, fish and marine mammals	Negligible (Not Significant)	None required.	Negligible (Not Significant)
Lighting	Medway Estuary MCZ, River Thames and its Tidal Tributaries SINC, marine habitats and	Negligible (Not Significant)	None required.	Negligible (Not Significant)

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
	associated intertidal and subtidal communities, marine plants and macroalgae, plankton, fish and marine mammals			
Vessel strikes	Marine mammals	Negligible (Not Significant)	None required.	Negligible (Not Significant)
Increased wave wash	Medway Estuary MCZ, River Thames and its Tidal Tributaries SINCE, marine habitats and associated intertidal and subtidal communities, marine plants and	Negligible (Not Significant)	None required.	Negligible (Not Significant)

Description of the effect	Sensitive Receptor	Significance of Effect with Embedded Mitigation	Additional Design, Mitigation, Enhancement measure	Residual effect
	macroalgae, fish and marine mammals			
Spread of INNS	Medway Estuary MCZ, River Thames and its Tidal Tributaries SINC, marine habitats and associated intertidal and subtidal communities, marine plants and macroalgae and fish	Negligible (Not Significant)	None required.	Negligible (Not Significant)

8.12. LIMITATIONS AND ASSUMPTIONS

8.12.1. This section outlines the limitations, uncertainties, and assumptions made in undertaking marine biodiversity reported in this chapter:

- No borehole/vibrocore samples have been taken within the dredge pocket. Therefore, a worst case and precautionary assessment is provided for the potential mobilisation and deposition of contaminated sediments.
- Data analysis of historical water quality data is provided in **Appendix 11-1: Water Framework Directive Assessment (Volume 3)**.
- It is uncertain as to whether the Belvedere Power Station Jetty (disused) will be removed as part of the Proposed Scheme. Therefore, both options have been considered within this chapter, with an assessment undertaken on the worst case scenario according to different receptors.
- Fish survey data was from two occasions during 2023 (spring and autumn) and only provides a snapshot of the species composition, however, this is complimented by historical desk study data.
- Only beam trawls could be undertaken for fish surveys, due to H&S factors such as site access not allowing for a multi-method approach to be adopted. This included the presence of soft intertidal mud that would not allow for seine netting to be undertaken safely. In addition, Fyke nets were not deployed as there was no safe access to the intertidal zone from the existing seawall. On discussion with the Environment Agency, beam trawls were deemed the most appropriate subtidal survey method.
- The intertidal survey of the mudflat was undertaken from a survey vessel, rather than by foot, due to H&S concerns regarding the soft intertidal mudflat. Furthermore, a hovercraft could not be used due to the large distance of a potential launch location to the Site and H&S considerations in encountering a large number of vessels on route to the Site.

8.13. REFERENCES

- ¹ Department for Energy Security and Net Zero. (2024). 'Overarching National Policy Statement for Energy (EN-1)'. Available at: <https://assets.publishing.service.gov.uk/media/655dc190d03a8d001207fe33/overarching-nps-for-energy-en1.pdf>
- ² Department for Levelling Up, Housing and Communities. (2023). 'National Planning Policy Framework'. Available at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2>
- ³ Greater London Authority. (2021). 'The London Plan'. Available at: https://www.london.gov.uk/sites/default/files/the_london_plan_2021.pdf
- ⁴ London Borough of Bexley. (2023). 'The Bexley Local Plan 2023'. Available at: <https://www.bexley.gov.uk/sites/default/files/2023-04/bexley-local-plan-adopted-26-april-2023.pdf>
- ⁵ Greater London Authority. (2018). 'London Environment Strategy'. Available at: https://www.london.gov.uk/sites/default/files/london_environment_strategy_0.pdf
- ⁶ JNCC. (2012). 'The UK post-2010 Biodiversity Framework 2011-2020 (JNCC and DEFRA)'. Available at: <https://hub.jncc.gov.uk/assets/587024ff-864f-4d1d-a669-f38cb448abdc#UK-Post2010-Biodiversity-Framework-2012.pdf>.
- ⁷ UK Government. (2018). 'A Green Future: Our 25 Year Plan to Improve the Environment'. Available at: <https://www.gov.uk/government/publications/25-year-environment-plan>
- ⁸ Greater London Borough of Bexley. (2011). 'The Bexley Biodiversity Action Plan'. Available at: <https://www.bexley.gov.uk/sites/default/files/2020-05/Bexley-Biodiversity-Action-Plan-Adopted-June-2011.pdf>
- ⁹ HM Government. (2011). 'Biodiversity 2020: A Strategy for England's wildlife and ecosystem services'. Available at: <https://www.gov.uk/government/publications/biodiversity-2020-a-strategy-for-england-s-wildlife-and-ecosystem-services>
- ¹⁰ Department for Environment, Food and Rural Affairs. (2021). 'South East Inshore Marine Plan 2021'. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1004493/FINAL_South_East_Marine_Plan_1_.pdf
- ¹¹ HMSO. (2022). 'Thames River Basin District River Basin Management Plan'. Available at: <https://www.gov.uk/guidance/thames-river-basin-district-river-basin-management-plan-updated-2022>.
- ¹² UK Government. (2021). 'Environment Act'. Available at: <https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted>

- ¹³ HMSO. (1981). 'The Wildlife and Countryside Act'. HMSO, Norwich, JNCC and Defra. Available at: <http://jncc.defra.gov.uk/page-1377>
- ¹⁴ HMSO. (2006). 'Natural Environment and Rural Communities (NERC) Act (2006)'. HMSO, Norwich. Available at: <https://www.legislation.gov.uk/ukpga/2006/16/contents>
- ¹⁵ HMSO. (2019). 'The Conservation of Habitats and Species Regulations (Amendment) (EU Exit)'. HMSO, Norwich. Available at: <https://www.legislation.gov.uk/ukdsi/2019/9780111176573>
- ¹⁶ HMSO. (1992). 'Council Directive 92/43/EEC'. No.43. Available at: <https://www.legislation.gov.uk/eudr/1992/43/contents>
- ¹⁷ EUR-Lex. (1992). 'Article 1(h) of EC Directive 92/43/EEC.'. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31992L0043>
- ¹⁸ HMSO. (1975). 'The Salmon and Freshwater Fisheries Act'. HMSO, Norwich. Available at: <http://www.legislation.gov.uk/ukpga/1975/51>
- ¹⁹ HMSO. (2009). 'The Eels (England and Wales) Regulations'. HMSO, Norwich. Available at: <http://www.legislation.gov.uk/uksi/2009/3344/contents/made>
- ²⁰ JNCC. (2022). 'Bern Convention'. Available at: <https://jncc.gov.uk/our-work/bern-convention>
- ²¹ HMSO. (2017). 'The Water Environment (Water Framework Directive) (England and Wales) Regulations'. HMSO, Norwich. Available at: <https://www.legislation.gov.uk/uksi/2017/407/contents/made>
- ²² HMSO. (2021). 'Conservation of Seals Act 1970'. HMSO, Norwich. Available at: <https://www.legislation.gov.uk/ukpga/1970/30>
- ²³ OSPAR Commission. (2007). 'Convention For The Protection of The Marine Environment of the North-East Atlantic'. Available at: <https://www.ospar.org/covention>
- ²⁴ HMSO. (2022). 'Marine and Coastal Access Act 2009'. Available at: <https://www.legislation.gov.uk/ukpga/2009/23/contents>
- ²⁵ Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government. (2021). 'National Planning Practice Guidance, Healthy and Safe Communities'. Available at: <https://www.gov.uk/guidance/health-and-wellbeing>
- ²⁶ CIEEM. (2017a). 'Guidelines for Preliminary Ecological Appraisal. CIEEM, Winchester. AND CIEEM (2017b). 'Guidelines for Ecological Report Writing. CIEEM, Winchester. Available at: <https://cieem.net/resource/guidance-on-preliminary-ecological-appraisal-gpea/>
- ²⁷ Cory Environmental Holdings Limited. (2023). 'Environment Impact Assessment Scoping Report: Cory Decarbonisation Project'. Available at: <https://infrastructure.planninginspectorate.gov.uk/wp->

<content/ipc/uploads/projects/EN010128/EN010128-000021-EN010128%20-%20Scoping%20Report.pdf>

²⁸ Cory Environmental Holdings Limited. (2023). 'Preliminary Environmental Information Report: Cory Decarbonisation Project'. Available at:

<https://corydecarbonisation.co.uk/document-library/>

²⁹ Planning Inspectorate. (2023). 'Environmental Impact Assessment Scoping Opinion: Cory Decarbonisation Project.' Available at:

<https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010128/EN010128-000026-EN010128%20-%20Scoping%20Opinion.pdf>

³⁰ Natural England. (2023). 'MAGIC website'. Available at:

<http://www.natureonthemap.naturalengland.org.uk/home.html>

³¹ Ordnance Survey. (2023). 'Ordnance Survey'. Available at:

<https://www.ordnancesurvey.co.uk>

³² Environment Agency. (2023). 'Catchment Data Explorer'. Available at:

<https://environment.data.gov.uk/catchment-planning>.

³³ Environment Agency. (2023). 'Ecology and Fish Data Explorer'. Available at:

<https://defra-ecology-prod.publishmydata.com/ecology-fish/>

³⁴ Estuary Edges. (2023). 'Estuary Edges- Case Studies'. Available at:

<https://www.estuaryedges.co.uk/case-studies/barking-creek-creekmouth/>

³⁵ ZSL. (2021). 'The State of the Thames 2021: Environmental trends of the Tidal Thames. McCormick, H., Cox, T., Pecorelli, J., and Debney, A.J. (Eds)'. ZSL, Regent's Park, London, UK. Available at: <https://www.zsl.org/what-we-do/projects/state-of-the-thames-2021>

³⁶ ZSL Bournemouth University & SC2. (2020). 'Thames Tideway Aquatic Ecology Research – Smelt Surveys on the Thames'. Available at:

<https://www.tideway.london/news/press-releases/2021/november/thames-ecology-research-programme/>

³⁷ ZSL (2022). 'The Thames European Eel Project Report'. Available at:

<https://www.zsl.org/what-we-do/projects/european-eel-conservation>

³⁸ ZSL. (2016). 'Guidance Document. Conservation of Tidal Thames Fish through the Planning Process'. Available at: <https://www.zsl.org/what-we-do/projects/fish-conservation-in-tidal-thames>

<https://www.zsl.org/what-we-do/projects/fish-conservation-in-tidal-thames>

³⁹ ZSL. (2023). 'The Greater Thames Shark Project'. Available at:

<https://www.zsl.org/what-we-do/projects/greater-thames-shark-project>

⁴⁰ ZSL. (2016). 'Guidance Document. Conservation of Tidal Thames Fish through the Planning Process'. Available at: <https://www.zsl.org/what-we-do/projects/fish-conservation-in-tidal-thames>

<https://www.zsl.org/what-we-do/projects/fish-conservation-in-tidal-thames>

- ⁴¹ ZSL. (2023). 'Thames Marine Mammal Survey'. Available at: https://sites.zsl.org/inthethames/?&_ga=2.236522569.972409256.1675155190-1564284012.1675155189#Public%20sightings
- ⁴² ZSL. (2023). 'Invasive Species in the Thames'. Available at: <https://www.zsl.org/conservation/regions/uk-europe/thamesestuary/invasive-species-in-the-thames,933,AR.html>
- ⁴³ ZSL. Bournemouth University & SC2 (2019). 'Larval and juvenile fish in the Thames: Investigating early life history stages (ELHS) to understand ecological function of the tidal Thames and the impact of improved water quality'. Available at: <https://www.tideway.london/news/press-releases/2021/november/thames-ecology-research-programme/>
- ⁴⁴ Environment Agency. (2021). 'Water Quality Archive- Thames At Erith'. Available at: <https://environment.data.gov.uk/water-quality/view/sampling-point/TH-PTTR0019>
- ⁴⁵ Greater London Borough of Bexley. (2016). 'Sites Of Importance For Nature Conservation Report'. Available at: <https://www.bexley.gov.uk/sites/default/files/2021-10/Sites-of-Importance-for-Nature-Conservation-SINC-Report-2016C.pdf>
- ⁴⁶ ABPmer. (2013). 'Hub for London, Ecology Desk Study Part B: Marine and Coastal Baseline'. Report No: Report R.2130.
- ⁴⁷ Transport for London. (2016). 'Silvertown Tunnel, 6.1 Environmental Statement'. Available at: <https://infrastructure.planninginspectorate.gov.uk/projects/london/silvertown-tunnel/>
- ⁴⁸ Thames Water Utilities Limited. (2014). 'Thames Tideway Tunnel, ES Volume 24: Greenwich Pumping Station'. Available at: London Tideway ES; Volume 24: Greenwich Pumping Station <https://www.tideway.london/media/1748/6224-environmental-statement-volume-24-greenwich-pumping-station-site-assessment-sections-1-to-15.pdf>
- ⁴⁹ Transport for London. (2015). 'Silvertown Tunnel Preliminary Environmental Information Report'. Available at: <https://infrastructure.planninginspectorate.gov.uk/projects/london/silvertown-tunnel/>
- ⁵⁰ Ballerstedt. (2006). '*Electra crustulenta*. A sea mat. Marine Life Information Network: Biology and Sensitivity Key Information Subprogramme. Plymouth: Marine Biological Association of the United Kingdom'. Available at: <http://www.marlin.ac.uk/speciesinformation.php?speciesID=3245>
- ⁵¹ Attrill, M.J., (2002). 'A testable linear model for diversity trends in estuaries'. J Animal Ecol 71(2): 262-269.
- ⁵² Balanced Seas. (2011). 'Balanced Seas Marine Conservation Zone Project. Final Recommendations'. Available at: <http://publications.naturalengland.org.uk/publication/1463173>.

- ⁵³ Birtwell, I.K. and Arthur, D.R., (1980). 'The ecology of tubificids in the Thames estuary with particular reference to *Tubifex costatus* (Claparede)'. *Aquatic oligochaete biology* pp. 331-381.
- ⁵⁴ Aston, R.J., (1973). 'Tubificids and water quality: a review'. *Environmental Pollution* (1970), 5(1), pp.1-10.
- ⁵⁵ The Rivers Trust. (2023). 'Sewage Map Application'. Available at: <https://theriverstrust.org/key-issues/sewage-in-rivers>.
- ⁵⁶ Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. (2012). 'Spawning and nursery grounds of selected fish species in UK waters'. *Sci. Ser. Tech. Rep.*, Cefas Lowestoft. Available at: <https://www.cefas.co.uk/publications/techrep/techrep147.pdf>
- ⁵⁷ Holliday, F.G.T., & Blaxter, J.H.S. (1960). 'The effects of salinity on the developing eggs and larvae of the herring'. *J. Mar. Biol. Assoc. UK*, 39(3), 591-604.
- ⁵⁸ Cox, T., Barker, J., Bramley, J., Debney, A., Thompson, D. and Cucknell A.C (2020). 'Population trends of harbour and grey seals in the Greater Thames Estuary'. *Mammal Communications* 6:42-51.
- ⁵⁹ Cucknell, A., Moscrop, A, Boisseau, O. & McLanaghan, R. (2020). 'Confirmation of the presence of harbour porpoise (*Phocoena phocoena*) within the tidal Thames and Thames Estuary'. *Mammal Communications* 6: 21-28, London.
- ⁶⁰ Port of London Authority. (2023). 'Marine mammals in the tidal Thames'. Available at: <http://www.pla.co.uk/Environment/Marine-Mammals-in-the-Tidal-Thames>.
- ⁶¹ The International Union for Conservation of Nature. (2023). 'Red List of Threatened Species'. Available at: <https://www.iucnredlist.org/>
- ⁶² Google. (2023). 'Aerial and street view maps covering Study Area'. Available at: <https://www.google.com/maps/>
- ⁶³ CIEEM. (2022). 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (Version 1.2)'. Chartered Institute of Ecology and Environmental Management, Winchester. Available at: <https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.2-April-22-Compressed.pdf>.
- ⁶⁴ Highways Agency. (2019). 'Design Manual for Roads and Bridges, LA 104 Environmental assessment and monitoring'. Available at: <https://www.standardsforhighways.co.uk/dmrB/search/0f6e0b6a-d08e-4673-8691-cab564d4a60a>
- ⁶⁵ Marine Biological Association (2024). 'The Marine Life information network (MarLIN)'. Available at: <https://www.marlin.ac.uk/>
- ⁶⁶ IUCN (2023). 'The IUCN Red List of Threatened Species'. Available at: [IUCN Red List of Threatened Species](https://www.iucn.org/en/iucn-red-list-of-threatened-species)

- ⁶⁷ The Rivers Trust. (2023). 'Sewage Map Application'. Available at: <https://theriverstrust.org/key-issues/sewage-in-rivers>.
- ⁶⁸ Transport for London. (2016). 'Silvertown Tunnel, 6.1 Environmental Statement'. Available at: <https://infrastructure.planninginspectorate.gov.uk/projects/london/silvertown-tunnel/>.
- ⁶⁹ Transport for London. (2015). 'Silvertown Tunnel Preliminary Environmental Information Report'. Available at: <https://infrastructure.planninginspectorate.gov.uk/projects/london/silvertown-tunnel/>
- ⁷⁰ Ballerstedt. (2006). '*Electra crustulenta*. A sea mat. Marine Life Information Network: Biology and Sensitivity Key Information Subprogramme. Plymouth: Marine Biological Association of the United Kingdom'. Available at: <http://www.marlin.ac.uk/speciesinformation.php?speciesID=3245>
- ⁷¹ ZSL. Bournemouth University & SC2. (2019). 'Larval and juvenile fish in the Thames: Investigating early life history stages (ELHS) to understand ecological function of the tidal Thames and the impact of improved water quality'. Available at: <https://www.tideway.london/news/press-releases/2021/november/thames-ecology-research-programme/>
- ⁷² Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. (2012). 'Spawning and nursery grounds of selected fish species in UK waters'. Sci. Ser. Tech. Rep., Cefas Lowestoft. Available at: <https://www.cefas.co.uk/publications/techrep/techrep147.pdf>
- ⁷³ Cox, T., Barker, J., Bramley, J., Debney, A., Thompson, D. and Cucknell A.C (2020). 'Population trends of harbour and grey seals in the Greater Thames Estuary'. Mammal Communications 6:42-51
- ⁷⁴ ZSL. (2016). 'Guidance Document. Conservation of Tidal Thames Fish through the Planning Process'. Available at: <https://www.zsl.org/what-we-do/projects/fish-conservation-in-tidal-thames>
- ⁷⁵ ZSL. (2023). 'Thames Marine Mammal Survey'. Available at: https://sites.zsl.org/inthethames/?&_ga=2.236522569.972409256.1675155190-1564284012.1675155189#Public%20sightings
- ⁷⁶ Cucknell, A., Moscrop, A, Boisseau, O. & McLanaghan, R. (2020). 'Confirmation of the presence of harbour porpoise (*Phocoena phocoena*) within the tidal Thames and Thames Estuary'. Mammal Communications 6: 21-28, London.
- ⁷⁷ Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas. Available at: <https://www.ascobans.org/>
- ⁷⁸ ZSL. (2023). 'Invasive Species in the Thames'. Available at: <https://www.zsl.org/conservation/regions/uk-europe/thamesestuary/invasive-species-in-the-thames,933,AR.html>

- ⁷⁹ Environment Agency. (2023). 'Ecology and Fish Data Explorer'. Available at: <https://defra-ecology-prod.publishmydata.com/ecology-fish/>
- ⁸⁰ Poff, N.L., Brinson, M.M. and Day, J.W., 2002. 'Aquatic ecosystems and global climate change'. Pew Center on Global Climate Change, Arlington, VA, 44, pp.1-36.
- ⁸¹ Joint Nature Conservation Committee (JNCC). (2010). 'Statutory nature conservation agency protocol for minimising risk of injury to marine mammals from piling noise'. Available at: <https://jncc.gov.uk>
- ⁸² Maritime and Coastguard Agency (2018). 'Guidance Control and management of ballast water'. Available at: <https://www.gov.uk/guidance/control-and-management-of-ballast-water>
- ⁸³ Natural England. (2021). 'European smelt (*Osmerus eperlanus* (L.)) Recovery Management Plan for the Solway Firth Marine Conservation Zone (MCZ)'.
- ⁸⁴ Todd, V.L., Todd, I.B., Gardiner, J.C., Morrin, E.C., MacPherson, N.A., DiMarzio, N.A. and Thomsen, F. (2015). A review of impacts of marine dredging activities on marine mammals. *ICES Journal of Marine Science*, 72(2), pp.328-340.
- ⁸⁵ Shahjahan, M., Taslima, K., Rahman, M.S., Al-Emran, M., Alam, S.I. and Faggio, C. (2022). 'Effects of heavy metals on fish physiology—a review'. *Chemosphere*, 300, p.134519.
- ⁸⁶ Crump, K.L. and Trudeau, V.L. (2009). 'Mercury-induced reproductive impairment in fish'. *Environmental Toxicology and Chemistry: An International Journal*, 28(5), pp.895-907.
- ⁸⁷ García-Seoane, R., Aboal, J.R., Boquete, M.T. and Fernández, J.A. (2020). 'Phenotypic differences in heavy metal accumulation in populations of the brown macroalgae *Fucus vesiculosus*: A transplantation experiment'. *Ecological Indicators*, 111, p.105978.
- ⁸⁸ Dufresne, M.M., Frouin, H., Pillet, S., Lesage, V., De Guise, S. and Fournier, M. (2010). 'Comparative sensitivity of harbour and grey seals to several environmental contaminants using in vitro exposure'. *Marine pollution bulletin*, 60(3), pp.344-349.
- ⁸⁹ Lee, K.M., Wochner, M.S. and Wilson, P.S. (2012). 'Mitigation of low-frequency underwater anthropogenic noise using stationary encapsulated gas bubbles'. In *Proceedings of Meetings on Acoustics* (Vol. 17, No. 1). AIP Publishing.
- ⁹⁰ Denny, M., Gaylord, B., Helmuth, B. & Daniel, T. (1998). 'The menace of momentum: dynamic forces on flexible organisms'. *Limnology and Oceanography*, 43 (5), 955-968.
- ⁹¹ Perry, F. & Hill, J.M. (2015). 'Barnacles and fucoids on moderately exposed shores'. In Tyler-Walters H. and Hiscock K. (eds) *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*, [online]. Plymouth: Marine Biological Association of the United Kingdom. DOI <https://dx.doi.org/10.17031/marlinhab.33.1>

⁹²Maritime and Coastguard Agency (2018). 'Guidance Control and management of ballast water'. Available at: <https://www.gov.uk/guidance/control-and-management-of-ballast-water>

⁹³PLA. (2023). 'Guidance on invasive species'. Available at: <https://www.pla.co.uk/Environment/Guidance-on-Invasive-Non-Native-Species>



DECARBONISATION

10 Dominion Street
Floor 5
Moorgate, London
EC2M 2EF
Contact Tel: 020 7417 5200
Email: enquiries@corygroup.co.uk
corygroup.co.uk