13 AQUATIC ECOLOGY

13.1 INTRODUCTION

13.1.1 Company

Carcinus Ltd

13.1.2 Author

Matthew Davison, BSc, MIFM

Matthew Davison is a director and principal aquatic ecologist with over ten years' commercial experience. He routinely works in support of nationally important infrastructure schemes to provide specialist fisheries environmental assessments.

Matthew Crabb, BSc, FLS, MSB

Matthew Crabb is a director and principal aquatic ecologist with over ten years' commercial experience. He routinely works in support of nationally important infrastructure schemes to provide specialist marine and freshwater environmental assessments. Joshua Baker, MSc, BSc

Joshua Baker is a marine and freshwater ecologist who has experience of assisting with delivery of environmental impact assessments for a variety of large scale projects.

Lucy Shuff

Lucy is a highly experienced benthic ecologist who specialises in undertaking marine environmental impact assessments on behalf of large infrastructure schemes.

Rayner Piper

Rayner has been working as a marine ecologist specialising in marine mammals, birds and fish for over 15 years. During this time, he has worked at an international level across a broad range of sectors including government, oil & gas, renewables and coastal developments.

13.1.3 Chapter Purpose

This chapter of the Environmental Statement (ES) assesses the likely significant effects of the proposed development on the environment in terms of Aquatic Ecology; fish and shellfish ecology/fisheries, benthic ecology, marine mammals and sediment chemistry. The chapter and it's supporting appendices describe the planning policy context, the assessment methodology; the baseline conditions at the application site and surroundings; the likely significant effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; the likely residual effects after these measures have been employed; and the cumulative effects. In summary, the objectives of the chapter are to:

- Establish the baseline conditions for fish, benthic fauna and marine mammals inhabiting the application site and neighbouring environs;
- Assess the impact of the proposed development on the fish and shellfish ecology;
- Assess the impact of the proposed development on the benthic ecology;
- Assess the impact of the proposed development on marine mammals; and
- Assess the impact of the proposed development on sediment chemistry.

13.1.4 Figures

- Figure 13.1 Relative (%) abundance of species landed in terms of quantity with a weight totalling >1 tonne within ICES 35E6 between 2014 to 2018 (Source: Scottish Government, 2018);
- Figure 13.2 Mean sediment bound metal concentrations from within Bramley-Moore Dock, comparison with Cefas ALs – (Sampled 26th September 2017 ('Peoples Project: Sediment Sampling – Ref LO_A100795_V1, White, Young & Green (WYG) (2017b));
- Figure 13.3 Mean sediment bound metal concentrations from within Bramley-Moore Dock, comparison with ISQGs – Sampled 26th September 2017 ('Peoples Project: Sediment Sampling – Ref LO_A100795_V1, White, Young & Green (WYG) (2017b));
- Figure 13.4 Mean sediment bound organo-tin concentrations from within Bramley-Moore Dock, comparison with Cefas ALs – Sampled 26th September 2017 ('Peoples Project: Sediment Sampling – Ref LO_A100795_V1, White, Young & Green (WYG) (2017b));
- Figure 13.5 Mean sediment bound PAH concentrations from within Bramley-Moore Dock, comparison with Cefas ALs – Sampled 26th September 2017 ('Peoples Project: Sediment Sampling – Ref LO_A100795_V1, White, Young & Green (WYG) (2017b));
- Figure 13.6 Mean sediment bound PAH concentrations from within Bramley-Moore Dock, comparison with ISQGs – Sampled 26th September 2017 ('Peoples Project: Sediment Sampling – Ref LO_A100795_V1, White, Young & Green (WYG) (2017b));
- Figure 13.7 Mean sediment bound PCB concentrations from within Bramley-Moore Dock, comparison with Cefas ALs – Sampled 26th September 2017 ('Peoples Project: Sediment Sampling – Ref LO_A100795_V1, White, Young & Green (WYG) (2017b)); and
- Figure 13.8 Mean sediment bound PCB concentrations from within Bramley-Moore Dock, comparison with ISQGs – Sampled 26th September 2017 ('Peoples Project: Sediment Sampling – Ref LO_A100795_V1, White, Young & Green (WYG) (2017b)).

13.1.5 Appendices

- Appendix 13.1: Bramley-Moore Dock Aquatic Ecology Technical Report (Carcinus Ltd, January 2020).

13.2 METHODOLOGY

13.2.1 Legislation

The following legislation have been considered in undertaking the assessment:

- Water Framework Directive (WFD) [1];
- Marine and Coastal Access Act [2];
- Wildlife and Countryside Act [3];
- Oslo Paris (OSPAR) Convention for the Protection of the Marine Environment [4];
- Countryside and Rights of Way Act (CRoW) [5];;
- Marine Strategy Framework Directive (2008/56/EC) [6];
- Natural Environment and Rural Communities (NERC) Act [7];
- The Conservation of Habitats and Species Regulations [8];
- Offshore Marine Conservation (Natural Habitats &c.) Regulations [9]; and
- Other legislation including:
  - Clean Seas Environmental Monitoring Programme (CSEMP [10]; and
  - The International Convention for the Prevention of Marine Pollution (MARPOL) 73/78 [11].

13.2.2 Policy

The following policy have been considered in undertaking the assessment:

- Liverpool Local Plan (Submission Draft, May 2018) [12];
- National Planning Policy Framework (March 2012, updated in February 2019) [13]; and
- UK Marine Policy Statement (MPS) Defra, 2011. [14]

The North West Marine Plan has been considered but has not yet been adopted (as of the last update in January 2019). The Marine Management Organisation (MMO) state that the Marine Policy Statement is to be used until the plan is formally adopted.

13.2.3 Consultees

- Environment Agency (2017)
- Marine Management Organisation (2017)
- Natural England (2017 & 2019)
- Merseyside Environmental Advice Service (MEAS) (2017 & 2019)

Further details on these consultations are provided in the Scoping section below.

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13.2.4 Scoping

A formal scoping report (Appendix 2.1, ES Volume III) in relation to the application site was submitted to LCC and the Marine Management Organisation (MMO) on 15th May 2017 and a formal Scoping Opinion (Appendix 2.2, ES Volume III) was received from LCC and the MMO on the 8th November 2017. Responses were received in relation to ecology, in advance of the Scoping Opinion issue, from NE (June 2017) and MEAS (June 2017).

A meeting was held between WYG, NE and MEAS on 9th August 2019 in order to further confirm requirements of both consultees in relation to this assessment. Written correspondence from both NE and MEAS following this meeting are presented within Appendix 12.00. Further details regarding the scope of the study area are provided subsequently.

Table 13.1 summarises key assessment topics associated with aquatic ecology as highlighted within the scoping document and consultee responses received in 2017. Aquatic ecosystems and ecological complexes were screened into the assessment as part of this process. The benthic ecology of Bramley-Moore Dock was identified as a potential receptor in relation to the marine fauna and flora inhabiting the vertical dock walls, submerged structures and soft sediment environments as well as the surrounding environs of the lower Mersey and wider Liverpool dock network.

Table 13.1

Scoping opinion/consultee responses given in response to aquatic ecology and corresponding sections outlining further information within Chapter 13

SCOPING OPINION/CONSULTEE RESPONSES	FURTHER INFORMATION
Determination of Invasive Non-Native Species (INNS) likely to be present within Bramley-Moore Dock and the measures required to avoid their spread during construction.	Chapter 13 & Appendix 13.1 (Section 4.2, Subsection 4.2.2 / Section 6.1, Subsection 6.1.1, 6.1.2 and 6.1.3 / Section 6.2, Subsection 6.2.1 / Section, 6.3, Subsection 6.3.1 / Section 6.4, Subsection 6.4.1).
Consideration of potential direct disturbance to fish inhabiting the dock. This is especially applicable to species of conservation importance known to inhabit the dock such as European eel *Anguilla anguilla*. And atlantic salmon *Salmo salar*	Chapter 13, Appendix 13.1 (Section 5.1, 5.2, 5.3, 5.4 and 5.5 (including subsections)).
Consideration of environmentally harmful sediment bound contaminants.	Chapter 13, Appendix 13.1 (Section 4.1, Subsection 4.2.2 / Section 7, Section 7.1, 7.2, 7.3, 7.4, 7.5 (including subsections)).

A meeting was held between WYG, NE and MEAS on Monday the 9th of August 2019 in order to confirm requirements of both consultees in relation to this assessment. During this meeting, aquatic ecology survey effort was discussed and agreed as appropriate in principal. MEAS made no comment in relation to aquatic ecology in their consultation response (dated 21st August 2019). Consultation response received from Natural England (dated 2nd September 2019) highlights the requirement to consider the marine environment /dock waters within ecological assessment, in particular potential impacts which may affect the River Mersey during the construction phase.

13.2.5 Consideration of Climate Change

The baseline situation is unlikely to change from that outlined within the chapter for the foreseeable future. The frequency of occurrence and general distribution is therefore anticipated to remain the same as that described. However, with increasing sea temperatures, gradual shifts in distribution and alterations to species assemblages in favour of seasonally warmer waters may be seen within the lifetime of the proposed development.

13.2.6 Consideration of Human Health

Human health in regard to the potential for release of sediment bound contaminants during the construction process is addressed in Chapter 11 Water Resources, Flood Risk & Drainage and Chapter 10 Ground Conditions & Contamination.

13.2.7 Consideration of Risk of Major Accidents and/or Disasters

Major accidents and/or disasters identified as relevant to the proposed development have been assessed within the chapter. These focus mainly on the potential for accidental spill or release of environmentally harmful substances during construction and operation.

13.2.8 Alternatives

A comprehensive alternative sites assessment has been undertaken and is addressed within Chapter 5 Alternatives and Design Evolution. An alternative future baseline scenario has been included within the assessment for comparison purposes as stated in Chapter 2 EIA Methodology.

13.2.9 Assessment of Baseline Conditions & Receptor Sensitivity

Data used to inform the baseline characterisation of the aquatic ecology chapter were drawn from a combined review of the available literature and site-specific surveys undertaken in support of the proposed development.

Site specific data sources are detailed below:

- [15] November 2017. Scientific Report P00001932 for WYG Environment Planning Transport Ltd. 44 pp.; and
- [16] Sediment Sampling – Ref: LO_A100795_V1.

Further data sources used in the preparation of the chapter are credited in the reference list. Key sources include:

- [17] Biodiversity Information Report 16/06/2017. MBB reference: 2215-WYG. Site: Bramley-Moore Dock;
- [18] Salmon stocks and fisheries in England and Wales in 2017;
- [19] Fishery sensitivity Maps in British Waters Published and distributed by UKOOA Ltd;
- [20] Spawning and nursery grounds of selected fish species in UK waters Scientific Series Technical Report, Lowestoft: Cefas, No. 147;
- [21] Cetaceans in Liverpool Bay and Northern Irish Sea. An update for the period 2001-2005. Sea Watch Foundation, Oxford. 7pp;
- [22] Fishing Effort and Quantity and Value of Landings by ICES Rectangle;
- [23] Bramley-Moore Dock. Ecological Appraisal for Everton Stadium Development Limited. A100795, August 2017; and
- [24] Technical guidance on: Underwater sound in relation to dredging.

The spatial extent of the study area primarily focuses on two areas, the zone of influence (ZoI) within which the proposed development will be contained and the local area incorporating the wider dock network and the lower Mersey. Receptors within the ZoI are expected to have limited connectivity to the local area due to the nature of the dock network. Receptors such as migratory fish and marine mammals have also been assessed against a wider regional/national scale in recognition of their increased mobility.

Temporal consideration of seasonal shifts in abundance, biodiversity and distribution are considered throughout the chapter. Detail is given in relation to spawning and nursery periods, prey abundance and foraging opportunities as well as migratory pathways.

The key receptors assessed within the chapter consist of fish and shellfish, benthic fauna and flora, and marine mammals.

Table 13.2 sets out the scale of sensitivity that has been applied to receptors identified and considered within this assessment.

Table 13.2

Scale of aquatic ecology sensitivity used in the assessment

SENSITIVITY	DESCRIPTION
Very High	**International Scale**: High importance and rarity. International scale and limited potential for substitution, e.g. Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites etc.
High	**National Scale**: High importance and rarity, national or regional scale with limited potential for substitution, e.g. Sites of Special Scientific Interest (SSSI), national nature reserves etc.

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SENSITIVITY	DESCRIPTION
Medium	**Regional / County Scale**: High or medium importance and rarity, local or regional scale and (limited) potential for substitution, e.g. local nature reserves, county wildlife sites etc.
Low	**District / Local Scale**: Low or medium importance and rarity, local scale, e.g. low intensity nursery / spawning areas.
Negligible	**Within Zone of Influence**: Very low importance and rarity, local scale, e.g. areas of built development or active dredge areas.

13.2.10 Assessment of Magnitude

The assessment was undertaken based on the description of development contained in Chapter 3 of this volume of the ES. Table 13.3 indicates the scale of impact magnitude that has been used in undertaking the assessment.

Table 13.3

Scale of magnitude for aquatic ecology impacts used in the assessment

MAGNITUDE	DESCRIPTION
Very large	■ Loss of, permanent damage to, or, adverse effect on integrity of any part of a site of international or national importance; ■ Loss of a substantial part or key feature of a site of county importance; ■ Loss of Favourable Conservation Status (FCS) of a legally protected species; and ■ Loss of or damage to a population of nationally rare or scarce species.
Large	■ Temporary disturbance to a site of international or national importance, but no permanent damage; ■ Loss of, or, permanent damage to any part of a site of county importance; ■ Loss of a key feature of local importance; ■ A substantial reduction in the numbers of legally protected species such that there is no loss of FCS but the population is significantly more vulnerable; and ■ Reduction in the amount of habitat available for a nationally rare or scarce species, or species that are notable at a regional or county level.
Medium	■ Temporary adverse disturbance to a site of county value, but no permanent damage; ■ Loss of, or permanent damage to a feature with some ecological value in a local context but that has no nature conservation designation; ■ A minor impact on a legally protected species but no significant habitat loss or reduction in FCS; and ■ A minor impact on populations of nationally rare or scare species or species that are notable at a regional or county level.
Small	■ No effect on sites of international, national or county importance; ■ Temporary disturbance or damage to a small part of a feature of local importance; ■ Loss of or damage to land of negligible nature conservation value; and ■ No reduction in the legally protected, nationally rare, nationally scare or notable (regional / county level) species on the site or its immediate vicinity.

13.2.11 Cumulative Schemes

A review of 41 local projects was undertaken to identify any potential developments that might have potential to cause a cumulative effect. Screening was made on the basis that the proposed development was within or sufficiently close to the Liverpool Dock or Mersey Estuary and that either the construction or operation of the development would likely result in an aquatic ecological disturbance. In total, there were four developments which occurred close to the Bramley-Moore Dock: Liverpool Waters (including proposal for new Isle of Man Ferry Terminal and other commercial developments requiring dock infill works), William Jessop House development (part of the Liverpool Waters plan within Princes Dock), Liverpool Cruise Liner Terminal and Plot CO2, (a residential development forming part of the Liverpool Waters plans). All have potential to cause a degree of habitat disturbance, increased suspended sediment concentration and release of INNS. Cumulative effects of these scheme alongside the current proposals are reported later in this chapter.

13.2.12 Assessment of Significance

The assessment of significance within this chapter is based on the matrix presented in Table 13.4.

Table 13.4

Significance Matrix

MAGNITUDE OF EFFECT	SENSITIVITY OF RECEPTOR				
	Very High	High	Medium	Low	Negligible
Very Large	Major Significance	Major Significance	[3]	Moderate Significance	[1]
Large	Major Significance	[3]	Moderate Significance	Minor Significance	[2]
Medium	[3]	Moderate Significant	Minor Significance	[2]	[2]
Small	Moderate Significance	Minor Significance	[2]	Negligible Significance	[2]
Negligible	[1]	[2]	Negligible Significance	Negligible Significance	Negligible Significance

[1] The choice between 'Moderate Significance', 'Minor Significance' and 'Negligible Significance' will depend on the specifics of the impact and will be down to professional judgement and reasoning.

[2] The choice between 'Minor Significance' and 'Negligible Significance' will depend on the specifics of the impact and will be down to professional judgement and reasoning.

[3] The choice between 'Major Significance' and 'Moderate Significance' will depend on the specifics of the impact and will be down to professional judgement and reasoning.

n.b. 'Negligible Significance' includes 'Neutral' and 'No Impact' assessments.

13.2.13 Relevant Associated Development

No associated development relevant to aquatic ecology has been identified.

13.2.14 Assumptions/Limitations

In undertaking the aquatic ecology assessment of the application site and wider surrounding area, there are a number of limitations and constraints affecting the outputs from this work. These include:

- The site-specific surveys undertaken to inform the assessment provided a snapshot of the fish and benthic assemblages within the study area. The surveys were not designed to target pelagic (mid-water) or migratory fish, or juvenile fish and shellfish. Data are assumed to be representative of general distribution patterns within proposed development area. Furthermore, the desk top review has provided a broader picture of the aquatic ecology across the wider study area to ensure a robust characterisation for the purpose of the assessment;
- Sensitivity assessment for spawning, nursery and migratory pathways have been defined using broad scale maps. Aquatic habitat utilisation has therefore been inferred from these sources;

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- Data used to define the likely seasonal abundance and distribution of migratory species within the lower Mersey and ZoI is limited. Key species assemblages have been described using regional studies such as those detailed within the Celtic Sea Trout Project;
- Understanding of sediment bound contaminants is limited to surface sediments only where raking activities will take place. Sampling at depth was not undertaken as part of the site-specific survey as no dredging will be required as part of the construction process; and
- Invasive Non-Native Species (INNS) have been identified during the during the site-specific survey. Control of the spread and release of these species is given within the assessment. Further consideration will be required within a biosecurity plan that will take account of the wider Liverpool Dock network and lower Mersey. The plan will be made in the context of the species present and the potential for release during construction only. Pre-existing INNS colonies outside of Bramley-Moore Dock fall outside the remit of control for this assessment.

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13.3 BASELINE CONDITIONS

RECEPTOR	DESCRIPTION	FURTHER INFORMATION
Fish and Shellfish	The highest densities of fish recorded during the baseline site-specific survey occurred in the south east and north east areas of the dock with the lowest being within the north and north eastern section. The most common fish species recorded was pouting *Trisopterus luscus* [No. 63]. This was followed by coal fish *Pollachius virens* [No. 11], European (silver) eel *Anguilla anguilla* [No. 5], sole *Solea solea* [No. 1] and plaice *Pleuronectes platessa* [No. 1]. Overall, fish densities within Bradley-Moore dock were reported to be relatively high at >3,000 fish per hectare observed throughout. Relatively large numbers of crabs were also recorded [No. 48 – various species including shore crab *Carcinus maenas* and edible crab *Cancer pagurus*].	Appendix 13.1, Section 5.1, Subsection 5.1.2., ES Volume III
	Four species of fish were recorded within 2 km of the dock – these consist of Atlantic cod *Gadus morhua* (0.1 km NNE), European eel (0.1 km NNE), plaice (1.53 km WSW) and whiting *Merlangius merlangus* (0.1 km NNE).	Appendix 13.1, Section 5.1, Subsection 5.1.3., ES Volume III
	In total, 10 species of fish were identified as using the local area (lower Mersey) for spawning with six utilising the same area for nursery. Of those recorded, herring *Clupea harengus*, cod and whiting use the local area for high intensity spawning while sandeel use the same area for high intensity nursey purposes.	Appendix 13.1, Section 5.1, Subsection 5.1.4., ES Volume III
	Migratory fish present within the local area include Atlantic salmon, sea trout, European eel, sea lamprey and river lamprey. Of these, European eel are considered the most likely to encounter the application site as they are known to reside within coastal waters and estuaries for several years. Juvenile eel (known as elvers) will be present within the estuary between February and June with a likely peak in abundance between March and April (depending on seasonal conditions). Adults will be present in greater abundance between August and September – coinciding within emigration between freshwater environments.	Appendix 13.1, Section 5.1, Subsection 5.1.5., ES Volume III
	Several species including cod, plaice, sole and whiting as well as European eel, Atlantic salmon and sea trout are afforded protection under national and international legislation.	Appendix 13.1, Section 5.1, Subsection 5.1.6., ES Volume III
	A broad overview of the commercial fish and shellfish community of the lower and outer Mersey Estuary has been completed from examination of commercial catch data landed from within the corresponding ICES statistical rectangle 35E6. In total, 37 species were landed over a five-year period 2014 – 2018. Demersal (bottom dwelling) species such as Atlantic cod, plaice, anglerfish *Lophius piscatorius* and thornback ray *Raja clavata* dominated the finfish catch. Pelagic species included herring and mackerel *Scomber scombrus*. Shellfish were represented predominantly by mollusc species such as whelks *Buccinum undatum* and scallop *Pecten maximus* but also included crustacea such as lobster *Homarus gammarus* and various crab species including velvet swimming crab.	Appendix 13.1, Section 5.1, Subsection 5.1.7., ES Volume III
Benthic Ecology	No subtidal benthic habitats or species are included within the local and regional designated sites.	Appendix 13.1, Section 5.2, Subsection 5.2.2., ES Volume III
	A total of 57 benthic species were identified at 12 grab stations within Bramley-Moore Dock with annelid worms dominant throughout. Species of the genus *Tharyx* were present in all samples and were most abundant overall. Annelids also represented the highest biomass at most stations. In total, 18 benthic taxa were considered "notable", two of which were commercially important molluscs (*Mytilus edulis*, *Cerastoderma edule*), five were identified as non-native to the UK (although none of specific concern), six were considered cryptogenic (of unresolved origin) and individuals from a further three genus' may include invasive and non-native species.	Appendix 13.1, Section 5.2, Subsection 5.2.2., ES Volume III
	Dock walls were generally densely colonised with approximately 90% cover with less dense growth closest to the water surface. An algal band occurred close to the water surface with tunicates dominating the deeper sections of the wall; the most prevalent tunicate species were identified as *Ciona intestinalis* and *Ascidiella aspersa*. Whilst the INNS *Styela clava* was identified in both video footage and a scrape sample, it was considered uncommon. Blue mussel (*M. edulis*) and the barnacle *Semibalanus balanoides* were commonly observed during the dive survey of the dock wall, along with byozoans and hydroids.	Appendix 13.1, Section 5.2, Subsection 5.2.2, ES Volume III
	Above the waterline, 12 scrape samples were collected from the dock wall containing a total of 23 species. The barnacle *Austrominius modestus* (INNS) was dominant. Other taxa included *S. balanoides*, the isopod *Jaera albifrons*, the gastropod *Littorina saxatilis* and three native species of algae, bryozoan and hydroids.	Appendix 13.1, Section 5.2, Subsection 5.2.2, ES Volume III
	Baited traps recorded relatively high abundances of shore crab *Carcinus maenas* and low numbers of the commercial edible crab, *Cancer pagurus*, goby *Pomatoschistus* spp. and prawns *Palaemon* spp. were also captured during the survey.	Appendix 13.1, Section 5.2, Subsection 5.2.2, ES Volume III
Sediment Chemistry	Surface sediments within Bramley-Moore Dock were generally described as black or dark silt during the field campaign and were typically categorised as sandy silt through Particle Size Analysis (PSA).	Appendix 13.1, Section 5.2, Subsection 5.2.2, ES Volume III
	Mean sediment bound concentrations across Bramley-Moore Dock of all trace metals analysed were above Cefas Action Levels (AL)1 and below AL2. Concentrations of Copper, Lead, Zinc and Mercury exceeded Probable Effect Levels (PEL) levels.	Appendix 13.1, Section 5.2, Subsection 5.2.2, ES Volume III
	Concentrations for all organotin compounds with the exception of tributyl tin were reported at below Limits of Detection (LOD). Concentrations of tributyl tin exceeded AL1 at Station 3, with levels at all other Stations below AL1. Dibutyl tin concentrations were below AL1 concentration at all Stations. No ISQGs exist for the organo-tins.	Appendix 13.1, Section 5.2, Subsection 5.2.2, ES Volume III
	Mean sediment concentrations of PAHs across all Stations within Bramley-Moore Dock were compared against Cefas AL1 (Note: no AL2 exists for PAHs) and ISQGs. Mean total PAH (USEPA 16) concentrations exceeded AL1, within concentrations of individual PAHs exceeding the relevant AL1 except for Acenaphthene. Mean concentrations of PAHs exceeded TEL for all PAHs for which an ISQG level exists, with concentrations of Anthracene, Benzo(a)pyrene and Dibenzo(a,h)anthracene exceeding PEL when averaged.	Appendix 13.1, Section 5.2, Subsection 5.2.2, ES Volume III

RECEPTOR	DESCRIPTION	FURTHER INFORMATION
	Concentrations of BTEX were typically reported to be below LOD at most sites sampled within Bramley-Moore Dock.	Appendix 13.1, Section 5.2, Subsection 5.2.2, ES Volume III
Marine Mammals	All cetaceans are European Protected Species, listed on Annex IV of the 1992 Habitats Directive (as amended) [25]. The Conservation of Habitats and Species Regulations 2017 make it an offence to kill, injure, capture or disturb European marine protected species, whilst the Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007 extend the offence to areas of UK jurisdiction beyond 12 nautical miles (nm).	Appendix 13.1, Section 5.3, Subsection 5.3.2, ES Volume III
	Two species of pinniped – the grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina* and eighteen species of cetacean have been recorded in the Irish Sea region since 1975. Thirteen cetacean species have been recorded in the Mersey, Dee and East Liverpool Bay over the past 150 years. Only five of these cetaceans are known to occur annually, these are the Harbour porpoise *Phocoena phocoena*, Bottlenose dolphin *Tursiops truncates*, short beaked common dolphin *Delphinus delphis*, Risso's dolphin *Grampus griseus* and Minke Whale *Baloenoptera acutorostrata*. Only two cetaceans and a single seal species have been recorded within Liverpool Bay in recent decades. These are the cetaceans; bottle-nosed dolphin and the harbour porpoise and the pinniped grey seal.	Appendix 13.1, Section 5.3, Subsection 5.3.3, ES Volume III
	Summary of key species distribution: There are just nine records of grey seal occurring within 5 km of Bramley-Moore Dock recorded between 1955 and 2010. The NBN gateway has 16 records of harbour porpoise occurring within 5 km of Bramley-Moore Dock. Three of these sightings occur in the River Mersey within 2 km of Bramley-Moore Dock with the latest record from 2012. There has been a single record of one bottlenose dolphin from the River Mersey, made from the Mersey Ferry in May 2000.	Appendix 13.1, Section 5.3, Subsection 5.3.4 and 5.3.5, ES Volume III
Future Baseline	The Bramley-Moore Dock aquatic ecology baseline characterisation is unlikely to change significantly from that described above for the foreseeable future. Proposed developments such as the Liverpool Waters scheme, may result in highly localised habitat disturbances, increased suspended sediment concentrations and release of INNS, however the scheme does not outline the need for extensive infilling of the docks. As such, any cumulative change to the baseline is likely to be imperceptible.	Appendix 13.1, Section 6.5, 7.5, 8.5 and 9.5, ES Volume III

13.4 POTENTIAL SIGNIFICANT IMPACTS

PHASE	RECEPTOR / POTENTIAL IMPACT	ADVERSE/BENEFICIAL
Construction	Fish & Shellfish / Habitat Disturbance: Will occur as a result of the raking process, and gradual infilling with aggregate. The spatial extent of the habitat disturbance will be limited to within Bramley-Moore Dock. The Trailing Suction Hopper Dredger (TSHD), moored between 300 m and 400 m offshore, will not touch bottom and, therefore, not represent a seabed habitat disturbance. A highly localised, but permanent decrease in potential prey abundance for fish and shellfish will occur as a result of the construction process. Consequently, species known to inhabit Bramley-Moore Dock such as pouting, coal fish and European eel as well as sole and plaice may be indirectly affected through a loss of foraging habitat. This loss is highly unlikely to affect the wider fish and shellfish community inhabiting the lower Mersey	Adverse
Construction	Fish & Shellfish / Increased Suspended Sediment Concentration (SSC): Will occur as a result of the raking process and during infill of Bramley-Moore Dock with marine aggregate. Raking will be a singular event occurring early and over a very short timeframe within the proposed construction window. Dissolved oxygen levels are likely to fall immediately after raking due to the resuspension of sediment bound organic materials. Infilling will consist of episodic, singular events occurring relatively early in the construction phase. Each event would temporarily cause a localised increase in SSC. Species caught within Bramley-Moore Dock during raking and infill are likely to incur high mortalities due to the elevated SSC reducing the oxygen absorption ability of gills and eggs. Those species found outside of Bramley-Moore Dock would be expected to avoid localised areas of increased SSCs and are likely to re-occupy areas upon return of ambient conditions	Adverse
Construction	Fish & Shellfish / Underwater Noise and Vibration: Construction works may introduce sound energy into the water column within BMD and the surrounding dock basins. A degree of underwater noise and vibration will emanate from the TSHD. Aggregate pumping will be episodic, singular events occurring relatively early in the three-year construction phase. Pumping of fine soft sediments like sand and mud will result in low underwater noise levels. No auditory and non-auditory related injuries have been documented for activities relating to dredging projects (except for cases involving underwater blasting prior to substrate removal by conventional dredgers). However, if fish are exposed for long periods of time by staying within the vicinity of the dredger, low levels of damage to auditory tissues and temporary shifts in hearing thresholds may occur.	Adverse
Construction	Fish & Shellfish / Changes to Hydrodynamic Regime: During construction, Bramley-Moore Dock will be completely infilled to allow vehicle and machinery access. During this time, Nelson Dock to the south will be hydrologically isolated from the northern dock network, however Sandon Half-Tide Dock to the north will remain connected. This has the potential to alter the water quality parameters of Nelson Dock resulting in possible stagnation and fluctuations in salinity and dissolved oxygen. There is also a risk from harmful algal blooms that without water exchange, may remain in situ, causing further deterioration to water quality. These impacts are expected to be minimal as Nelson Dock currently receives significant input from southern water bodies, and only minimal input from BMD. Any effects from stagnation and alterations to the water quality will occur within Nelson Dock only and will not affect the fish and shellfish assemblages inhabiting the wider dock network or the Mersey.	Adverse
Construction	Fish & Shellfish / Unplanned Accidental Spill and Release of Environmentally Harmful Substance: Harmful substances such as fuel, oil and lubricants, could potentially contaminate the marine environment. The most likely source of any spill / release has been identified as the trailer dredger moored within the lower Mersey during the infill process. The severity of this effect on fish and shellfish receptors depends upon the quantities and nature of the spillage / release, the dilution and dispersal properties of the receiving waters and the bioavailability of the contaminant to identified species.	Adverse
Construction	Fish & Shellfish / Entrainment: During the infill process it will be necessary to pump aggregate from the TSHD, moored within the Mersey, to Bramley-Moor Dock via a floating pipeline. To allow efficient pumping, it will be necessary to fluidise the aggregate with water abstracted directly from the lower Mersey. Onboard pumps within the trailer dredger will be used throughout the infilling process. Bottom dwelling fish and shellfish are unlikely to be affected. The greatest perceived risk would be to elvers that will be ubiquitously distributed throughout the channel and do not possess the ability to swim upon first arrival (February to June peaking between March and April) within the lower Mersey.	Adverse

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PHASE	RECEPTOR / POTENTIAL IMPACT	ADVERSE/BENEFICIAL
Construction	Benthic Ecology / Net Loss of Habitat and Species: Total, permanent and irreversible benthic habitat loss within the Bramley-Moore Dock will occur as a result of the project. The raking process will disrupt any sedimentary habitats, potentially causing damage to infauna and epifauna. The careful placement of the initial layers of aggregate will effectively smother the existing benthic sedimentary habitat before infilling. Through the infilling process, sedentary species colonising the dock wall such as blue mussel (*M. edulis*), tunicates (*C. intestinalis*), barnacles (*S. balanoides, A. modestus*) and sponges (*H. panicea, H. oculata*) may become permanently exposed as the water is displaced or smothered as aggregate infill occurs. They will be unable to detach and re-submerge or mobilise to to the sediment surface and will, therefore, suffer mortality.	Adverse
Construction	Benthic Ecology / Release of Invasive or Non-Native Species: During construction INNS may become dislodged from the dock wall or excavated from the substrate during debris clearance (raking). They may consequently become suspended and entrained within the water inside Bramley-Moore Dock. Any INNS which may have become entrained within the water column during the raking process may be able to disperse into adjacent waterbodies.	Adverse
Construction	Benthic Ecology / Changes to Hydrodynamic Regime: Temporary habitat changes may occur as a result of preventing water exchange between Bramley-Moore Dock and Nelson Dock during the construction phase. Water quality within Nelson Dock is therefore expected to deteriorate as a result of reduced circulation during this period of isolation. Effects may include water stagnation and reduced dissolved oxygen content as well as foul odour, rendering the area unsuitable for habitation by the current benthic communities in both the sedimentary environment and on the dock wall. Any effects are anticipated to be minimal, given that Nelson Dock receives significant input from southern water bodies, and receives minimal input from BMD.	Adverse
Construction	Water Quality / Release of Contaminants: The dock bed will be raked to remove any debris and / or obstructions. The raking process will mobilise sediments and result in the potential release of sediment bound contaminants and the partitioning of these to aqueous phases i.e., increase dissolved concentrations within the water column. The release of sediment bound organic materials and chemicals will also temporarily increase the Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) within the water column.	Adverse
Construction	Marine Mammals / Underwater Noise and Vibration: The pumping of aggregates from the trailer dredger to Bramley-Moore Dock during infill is the greatest source of underwater noise, which could potentially impact marine mammals in close vicinity to the trailer dredger. Anthropogenic (human related) underwater sound (from construction activities etc.) may increase physiological stress and induce behavioural changes in marine mammals.	Adverse
Construction	Marine Mammals / Potential Collision Risk: The presence of the trailer dredger and displacement of other vessels in proximity of Bramley-Moore Dock presents the potential for death or injury to marine mammals due to collision. However, it is considered highly unlikely that collisions will occur as the trailer dredger will be moored up for much of the time. Furthermore, the trailer dredger typically moves at slow speeds and marine mammals are highly mobile and able to avoid slow vessels.	Adverse
Construction	Marine Mammals / Unplanned Accidental Spill and Release of Environmentally Harmful Substance: Accidental release of pollutants from the trailer dredger during construction may have a negative effect on marine mammals. Pollutants could include diesel, sewage, antifouling biocides and leachates from dredged sediments.	Adverse
Operation	Fish & Shellfish / Net Loss of Habitat: There will be a total and permanent loss of aquatic habitat within Bramley-Moore Dock upon completion of the construction process. All fish and shellfish species that once occupied Bramley-Moore Dock that are displaced or removed and translocated will be permanently displaced into neighbouring environs within the wider dock network and / or the lower Mersey.	Adverse
Operation	Fish & Shellfish / Underwater Noise and Vibration: During operation the only source of noise will be from the terrestrial environment during sporting events and music concerts etc. Much of this sound will be reflected by the water surface and any residual noise entering the water column is not unlikely to cause disturbance to fish and shellfish within the vicinity.	Adverse
Operation	Fish & Shellfish / Changes to Hydrodynamic Regime: A western channel will be established during operation to provide hydrological connectivity between Nelson Dock to the south and Sandon Half-Tide Dock to the north. Flow will be governed by a series of submerged pipes to regulate water exchange and help prevent stagnation to improve water quality within the Nelson Dock. This will reduce environmental stress to fish and shellfish and allow recolonization and mobilisation between the water bodies.	Beneficial
Operation	Fish & Shellfish / Unplanned Accidental Spill and Release of Environmentally Harmful Substance: The most likely source of any spill / release has been identified as the stadium. The severity of this effect on fish and shellfish receptors depends upon the quantities and nature of the spillage / release, the dilution and dispersal properties of the receiving waters and the bioavailability of the contaminant to identified species.	Adverse
Operation	Fish & Shellfish / Light Pollution / Overshadowing: New infrastructure associated with the proposed development will result in a marginal alteration to the day and night lighting regime of the adjoining waterbodies. The area to be affected will mainly incorporate Nelson Dock and will be highly localised. Changes will occur frequently (daily) throughout the lifespan of the proposed stadium within Bramley-Moore Dock.	Adverse
Operation	Benthic Ecology / Habitat Alteration: A western water channel will be created upon completion of the construction phase. Flow will be governed by a series of submerged pipes contained within the dock gate. This will allow hydrological connectivity between Nelson Dock and Sandon Half-Tide Dock.	Beneficial

13.5 DESIGN INTERVENTIONS

DESIGN INTERVENTION	DESCRIPTION	REASON FOR INTERVENTION	FURTHER INFORMATION
In relation to aquatic ecology, no design interventions have been considered necessary.	Not applicable.	Not applicable.	Not applicable.

13.6 ASSESSMENT PRE-MITIGATION (INCLUDING DESIGN INTERVENTION)

PHASE	RECEPTOR(S) AFFECTED	IMPACT	RECEPTOR SENSITIVITY	MAGNITUDE PRE-MITIGATION	SIGNIFICANCE PRE-MITIGATION	MITIGATION PROPOSED?	FURTHER INFORMATION
Construction	Fish & Shellfish	Habitat Disturbance	High	Small	Minor Adverse	Yes	Appendix 13.1, Section 6, Subsection 6.1.1, ES Volume III
Construction	Fish & Shellfish	Increased Suspended Sediment Concentration	High	Small	Minor Adverse	Yes	Appendix 13.1, Section 6, Subsection 6.1.2, ES Volume III

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PHASE	RECEPTOR(S) AFFECTED	IMPACT	RECEPTOR SENSITIVITY	MAGNITUDE PRE-MITIGATION	SIGNIFICANCE PRE-MITIGATION	MITIGATION PROPOSED?	FURTHER INFORMATION
Construction	Fish & Shellfish	Underwater Noise and Vibration	High	Small	Minor Adverse	Yes	Appendix 13.1, Section 6, Subsection 6.1.3, ES Volume III
Construction	Fish & Shellfish	Changes to Hydrodynamic Regime	High	Small	Minor Adverse	Yes	Appendix 13.1, Section 6, Subsection 6.1.4, ES Volume III
Construction	Fish & Shellfish	Unplanned Accidental Spill and Release of Environmentally Harmful Substance	High	Small	Minor Adverse	Yes	Appendix 13.1, Section 6, Subsection 6.1.5, ES Volume III
Construction	Fish & Shellfish	Entrainment	High	Small	Minor Adverse	Yes	Appendix 13.1, Section 6, Subsection 6.1.6, ES Volume III
Construction	Benthic Ecology	Net Loss of Habitat and Species	Negligible	Small	Negligible	Yes	Appendix 13.1, Section 7, Subsection 7.1.1, ES Volume III
Construction	Benthic Ecology	Release of Invasive or Non-Native Species	Medium	Small	Minor Adverse	Yes	Appendix 13.1, Section 7, Subsection 7.1.2, ES Volume III
Construction	Benthic Ecology	Changes to Hydrodynamic Regime	Negligible	Small	Negligible	Yes	Appendix 13.1, Section 7, Subsection 7.1.3, ES Volume III
Construction	Water Quality	Release of Contaminants	Very high	Small	Moderate Adverse	Yes	Appendix 13.1, Section 8, Subsection 8.1.1, ES Volume III
Construction	Marine Mammal	Underwater Noise and Vibration	Medium	Small	Negligible	No	Appendix 13.1, Section 9, Subsection 9.1.1, ES Volume III
Construction	Marine Mammal	Potential Collision Risk	Medium	Small	Negligible	No	Appendix 13.1, Section 9, Subsection 9.1.2, ES Volume III
Construction	Marine Mammal	Unplanned Accidental Spill and Release of Environmentally Harmful Substance	Medium	Small	Negligible	Yes	Appendix 13.1, Section 9, Subsection 9.1.3, ES Volume III
Operation	Fish & Shellfish	Net Loss of Habitat	Low	Small	Negligible	No	Appendix 13.1, Section 6, Subsection 6.2.1, ES Volume III
Operation	Fish & Shellfish	Underwater Noise and Vibration	Low	Small	Negligible	No	Appendix 13.1, Section 6, Subsection 6.2.2, ES Volume III
Operation	Fish & Shellfish	Changes to Hydrodynamic Regime	High	Small	Minor Beneficial	Yes	Appendix 13.1, Section 6, Subsection 6.2.3, ES Volume III
Operation	Fish & Shellfish	Unplanned Accidental Spill and Release of Environmentally Harmful Substance	High	Small	Minor Adverse	Yes	Appendix 13.1, Section 6, Subsection 6.2.4, ES Volume III
Operation	Fish & Shellfish	Light Pollution / Overshadowing	Medium	Small	Negligible	No	Appendix 13.1, Section 6, Subsection 6.2.5, ES Volume III
Operation	Benthic Ecology	Habitat Alteration	Negligible	Small	Negligible	Yes	Appendix 13.1, Section 7, Subsection 7.2.1, ES Volume III

13.7 MITIGATION & ENHANCEMENT MEASURES

PHASE	POSSIBLE EFFECT BEING MITIGATED	MITIGATION MEASURE	HOW SECURED / TRIGGER	MAGNITUDE POST-MITIGATION	ADVERSE/BENEFICIAL	FURTHER INFORMATION
Construction	Risk of increased mortality to fish via habitat disturbance / increased suspended sediment concentration	Fish rescues and translocations will take place during construction to reduce fish mortality. The first will commence prior to raking to mitigate the associated risk from increased SSC's. A second will be undertaken following dock closure works. Methods will be agreed in advance with the relevant Statutory Nature Conservation Bodies (SNCBs) to target all known fish species including pouting, European eel and coal fish known to inhabit the dock. In addition, bubble curtains will be installed to deter fish away from the northern water channel adjacent to Sandon Half-Tide Dock. The bubble curtain and subsequent silt curtain will be in place until the permanent northern isolation structure is installed.	Planning condition	Small	Beneficial	Appendix 13.1, Section 6, Subsection 6.3.1 and 6.3.2, ES Volume III
Construction	Risk from underwater noise and vibration to fish.	Selected construction approach such as all percussive piling activities taking place after the dock has been drained will mitigate the effects on fish from underwater noise and vibration.	Planning condition	Small	Beneficial	Appendix 13.1, Section 6, Subsection 6.3.3, ES Volume III
Construction / Operation	Risk to fish and shellfish as well as marine mammals and benthic communities from environmentally harmful substances.	Selected construction approach such as adoption and implementation of a suitable Construction Environmental Monitoring Plan (CEMP) and appropriate drainage systems to minimise risk of occurrence and to resolve any incidents quickly will mitigate risk.	Planning condition	Small	Adverse	Appendix 13.1, Section 6, Subsection 6.3.4, ES Volume III

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PHASE	POSSIBLE EFFECT BEING MITIGATED	MITIGATION MEASURE	HOW SECURED / TRIGGER	MAGNITUDE POST-MITIGATION	ADVERSE/BENEFICIAL	FURTHER INFORMATION
Construction / Operation	Habitat Disturbance / Net Loss of Habitat for fish and benthic ecology	Biodiversity enhancements within newly created western channel to increase habitat complexity in the form of artificial cracks and crevices, achieved through the use of textured concrete cladding tiles fixed to the channel walls, increasing the substrate rugosity and providing enhanced surface textures and crevices for both mobile and sessile benthic fauna to establish. The bed of the channel may also be enhanced though the placement of rock substrate, although some soft substrate should also be retained to provide habitat for soft sediment infauna species. This will enhance overall food sources for a wide range of fish species that will remain within the Nelson Dock and Sandon Half-Tide Dock and within the new channel itself.	Planning condition	Small	Beneficial	Appendix 13.1, Section 6, Subsection 6.3.7 and Section 7.3, Subsection 7.3.5, ES Volume III
Construction	Rik to fish inhabiting the lower Mersey, particularly juvenile eel, from entrainment during infilling.	Abstraction will most likely need to adhere to the terms set out in an abstraction licence. These are likely to include consideration of pump screening, volume / rate of abstraction and seasonal occurrence. Any seasonal restriction should be timed to coincide with the peak seasonal arrival of elver within the lower Mersey Estuary. This will be variable year-on-year due to environmental perturbations but is likely to run between March and April.	Planning condition	Small	Adverse	Appendix 13.1, Section 6, Subsection 6.3.6, ES Volume III
Construction	Risk to benthic ecology through net loss of habitat.	Opportunistic retention of mobile benthic fauna made during the fish recue will result in a small proportion of the benthos being translocated. Use of bubble curtains and silt curtain within the northern entrance to Bramley-Moore Dock will help prevent re-entry of marine life into Bramley-Moore Dock.	Planning condition	Small	Adverse	Appendix 13.1, Section 7, Subsection 6.3.1, ES Volume III
Construction	Risk to benthic ecology and water quality through release of contaminants.	Approximately two months of standby time will occur between the completion of raking operations and the infill of aggregate within Bramley-Moore Dock. This is to allow time for the re-suspended particulate (including remobilised contaminants) to settle back out of the water column.	Planning condition	Small	Adverse	Appendix 13.1, Section 7, Subsection 6.3.2, ES Volume III
Construction	Risk to benthic ecology via release of invasive or non-native species.	During the raking process, Bramley-Moore Dock will be isolated from the remainder of the dock network and the Mersey Estuary; this will prevent the inadvertent release of mobilised INNS into adjacent areas and habitats through water transfer. In addition, approximately two months of standby time will occur between the completion of raking operations and the initial careful infill with aggregate.	Planning condition	Small / Medium	Adverse	Appendix 13.1, Section 7, Subsection 7.3.3, ES Volume III

13.8 ASSESSMENT POST-MITIGATION

PHASE	RECEPTOR	RESIDUAL IMPACT	RESIDUAL EFFECT					
			SIGNIFICANCE	ADV/BEN	ST/MT/LT	D/IND	P/T	R/IRR
Construction	Fish and Shellfish	Habitat Disturbance - Will occur as a result of the raking process and gradual infilling with aggregate. The spatial extent of the habitat disturbance will be limited to within Bramley-Moore Dock. Species of conservation importance and other species present will be targeted for removal via proposed mitigation.	Negligible	Adverse	Long-term	Direct	Permanent	Irreversible
Construction	Fish and Shellfish	Increased Suspended Sediment Concentration (SSC) - Will occur as a result of the raking process and during infill of Bramley-Moore Dock with marine aggregate. Raking will be a singular event occurring early and over a very short timeframe within the proposed construction window. Species of conservation importance and other species present will be targeted for removal via proposed mitigation prior to raking occurring. In addition, mitigation measures are in place to monitor and enhance as needed the water quality in adjacent water bodies.	Negligible	Adverse	Short-term	Direct	Temporary	Reversible
Construction	Fish and Shellfish	Underwater Noise and Vibration - A degree of underwater noise and vibration will emanate from the TSHD. Aggregate pumping will be episodic, singular events occurring relatively early in the three-year construction phase but will be of similar magnitude to that resulting from existing vessel traffic in the region. The introduction from construction works within and surrounding BMD will be largely mitigated through the proposed approach to pilling.	Negligible	Adverse	Short-term	Direct	Temporary	Reversible
Construction	Fish and Shellfish	Changes to Hydrodynamic Regime - Temporary habitat changes may occur as a result of preventing water exchange between Bramley-Moore Dock and Nelson Dock during the construction phase. Water quality effects within Nelson Dock such as water stagnation and reduced dissolved oxygen content as well as foul odour, although these effects are anticipated to be minimal, given the fact that Nelson Dock receives most of its input from southern waterbodies.	Negligible	Adverse	Short-term	Indirect	Temporary	Reversible

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PHASE	RECEPTOR	RESIDUAL IMPACT	RESIDUAL EFFECT					
			SIGNIFICANCE	ADV/BEN	ST/MT/LT	D/IND	P/T	R/IRR
Construction	Fish and Shellfish	Entrainment - During the infill process it will be necessary to pump aggregate from the TSHD, moored within the Mersey, to Bramley-Moor Dock via a floating pipeline. The greatest perceived risk would be to elvers that will be ubiquitously distributed throughout the channel and do not possess the ability to swim upon first arrival (February to June peaking between March and April) within the lower Mersey. Abstraction to adhere to the terms set out in an abstraction licence and are likely to include consideration of pump screening, volume / rate of abstraction and seasonal occurrence. Any seasonal restriction should be timed to coincide with the peak seasonal arrival of elver within the lower Mersey Estuary. This will be variable year-on-year due to environmental perturbations.	Negligible	Adverse	Short-term	Direct	Temporary	Reversible
Construction	Water Quality	Release of Contaminants - The raking process will mobilise sediments and result in the potential release of sediment bound contaminants and the partitioning of these to aqueous phases i.e., increase dissolved concentrations within the water column. The release of sediment bound organic materials and chemicals will also temporarily increase the Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) within the water column. Effects on fish and some mobile benthic fauna within BMD will be mitigated through their removal and translocation pre-raking. Effects on adjacent waterbodies will be mitigated through the retention of suspended materials within BMD via the bubble curtain and silt curtain and a period of approximately two months of standby time between completion of raking operations and the infill of aggregate within Bramley-Moore Dock.	Negligible	Adverse	Short-term	Direct	Temporary	Reversible
Construction	Benthic Ecology	Any INNS dislodged from the dock wall or excavated from the substrate during raking may consequently become suspended and entrained within the water inside Bramley-Moore Dock. During the raking process, Bramley-Moore Dock will be isolated from the remainder of the dock network and the Mersey Estuary due to the presence of the northern bubble curtain and silt barrier and southern isolator structures. This will prevent the inadvertent release of mobilised INNS into adjacent areas and habitats through water transfer. In addition, approximately two months of standby time will occur between the completion of raking operations and the initial careful infill with aggregate.	Negligible	Adverse	Long-term	Indirect	Permanent	Irreversible
Construction and Operation	Fish and Shellfish, Benthic Ecology and Marine Mammals	Unplanned Accidental Spill and Release of Environmentally Harmful Substance – Harmful substances such as fuel, oil and lubricants, could potentially contaminate the marine environment. The severity of this effect on receptors depends upon the quantities and nature of the spillage / release, the dilution and dispersal properties of the receiving waters and the bioavailability of the contaminant to identified species. The risk and severity of any release of harmful substances such as fuel, oil and lubricants, that could potentially contaminate the marine environment would be mitigated though the adoption and implementation of a suitable Construction Environmental Monitoring Plan (CEMP) and appropriate drainage systems to minimise risk of occurrence and to resolve any incidents quickly will mitigate risk.	Negligible	Adverse	Short-term	Indirect	Temporary	Reversible
Operation	Fish and Shellfish	Net loss of habitat - An overall permanent net loss of fish and shellfish habitat will result because of the project. It will not be possible to directly mitigate this habitat loss due to the plans to convert the aquatic environments of Bramley-Moore Dock into a terrestrial environment. All existing fish and shellfish populations within Bramley-Moore Dock will either be lost or permanently displaced or rescued and translocated into the adjoining dock network or lower Mersey. Fish rescue and translocation is anticipated to removed protected species such as European eel, reducing the nature conservation value of any remaining fish assemblage prior to infill.	Negligible	Adverse	Long-term	Direct	Permanent	Irreversible
Operation	Fish and Shellfish	Light pollution / overshadowing - fish communities inhabiting the area immediately adjacent to the development (within areas of artificial illumination / shade) may incur alterations to predator prey relationships.	Negligible	Adverse	Long-term	Direct	Permanent	Irreversible
Operation	Benthic Ecology	Habitat loss - habitat loss is considered a residual effect which cannot be completely mitigated against during construction and operations.	Negligible	Adverse	Long-term	Direct	Permanent	Irreversible
Key: ADV/BEN = Adverse/Beneficial; ST/MT/LT = Short-term/Medium-term/Long-term; D/IND = Direct/Indirect; P/T = Permanent/Temporary; R/IRR = Reversible/Irreversible								

13.9 AQUATIC ECOLOGY: INTER-CUMULATIVE SCHEME IMPACTS

CUMULATIVE SCHEME	RECEPTOR	POTENTIAL FOR CUMULATIVE IMPACTS?	CONSIDERED WITHIN ASSESSMENT?
Liverpool Waters, William Jessop House development (part of the Liverpool Waters plan), Liverpool Cruise Liner Terminal and Plot CO2 (part of the Liverpool Waters plan)	Fish & Shellfish / Benthic Ecology / Water Quality / Marine Mammals	Given the industrial nature of the dock network, these sites were not considered likely to cause significant impacts to fish and shellfish / benthic ecology / water quality / marine mammal assemblages inhabiting the area due to the negligible habitat conservation value throughout. Plot CO2, Liverpool Waters will involve partial infilling of the Central Docks basin, therefore, resulting in future loss of fish and shellfish habitat as well as benthic habitat resulting in further species displacement within the wider dock network.	No

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