Environmental Statement Volume 1: Main Text

Liverpool Cruise Terminal

October 2017

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Quality Assurance – Approval Status

This document has been prepared and checked in accordance with Waterman Group's IMS (BS EN ISO 9001: 2008, BS EN ISO 14001: 2004 and BS OHSAS 18001:2007)

Issue	Date	Prepared by	Checked by	Approved by
First	October 2017	Various	Gavin Spowage Associate Director	Gavin Spowage Associate Director

Comments

Comments

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1. Introduction

Background to Environmental Statement

1.1. This Environmental Statement (ES) has been prepared by Waterman Infrastructure & Environment Limited (hereafter referred to as 'Waterman'), on behalf of Liverpool City Council (hereafter referred to as 'LCC' or the 'Applicant') to obtain planning permission, a Marine Works Licence and a Harbour Revision Order for a new cruise ship terminal and associated infrastructure (hereafter referred to as the 'Development').

1.2. The Development would be located within an area (hereafter referred to as the 'Site') covering approximately 5.77 hectares (ha), located at Princes Parade, Liverpool on the east bank of the Mersey Estuary. The determining authorities are LCC and the Marine Management Organisation (MMO). **Figure 1.1** shows the location of the Site. The redline planning boundary is shown in **Figure 1.2**.

1.3. The Applicant has commissioned Waterman to carry out an Environmental Impact Assessment (EIA) of the Development. EIA is a formal procedure that must be followed for certain types and scales of development, where the potential environmental effects of a development proposal are systematically assessed and reported, to assist in the determination of a planning application. The EIA process can also identify ways in which a development can be modified or potential adverse effects mitigated, to reduce or avoid adverse effects and to optimise beneficial effects. The potential environmental effects of the Development, both during construction and once completed and operational, have been considered, together with relevant cumulative effects.

Overview of the Site and the Proposed Development

1.4. The northern part of the Site currently includes the derelict Princes Jetty and an area of surface car parking known as Plot 11. The Jetty and Plot 11 are separated by Princes Parade which connects to Waterloo Road in the north and St Nicholas Place in the south. A series of floating pontoons are located in the west and southwest of the Site. The existing cruise ship terminal is located on Pontoon A (refer to **Figure 1.2**) The southern part of the Site contains the Isle of Man ferry terminal and a marshalling area associated with the cruise ship and ferry terminals. The Titanic Memorial is excluded from the Site boundary. A full description of existing land uses within and surrounding the Site is provided in **Chapter 3: Existing Land Uses and Activities**.

1.5. The proposed Development would comprise the demolition of the derelict Princes Jetty and the construction of a new jetty. A new Cruise Liner Terminal building would be constructed on the new jetty. The existing 'lower' cruise terminal building would be modified and refurbished for use as storage and staff welfare. The Development would also include vehicular link-span bridges, pedestrian walkways, parking for coaches, taxis and cars and areas of hard and soft landscaping. A full description of the proposed Development is provided in **Chapter 5: The Proposed Development**.

Legal Framework for the Environmental Statement

1.6. This EIA has been undertaken in accordance with the Town and Country Planning (Environmental Impact Assessment) Regulations 2017[1] (hereafter referred to as the 'EIA Regulations'). It also accords with the equivalent requirements set out in both the Marine Works (Environmental Impact Assessment) Regulations 2007[2], as amended[3] and the Harbour Work (Environmental Impact Assessment) (Amendment) (England and Wales) Regulations 2009[4], under the Harbours Act 1964[5].

1.7. The EIA Regulations require that, before consent may be granted for certain types of development, an EIA must be undertaken. The EIA Regulations set out the types of development which must always be subject to an EIA (Schedule 1 development) and other developments which may require assessments if they are likely to give rise to significant environmental effects (Schedule 2 development).

1.8. The proposed Development, for which the Applicant is seeking planning permission, and which is assessed within this ES, falls under Schedule 2, Category 10g of the EIA Regulations: 'construction of Harbour and Port Installations'. The Site is larger than the Schedule 2 threshold of 1ha. Schedule 3 of the EIA Regulations sets out the criteria for determining whether a Schedule 2 development should in fact be subject to EIA. In addition, due to the nature and scale of the Development, together with the environmental constraints and sensitivities associated with the Site, the Applicant voluntarily commissioned an EIA to identify and assess the likely significant environmental impacts of the Development and to ensure that adverse impacts are mitigated through design, where possible. As such, a formal Screening Opinion as to whether the Development requires an EIA was not sought.

1.9. The scope of the EIA was agreed with LCC through the preparation and consultation on an EIA Scoping Report, which is described in further detail in **Chapter 2: EIA Methodology**. The findings of the EIA are presented in this document, which comprises an ES in accordance with the EIA Regulations. Accordingly, the outline planning application will be determined by LCC, taking into account the environmental effects of the Development reported herein.

1.10. The EIA has been undertaken in accordance with the requirements of the EIA Regulations and current industry good practice. It is recognised that for the ES to fulfil its primary objective of enabling environmental considerations to be incorporated into the decision-making process, it must be focused on the most potentially significant environmental issues. These key issues were identified during the Scoping Study described in **Chapter 2: EIA Methodology**.

Nature of the Application

1.11. A hybrid planning application (part full, part outline) for the Development has been submitted to LCC for determination. For the purposes of the planning application, the Development is described on the application form as:

"Full planning application for the controlled dismantling and removal of the building shown on the Demolition Parameter Plan (Plan No 2), redundant mooring dolphins and dilapidated structures including the (timber framed and concrete decked) Princes Jetty in the River Mersey and;

Outline planning application for the construction of a new Cruise Liner Terminal (to cater for an increase in the number of cruise passengers) on a suspended deck structure in the River Mersey at the Princes Jetty site, together with the erection of a vehicular link span bridge and pedestrian bridge/ walkways (linking the new cruise terminal building and existing floating pontoons which act as the landing stage/berth for cruise ships, naval ships, working ships and prestige vessels); improvements to the existing landing stage(floating pontoons), including modification of existing buildings shown on the Demolition Parameter Plan (Plan No 2) and creation of an ancillary building for storage and for use by cruise related operational staff; improvements to Princes Parade to incorporate pedestrian crossing facilities, provision of terminal parking, pickup and drop off facilities, and supporting development. The new cruise terminal building is intended to be used for city events when not in use for its primary cruise operations/ port related purposes. All matters are reserved."

1.12. The Development is defined by the drawings submitted as part of the planning application. These drawings, together with the description of the Development provided in **Chapter 5: The Proposed**

Development, form the basis of the EIA. The drawings used to inform the EIA are presented in **ES Volume 2: Figures**.

1.13. A description of the anticipated construction programme, together with the likely construction activities, is provided in **Chapter 6: Development Programme and Construction**. Information set out in Chapter 6 was used to inform the assessment of likely significant environmental effects associated with the demolition and construction phases of the Development.

Structure and Content of the Environmental Statement

Overview

1.14. The ES comprises three separate volumes:

- Volume 1: Main Text (this document);
- Volume 2: Figures;
- Volume 3: Appendices.

1.15. In addition, a Non-Technical Summary (NTS) of the ES has been prepared and is presented as a standalone document.

1.16. The EIA Regulations state that ESs must:

"… *include the information reasonably required for reaching a reasoned conclusion on the significant effects of the development on the environment, taking into account current knowledge and methods of assessment*".

1.17. Schedule 4 of the EIA Regulations goes on to set out the information that should be included in ESs. **Table 1.1** indicates where the required information is located within this ES, in line with the requirements of Schedule 4.

Table 1.1: Location of Information within the ES (as per Schedule 4 of the EIA Regulations)

Specified Information		Location(s) within ES
1.	Description of the development, including in particular:	
(a)	A description of the location of the development.	Chapter 3: Existing Land Uses and Activities
(b)	A description of the physical characteristics of the whole development, including, where relevant, demolition works, and the land-use requirements during the construction and operational phases.	Chapter 5: The Proposed Development and Chapter 6: Development Programme and Construction
(c)	A description of the main characteristics of the operational phase of the development.	Chapter 5: The Proposed Development
(d)	An estimate, by type and quantity, of expected residues and emissions produced during the construction and operation phases.	Chapter 6: Development Programme and Construction; All technical ES chapters (Chapters 7-14)
2.	A description of the reasonable alternatives studied by the developer and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.	Chapter 4: Alternatives and Design Evolution

Specified Information		Location(s) within ES
3.	A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.	Chapter 3: Existing Land Uses and Activities; All technical ES chapters (Chapters 7-14)
4.	A description of the factors likely to be significantly affected by the development.	Chapter 3: Existing Land Uses and Activities; All technical ES chapters (Chapters 7-14)
5.	A description of the likely significant effects of the development on the environment resulting from, inter alia:	
(a)	The construction and existence of the development, including, where relevant, demolition works	All technical ES chapters (Chapters 7-14)
(b)	The use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources	All technical ES chapters (Chapters 7-14)
(c)	The emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste	Chapter 5: The Proposed Development and Chapter 6: Development Programme and Construction; Chapter 7: Air Quality; Chapter 8: Noise & Vibration
(d)	The risks to human health, cultural heritage or the environment (for example due to accidents or disasters)	Chapter 7: Air Quality; Chapter 8: Noise & Vibration; Chapter 9: Townscape and Visual Impact Assessment; Chapter 10: Built Heritage; Chapter 11: Archaeology
(e)	The cumulation of effects with other existing and/or approved projects	Chapter 15: Cumulative Effects
(f)	The impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change	Chapter 5: The Proposed Development; Chapter 7: Air Quality
(g)	The technologies and the substances used	All technical ES chapters (Chapters 7-14)
(6)	A description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved.	Chapter 2: EIA Methodology; All technical ES chapters (Chapters 7-14)
(7)	A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis).	All technical ES chapters (Chapters 7-14)
(8)	A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned.	Chapter 5: The Proposed Development. Refer also to the standalone Flood Risk Assessment submitted in support of the planning application.
(9)	A non-technical summary of the information provided under paragraphs 1 to 8.	Standalone NTS
(10)	A reference list detailing the sources used for the descriptions and assessments included in the environmental statement.	References are provided as endnotes to each ES chapter.

Environmental Statement – Non-Technical Summary

1.18. The NTS comprises a summary of the whole ES in 'non-technical language' as required under the EIA Regulations. Its objective is to provide a concise and balanced summary of the ES without excessive technical detail or scientific language, to be readily and quickly understood by non-technical experts and members of the public not familiar with EIA terminology. The NTS is produced as a separate document to facilitate wider public distribution.

Environmental Statement – Volume 1: Main Text

1.19. This document provides a description of the approach to the EIA (Chapter 2: EIA Methodology); the Site, activities and its surroundings (Chapter 3: Existing Land Uses and Activities); the main alternatives that were reasonably considered by the Applicant (Chapter 4: Alternatives and Design Evolution); the nature, extent and justification for the Development (Chapter 5: The Development) and the development programme and construction process (Chapter 6: Development Programme and Construction). Chapters 7 to 15 present the findings of the EIA for the following disciplines:

- Air Quality;
- Noise and Vibration;
- Townscape and Visual Impact;
- Built Heritage;
- Archaeology;
- Ground Conditions and Contamination;
- Ecology;
- Coastal Process, Sediment Transport and Contamination;
- Built Heritage; and
- Cumulative Effects.

1.20. Each technical chapter of the ES is set out in accordance with Government guidance and best practice. Accordingly, each technical chapter of the ES comprises:

- An introduction;
- A summary of the assessment methodology used, including a description of relevant significance criteria;
- A description of the relevant baseline conditions existing at and surrounding the Site;
- An assessment of the potential environmental effects of the Development and the significance of the potential effects;
- A description of required mitigation measures and a discussion of the resulting likely residual effects taking into account the required mitigation measures; and
- A summary of the key issues.

Environmental Statement – Volume 2: Figures

1.21. This comprises figures, illustrations and a selection of Planning Application Drawings which should be read together with the assessments reported within ES Volume 1.

Environmental Statement – Volume 3: Appendices

1.22. This comprises technical appendices (such as data, reports and correspondence) which are relevant to the assessments reported within ES Volume 1. They are provided within a separate Volume of the ES to prevent ES Volume 1 becoming excessively long. It also allows easy cross-reference when reading the text of the chapters in ES Volume 1.

Project Team

1.23. The EIA has been managed and co-ordinated by Waterman. This ES presents the results of the EIA which was undertaken by a number of specialist contributing consultants. These consultants, and the wider project team, are listed in **Table 1.2** together with their respective discipline(s) and contribution(s) to the EIA.

Table 1.2: EIA and Project Team

Role	Organisation
Applicant	Liverpool City Council
Architect	Stride Treglown
Planning Consultant	Jones Lang LaSalle
Structural Engineer	Ramboll
EIA Co-ordinator	Waterman
Townscape and Visual Impact; Built Heritage; Air Quality; Noise and Vibration; Ground Conditions and Contamination; Archaeology and Terrestrial Ecology.	Waterman
Ornithology and Marine Ecology	APEM
Coastal Processes, Sediment Transport and Contamination	HR Wallingford

ES Availability and Comments

1.24. The ES is available for viewing by the public on LCC website: www.liverpool.gov.uk. Copies of the ES are also available for viewing by the public during normal office hours in the LCC planning department at the address provided below. Comments on the planning application should be forwarded to the planning case officer at the following address:

Liverpool City Council
Planning
Municipal Building
Dale Street
Liverpool
L2 2DH

1.25. Additional hard or electronic copies of the ES can be purchased from Waterman on request:

Waterman Infrastructure & Environment Ltd
2nd Floor, South Central
11 Peter Street
Manchester M2 5QR

Tel: +44 161 839 8392; Fax: +44 3333 444501; Email: ie@watermangroup.com

References

1 HMSO, 2017, Statutory Instrument 2017 No. 571 – Town and Country Planning (Environmental Impact Assessment) Regulations 2017.

2 HMSO (2007) Marine Works (Environmental Impact Assessment) Regulations'

3 HMSO (2017) Marine Works (Environmental Impact Assessment) (Amendment) Regulations

4 HMSO (2009) Harbour Work (Environmental Impact Assessment) (Amendment) (England and Wales) Regulations

5 HMSO (1964) Harbours Act

2. EIA Methodology

2.1. This chapter sets out the general approach to the EIA. It describes the process of identifying the environmental issues to be addressed in the EIA and the methods used to identify potential effects and assess their significance.

2.2. Detailed descriptions of the assessment methodologies and the significance criteria relating to each technical assessment scoped into the EIA are contained within each of the relevant technical chapters of this ES (chapters 7 to 15 inclusive).

General Approach

2.3. This ES was prepared to comply with the EIA Regulations 2017[1], which implement European Union Council Directive No. 2014/52/EU[2]. It also accords with the equivalent requirements set out in both the Marine Works (Environmental Impact Assessment) Regulations 2007[3], as amended[4] and the Harbour Work (Environmental Impact Assessment) (Amendment) (England and Wales) Regulations 2009[5], under the Harbours Act 1964[6].

2.4. Reference has also been made to currently available good practice guidance in EIA including:

- National Planning Policy Framework (NPPF)[7]
- Department for Communities and Local Government: Online National Planning Practice Guidance[8];
- DCLG Guidance on Environmental Impact Assessment (updated July 2017)[9];
- EIA Guidelines and ES Review Criteria from the Institute of Environmental Management and Assessment (IEMA) 2004[10]; and
- Topic specific guidance referred to in each chapter of this ES, where appropriate.

2.5. The EIA has considered the potential environmental effects of the Development using current knowledge of the Site and the surrounding environment. For the purposes of the EIA, the baseline conditions have been taken as the existing conditions when surveys were undertaken or when latest relevant baseline data were available.

2.6. As stated within **Chapter 1: Introduction**, a hybrid planning application is being submitted for the Development. The outline elements of the planning application mean that the principles (but not the details) of the Development in terms of the land uses, quantum and scale are submitted for approval and this is the basis on which planning permission is sought. A series of parameters therefore provide the framework to guide and govern the subsequent detailed design and approvals under the permission sought. The EIA is therefore based on a set of Parameter Plans which set out, inter alia, the buildings and structures to be demolished, the maximum footprints and heights of proposed buildings and the proposed movement and access arrangements throughout the Site.

2.7. The technical assessments undertaken as part of the EIA have addressed both the potential beneficial and adverse significant effects of the Development during the construction works and once the Development is complete, occupied and operational. In line with legislative and best practice requirements, direct, indirect, cumulative, permanent, temporary, beneficial and adverse effects have been addressed where applicable. The approach taken for the assessment of cumulative effects is set out later in this chapter and within **Chapter 15: Cumulative Effects**.

2.8. Following the findings of various studies contributing to the EIA, methods of avoiding, reducing, or offsetting significant adverse effects (collectively known as 'mitigation measures') were identified. Such mitigation measures are set out in each relevant technical chapter.

2.9. Detailed technical studies have been undertaken on an on-going basis throughout the design process, providing information about environmental issues, constraints and opportunities that may influence the design of the Development. The Applicant and the design team have therefore taken these environmental issues and constraints into account during the design evolution and sought to 'design out' potential adverse effects, wherever possible and maximise opportunities to provide beneficial effects. Further details are provided in **Chapter 4: Alternatives and Design Evolution**.

Scoping the EIA

2.10. 'Scoping' is an important component of the EIA process because of its role in identifying the potentially significant effects of the Development throughout the design and construction, and once the Development is completed and operational, ensuring that appropriate mitigation options are considered.

2.11. The EIA Regulations provide applicants with the opportunity to ask the relevant local planning authority to state in writing the information that ought to be provided in an ES, i.e. a 'scoping opinion'. The Applicant commissioned Waterman to undertake an EIA Scoping Study.

2.12. The key issues to be addressed by the EIA were identified through consultation with various statutory consultees, consideration of available baseline information and professional judgement and relevant experience.

2.13. The findings of this exercise were presented in a report submitted to LCC in July 2017 to provide them and the statutory consultees the opportunity to comment on the content and the methodology to be used for the EIA. A copy of the EIA Scoping Report is provided in **Appendix 2.1**.

2.14. Following receipt of the EIA Scoping Report, LCC consulted with a number of statutory and non-statutory consultees before providing its Scoping Opinion. A copy of LCC's Scoping Opinion dated 8th September 2017 and the individual responses from the consultees are provided in **Appendix 2.2**.

2.15. In line with the EIA Scoping Opinion, the following topic areas are addressed within the ES:

- Air Quality;
- Noise and Vibration;
- Townscape and Visual Impact;
- Built Heritage;
- Archaeology;
- Ground Conditions;
- Ecology;
- Coastal Processes, Sediment Transport and Contamination; and
- Cumulative Effects.

2.16. The ES addresses each of these key environmental issues in turn.

Scoped-out Topics

2.17. As confirmed by LCC's Scoping Opinion, the following topics have been excluded from the EIA on the basis that either there would be no significant effects or that the topics would be dealt with within other ES chapters:

- Flood Risk (to be dealt with by way of a standalone Flood Risk Assessment and Drainage Strategy to support the planning application);
- Water Quality;
- Sustainability;
- Socio-Economics; and
- Human Health.

Responses to the Scoping Opinion

2.18. **Table 2.1** indicates where in the ES each of the issues raised in the Scoping Opinion are located.

Table 2.1: Location in the ES of Responses to the Scoping Opinion

Consultee	Issue	Location in the ES
Environment Agency	Site investigation works completed to date do not appear to have investigated all of the land associated with this development given the proposed planning application boundary. To ensure the risks to controlled waters are appropriately assessed we recommend additional works are undertaken within areas of land not previously covered and where required appropriate mitigation measures included within the remedial strategy to address any identified risks to controlled waters.	Chapter 12: Ground Conditions and Contamination
Merseyside Environmental Advisory Service (MEAS)	MEAS have advised that an energy chapter should be included in the EIA rather than as a separate report given the considerable energy requirements of the development and associated impacts.	Energy issues are addressed in Chapter 5: The Proposed Development
	The EIA must make a clear distinction between construction and operational impacts for all chapters including cumulative effects with details of phasing and timing of works for all site areas	All technical chapters (7 to 15)
	It is important that an integrated approach is taken to the EIA methodology to ensure consideration of interactions and in-combination effects. In addition, it is necessary to ensure that the results of the assessment are used to inform development design and the master plan.	Chapter 15: Cumulative Impacts
	A single EIA should be developed to cover both land use and marine consents elements of the scheme.	The ES considers the land and marine elements of the proposed Development
	A Habitats Regulations Assessment (HRA) screening exercise should be carried out and should be referred to as an Assessment of Likely Significant Effects (ALSE). It will be used by the Council to determine whether the scheme is likely to impact upon European sites. Including:	Habitats Regulations Assessment: Assessment of Likely Significant Effects – submitted as a standalone report in support of the planning application

Consultee	Issue	Location in the ES
	• Ribble and Alt Estuaries SPA and Ramsar sites; and • The Dee Estuary SPA and Ramsar sites	
	We advise that passage and wintering bird surveys (undertaken from September to March inclusive) will be required to inform the ALSE and EIA.	Subsequent consultation with MEAS and LCC confirmed that a series of wintering bird surveys would be undertaken between October 2017 and January 2018 and reported during the pre-determination period.
	If part of the EcIA, built structures within the site will need to be described and their bat roosting potential If potential bat roosting features were found to be present upon existing structures further dusk emergence and/or dawn re-entry surveys will be required.	Appendix 13.1: Preliminary Ecological Appraisal
	An integrated aquatic survey sampling methodology is needed to (i) characterize the aquatic communities / habitats present (ii) enable impact assessment to be completed and (iii) advise on any avoidance measures, mitigation and compensation needed.	Chapter 13: Marine Ecology, Ornithology and Terrestrial Ecology
	Sediment samples taken at the same time as the grab samples are also to be analysed for chemical contamination.	Chapter 14: Coastal Processes, Sediment Transport and Contamination
	Air quality and noise assessments are proposed to inform the EIA. These assessments (along with any assessment of lighting) should consider impacts upon statutory designated nature conservation sites. Impacts associated with the generation of waste during the construction process, such as dust and noise should be addressed through relevant chapters in the EIA.	Chapter 6: Development Programme and Construction; Chapter 7: Air Quality and Chapter 8: Noise and Vibration
Historic England	Due to the site's close proximity to various heritage assets a separate Heritage Impact Assessment should be undertaken for the application and the findings incorporated into the ES. The LPA support this recommendation and the advice that the HIA should comply with ICOMOS guidance on HIA (as a separate technical appendix of the ES). This development could, potentially, have an impact upon a number of designated heritage assets including: • Liver Building (I) • The Cunard (II*) • Port of Liverpool Building (II*) • Liverpool Maritime Mercantile World Heritage Site and its Buffer Zone (WHS) • The Titanic Memorial (II) • The Church of Our Lady and St Nicholas (II) We would also expect the Environmental Statement to consider the potential impacts on non-designated features of historic, architectural, archaeological or artistic interest.	Chapter 10: Built Heritage; Appendix 10.1: Heritage Desk-Based Assessment; ICOMOS Assessment report, submitted as a standalone report in support of the planning application

Consultee	Issue	Location in the ES
	The potential impacts of the cruiser liners themselves should also be evaluated as they would be a large scale The site is situated partially within the Liverpool Maritime Mercantile World Heritage Site, and partially within its Buffer Zone. Whilst the scoping report makes reference to the need to consider the potential impacts of the proposed development on the Outstanding Universal Value of the designation, we advise that this analysis should be carried out in a separate Heritage Impact Assessment (HIA), with the findings incorporated into the main body of the ES.	
	The assessment should take account of the potential impact which associated activities (such as construction, servicing and maintenance, and associated traffic) might have upon perceptions, understanding and appreciation of the heritage assets in the area. The assessment should also consider, where appropriate, the likelihood of alterations to drainage patterns that might lead to in situ decomposition or destruction of below ground archaeological remains and deposits, and can also lead to subsidence of buildings and monuments.	Chapter 9: Townscape and Visual Impact; Chapter 10: Built Heritage; Chapter 11: Archaeology
	Given the surrounding landscape character, this development is likely to be visible across a very large area and could, as a result, affect the significance of heritage assets at some distance from this site itself. We would expect the assessment to clearly demonstrate that the extent of the proposed study area is of the appropriate size to ensure that all heritage assets likely to be affected by this development have been included and can be properly assessed.	Chapter 9: Townscape and Visual Impact; Chapter 10: Built Heritage
Natural England	Natural England advises that the potential impact of the proposal upon features of nature conservation interest and opportunities for habitat creation/enhancement should be included within this assessment in accordance with appropriate guidance on such matters. EcIA may be carried out as part of the EIA process or to support other forms of environmental assessment or appraisal. The ES should thoroughly assess the potential for the proposal to affect designated sites. The ES should include a full assessment of the direct and indirect effects of the development on the features of special interest within these sites and should identify such mitigation measures as may be required in order to avoid, minimise or reduce any adverse significant effects. Natural England advises that a habitat survey (equivalent to Phase 2) is carried out on the site, in order to identify any important habitats present. In addition, ornithological, botanical and invertebrate surveys should be carried out at appropriate times in	Chapter 13: Marine Ecology, Ornithology and Terrestrial Ecology; Appendix 13.4: Preliminary Ecological Appraisal

Consultee	Issue	Location in the ES
	the year, to establish whether any scarce or priority species are present.	
	Natural England would wish to see details of local landscape character areas mapped at a scale appropriate to the development site as well as any relevant management plans or strategies pertaining to the area. The EIA should include assessments of visual effects on the surrounding area and landscape.	Chapter 9: Townscape and Visual Impact

Consultation

2.19. Consultation has been carried out throughout the EIA process. The following statutory and non-statutory organisations were consulted regarding the Development throughout the EIA process, either directly by the EIA team or through LCC as part of its consultations:

- Liverpool City Council;
- Marine Management Organisation;
- Environment Agency;
- Natural England;
- Historic England;
- Merseyside Ecological Advisory Service,
- Peel Holdings (Land and Property) Limited;
- United Utilities;
- Places Matter!; and
- Liverpool Waters Conservation Management Board.

2.20. All relevant comments from the consultees relating to the EIA are addressed in the relevant technical chapters (**Chapters 7** to **15** inclusive).

Means of Assessment

2.21. Detailed methodologies for the assessment of each of the environmental topic areas scoped into the EIA are provided within each technical chapter of this ES. However, in general terms, the assessments have been based upon:

- A review of the current situation at and surrounding the Site for the environmental topic areas under consideration via various sources of existing information, data and reports;
- Desk-top studies;
- Site surveys;
- Consideration of relevant legislation and planning policies (national, regional and local);
- Identification of potential environmental effects and an evaluation of their likely duration, magnitude and significance;
- Consideration of potentially sensitive receptors that could be affected by the Development;
- Expert opinion;

- Use of technical guidance and best practice; and
- Specific consultations with appropriate organisations (e.g. Environment Agency).

Evaluation of Significance of Effects

2.22. The EIA process aims to provide LCC with sufficient information with respect to the potential environmental effects of the Development in order to aid the decision-making process.

2.23. Potential environmental effects associated with the Development have been assessed with reference to definitive standards and legislation, where available. Where it was not possible to quantify the potential effects, qualitative assessments were carried out, based on available knowledge and professional judgement. Where professional judgement was used, or where uncertainty exists, this is noted in the relevant chapter.

2.24. The significance of the potential effects has been determined with reference to assessment criteria for each environmental topic considered. These criteria apply a common EIA approach of classifying effects according to whether they are major, moderate, minor or negligible effects considered to be adverse or beneficial.

2.25. Specific criteria for each environmental topic was developed, giving due regard to the following factors:

- Extent and magnitude of the effect;
- Duration of the effect (whether temporary or permanent);
- Nature of the effect (whether direct or indirect, reversible or irreversible);
- Likelihood of the effect to occur;
- Whether the effect occurs in isolation, is cumulative or interactive;
- Performance against environmental quality standards or other relevant pollution control thresholds;
- Sensitivity of the receptor; and
- Compatibility with environmental policies.

2.26. In order to provide a consistent approach to expressing the outcomes of the various assessments undertaken as part of the EIA, and thereby enable comparison between effects upon different environmental resources or receptors, the following terminology was used throughout the ES. Potential effects are expressed as:

- **Negligible:** no significant effect (either adverse or beneficial) to an environmental resource or receptor;
- **Minor significance:** slight, very short or highly localised effect of low significance;
- **Moderate significance:** some effect (by extent, duration or magnitude) which may be considered of moderate significance; or
- **Major significance:** considerable effect (by extent, duration or magnitude) of more than local significance or in breach of recognised acceptability, legislation, policy or standards which may be considered of substantial significance.

2.27. Effects identified are also expressed as:

- **Adverse:** detrimental or negative effects on an environmental resource or receptor; or
- **Beneficial:** advantageous or positive effects on an environmental resource or receptor.

2.28. Each of the technical chapters of this ES sets out the significance criteria, including sources and justifications, for quantifying the different levels of effect. Where possible, this was based upon quantitative and accepted criteria for example, air quality standards contained in the National Air Quality Strategy[11] and noise assessment guidelines set out by the NPPF. Elsewhere, value judgements and expert interpretations were used to establish to what extent a predicted effect would be environmentally significant.

2.29. In the context of the Development, 'temporary' effects would be generally those associated with the demolition and construction works, and 'permanent' effects would be those associated with the completed and operational Development. 'Local' effects would be those affecting receptors neighbouring the Site, whilst effects upon receptors within Liverpool assessed at a 'District' level. Effects upon the wider Merseyside area are assessed at a 'Regional' level. Effects upon different parts of the country, or England as a whole, are considered to be at a 'National' level.

Cumulative Effects

2.30. In line with the EIA Regulations, an EIA must consider the cumulative effects or interaction of effects of a development. Cumulative effects are those which result from incremental changes caused by other reasonably foreseeable activities or projects in the local area, in combination with the Development. Cumulative effects can be categorised into two types:

- Type 1 Effects: The combined effects of individual effects resultant from the Development upon a set of defined sensitive receptors, for example noise, dust and visual effects; and
- Type 2 Effects: The combined effects arising from another development site or sites, which individually might be insignificant, but when considered together, could create a significant cumulative effect.

2.31. Type 1 effects would relate predominantly to the construction works where effects such as construction noise and dust nuisance can occur together at nearby sensitive receptors. These are qualitatively assessed using the findings of the individual EIA technical studies and professional judgement.

2.32. A set of specific criteria have been established in order to determine the 'other' schemes likely to be reasonably foreseeable and therefore appropriate for inclusion within the Type 2 cumulative assessment. The criteria which are commonly applied to cumulative assessments are:

- Schemes close to the Site which have been granted planning permission where there is a net change in floorspace above 10,000sq.m GEA; and
- Schemes close to the Site that have been granted planning permission, but fall below the floorspace threshold stated above but which introduce sensitive receptors near to the Site.

2.33. A review of planning applications was undertaken to identify the other schemes to be considered within the assessment of Type 2 effects. Ten cumulative schemes were identified and agreed with LCC as detailed within **Chapter 15: Cumulative Effects**.

Structure of ES Volume 1: Main Text

2.34. Each key environmental topic considered in the EIA has been assigned a separate chapter in ES Volume 1 (Chapter 7 to Chapter 15 inclusive). Within each of the technical chapters the assessment is presented and reported in the following format:

Introduction

2.35. Provides a brief introduction to the assessment and the issues considered in the chapter. It lists any appendices which accompany the chapter.

Assessment Methodology and Significance Criteria

2.36. This section sets out the methods used in undertaking the technical study, together with an explanation of the approach to defining the significance of likely environmental effects with reference to published standard guidelines, best practice and defined significance criteria. The limitations and assumptions of the assessment are also defined, together with any specific consultation undertaken to agree the scope or methodology of the assessment.

Baseline Conditions

2.37. In order to assess the potential effects of the Development, it is necessary to establish the environmental conditions that currently exist on and surrounding the Site, in the absence of the Development. These are known as baseline conditions. The baseline conditions relevant to each environmental issue are set out in this section. As outlined earlier in this chapter, for the purposes of the EIA, the baseline conditions have been taken as the existing conditions when surveys were undertaken or when the latest relevant baseline data were available, as described in each assessment.

Likely Effects

2.38. This section presents the assessment of the likely effects of the Development during construction, and once the Development is completed and operational. The assessments were carried out in relation to the relevant baseline conditions. An evaluation of the significance of the potential effect is given in accordance with relevant criteria as defined earlier in the assessment.

Mitigation Measures and Likely Residual Effects

2.39. One of the principal aims of the EIA is to identify, and so assist in developing, mitigation measures to prevent, reduce and where possible, offset significant adverse effects of a development. Mitigation measures can relate to design, construction or the activities associated with the completed Development.

2.40. Where significant adverse environmental effects have been identified, the Applicant has committed to implement the appropriate mitigation measures as set out in the relevant technical assessments.

2.41. This section also identifies the nature and significance of the likely residual effects of the Development, assuming the implementation of the proposed mitigation measures. The significance of likely residual effects is identified in accordance with the significance criteria defined for the respective assessment.

Summary

2.42. This section provides a brief summary of the findings of the assessment in relation to the relevant environmental issue.

Assumptions and Limitations

2.43. The principal assumptions that have been made and limitations that have been identified in undertaking the EIA are set out below.

- The 'baseline conditions' for all assessments have been taken to be those existing on and surrounding the Site at the time of the assessments being undertaken, i.e. approximately April to October 2017;
- The predicted 'opening year' of the Development is 2020; however, the traffic data provided for the air quality and noise assessments is based on a 2019 opening year in order to correspond with planned highway reconfiguration in the vicinity of the Site. It is considered that the difference between 2019 and 2020 traffic data is insignificant for assessment purposes;
- While every effort has been made to ensure that information received from third parties is accurate, complete and up to date, Waterman cannot guarantee third party accuracy;
- As noted in **Table 2.1**, it has been agreed with MEAS and LCC that a series of wintering bird surveys would be undertaken between October 2017 and January 2018 and reported during the pre-determination period.
- The assessment of construction related effects is based upon the anticipated construction programme and methodologies as provided by the project team and agreed by the Applicant (refer to **Chapter 6: Development Programme and Construction**);
- It is assumed that the design, construction and operation of the Development would satisfy environmental standards consistent with contemporary legislation, practice and knowledge as a minimum, but would also strive to achieve best practice at the time of the works where reasonable;
- A Construction Environmental Management Plan (CEMP) would be discussed and agreed with LCC after the planning application is determined, to control subsequent construction activities. The CEMP would be enforced and monitored during the construction of the Development.

2.44. Assumptions specifically relevant to each environmental topic are described where applicable in each relevant technical chapter of ES Volume 1 (this document).

Competent Experts

2.45. In line with the 2017 EIA Regulations, we can confirm that this ES has been compiled by appropriately qualified, experienced and competent experts, as summarised in Table 2.2.

Table 2.2: Summary of Competent Experts

Technical Discipline	Name	Qualifications	Experience
EIA Project Management	Gavin Spowage	BSc (Hons) Environmental and Management Sciences MSc with Distinction - Environmental Management Practitioner Member of the Institute of Environmental Management and Assessment (PIEMA)	13 years' experience of Environmental Impact Assessment, Environmental Management Plans and general environmental assessment for a variety of project types.

Technical Discipline	Name	Qualifications	Experience
Air Quality	Chris Brownlie	BSc (Hons) MSc Member of Institute of Air Quality Management Member of the Institute of Environmental Science Associate Member of Institute of Environmental Management and Assessment	Over 10 years of air quality consultancy experience. Technical expert in the use of a variety of advanced atmospheric dispersion models (including the ADMS and AERMOD suite of models) as well as screening air quality modelling methods (DMRB and WebTAG).
Noise and Vibration	Innes Urbanski	MSc Applied Acoustics BSc (Hons) Natural Environmental Sciences Member of the Institute of Acoustics Certificate of competence in workplace noise assessment	Over 15 years' experience in acoustics with extensive experience in undertaken EIAs from urban extensions, inner-city mixed use developments and industrial ports, covering scoping, outline and detailed assessments.
Townscape and Visual Impact	Jim Gibson	BSc (Hons) Geography BLD (Bachelor of Landscape Design) CMLI (Chartered Member of the Landscape Institute)	25 years' experience as a practicing landscape architect involved with Environmental Impact Assessment and the preparation of Landscape and Visual Impact Assessments (LVIAs) for a variety of project types
	Helen Johnson	BA (Hons) Landscape Architecture Batchelor of Landscape Architecture CMLI (Chartered Member of the Landscape Institute)	15 years' experience as a practicing landscape architect involved with Environmental Impact Assessment and the preparation of Landscape and Visual Impact Assessments (LVIAs) for a variety of project types
Built Heritage	Hannah Rae	BSc (Hons) Architecture MSc Historic Conservation Affliate Member of the Institute of Historic Building Conservation (IHBC) Affiliate Member of the Chartered Institute for Archaeologists (CIfA)	3 years' experience of Heritage Impact Assessments, including setting assessments, and Heritage, Townscape and Visual Impact Appraisals for a wide range of projects.
Archaeology	Susana Parker	Practitioner Member of IEMA (PIEMA) Associate Member of the Chartered Institute for Archaeologists (ACIfA)	15 years' experience of preparing Archaeological / Historic Environment Desk-based Assessments and Environmental Statement Chapters under the Town & Country Planning Act EIA Regulations.
Ground Conditions	Paul Latta	BA (Hons) Geography MSc Energy and Environmental Management Member of the Institute of Environmental Sciences	9 years' experience in contaminated land consultancy undertaking a variety of services including desk based Phase 1 assessments, ground investigation design and interpretative reporting, remediation design and verification.

Technical Discipline	Name	Qualifications	Experience
Marine Ecology, Ornithology and Terrestrial Ecology	Roger Buisson	BSc (Hons) Agricultural Chemistry PhD: Fate of chlorinated pollutants in aquatic systems Chartered Member of Chartered Institution for Water and Environmental Management Chartered Environmentalist	30 years' experience in land and water management for wild birds 15 years' experience of Environmental Impact Assessment, Habitats Regulations Assessments and Environmental Mitigation and Management Plans for infrastructure projects potentially affecting sites used by wild bird populations
	Marc Hubble	BSc (Hons) Applied Marine Biology PhD: The ecological significance of body size in tropical wrasses	15 years' experience of Environmental Impact Assessment, Habitats Regulations Assessments, Water framework Directive Assessments and Marine Conservation Zone Assessments for marine developments.
Coastal Processes, Sediment Transport and Contamination	David Sutherland	MSCi Oceanography Chartered Environmentalist (CEnv) Member of the Energy Institute (MEI)	12 years' experience of marine environmental assessment for a variety of project types in offshore renewables, oil and gas industry and coastal development. This includes offshore surveys, habitat assessments, developing Environmental Impact Assessments, the preparation of Environmental (and Social) Management Plans and the design of monitoring protocols.

References

1 HMSO, 2017, Statutory Instrument 2017 No. 571 – Town and Country Planning (Environmental Impact Assessment) Regulations 2017

2 Eurolex (2014) 'Directive 2014/52/EU Amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment

3 HMSO (2007) Marine Works (Environmental Impact Assessment) Regulations'

4 HMSO (2017) Marine Works (Environmental Impact Assessment) (Amendment) Regulations

5 HMSO (2009) Harbour Work (Environmental Impact Assessment) (Amendment) (England and Wales) Regulations

6 HMSO (1964) Harbours Act

7 Department of Communities and Local Government (March 2012) 'National Planning Policy Framework' (NPPF).)

8 Department for Communities and Local Government: Online Planning Practice Guidance (http://planningguidance.planningportal.gov.uk/blog/guidance/environmental-impact-assessment/) ID4 Updated 06.03.14

9 DCLG (2017) Guidance on Environmental Impact Assessment; updated 28 July 2017; https://www.gov.uk/guidance/environmental-impact-assessment;

10 DCLG (2006) Environmental Impact Assessment: A guide to good practice and procedures – A consultation paper.

11 Department of the Environment (DoE) (2007) 'The UK National Air Quality Strategy', HMSO, London.

3. Existing Land Uses and Activities

Introduction

3.1. This chapter provides a summary of the land uses and activities currently occurring on and immediately surrounding the Site. This includes a summary of designations and environmental conditions existing at and near to the Site, thereby identifying potentially sensitive receptors which may be affected by the Development.

3.2. A full description of the baseline conditions relevant to each assessment undertaken as part of the EIA is provided within each technical chapter (**Chapters 7 to 14**).

Overview of the Site and Surrounding Land Use

3.3. The Site falls within the administrative boundary of Liverpool City Council (LCC). It is centred on National Grid Reference 333670, 390670 and occupies an area of approximately 5.77 hectares (ha) (refer to **Figures 1.1 and 1.2).**

3.4. The Site is an irregular 'C' shape, bound by the Mersey Estuary to the west, the residential Alexandra Tower and the Princes Half Tide Dock to the north, Princes Dock and office buildings to the east and the Royal Liver Building and Water Street to the south. The current temporary 'Upper' Cruise Terminal is located adjacent to the south-east of the Site.

3.5. The northern part of the Site currently includes the derelict Princes Jetty and an area of surface car parking known as Plot 11. The Jetty and Plot 11 are separated by Princes Parade which connects to Waterloo Road in the north and St Nicholas Place in the south. A series of floating pontoons (Pontoons A to D) are located in the west and south-west of the Site. The existing 'Lower' Cruise Terminal building is located on Pontoon A (refer to **Figure 3.1**) The southern part of the Site contains the Isle of Man ferry terminal and a marshalling area associated with the cruise ship and ferry terminals. The Titanic Memorial is excluded from the Site boundary.

3.6. **Figure 3.1** shows the key existing land uses of the Site and the surrounding area.

Detailed Description of the Site

Plot 11

3.7. Plot 11 is in the north of the Site and comprises a hard-standing surface car park, currently used for short term parking. The hard-standing comprises a mixture of tarmac and cobbles with some gravel areas. A disused railway line runs through this part of the Site.

Princes Jetty

3.8. The derelict timber and concrete Princes Jetty and an area of open water occupy the north-west corner of the Site. Princes Jetty is surrounded by security fencing and is not publicly accessible. It is formed of a concrete deck supported by approximately 140 timber uprights. Two mooring dolphins are located within the open water area to the south of the jetty.

Pontoons

3.9. A series of four floating pontoons are in the south-west of the Site, forming the current Liverpool Landing Stage. The landing stage facilitates the berthing and servicing of cruise ships. There are a number of buildings and structures on the pontoons including a small building is located at the north end of Pontoon D that is currently utilised as a Pilot launch facility. The lower Cruise Terminal building and Isle of Man Ferry Terminal are also located on the southern pontoons. The pontoons are connected to Princes Dock by a number of link bridges providing pedestrian and vehicular access.

Southern Area

3.10. The south part of the Site contains a marshalling area and the Isle of Man ferry terminal along with a small surface car park. An area of soft landscaping and the Grade II Listed Titanic Memorial is in this area but is specifically excluded from the Site boundary. A subterranean section of the Liverpool Canal Link runs beneath the car park.

Access Roads

3.11. The Site is accessed from St Nicholas Place in the south-east. St Nicholas Place runs westwards through the south of the Site before turning north to become Princes Parade. Princes Parade forms the eastern boundary of the Site as it runs northwards before it bisects Princes Jetty and Plot 11. It then turns to the east in the north of the Site, eventually linking with Bath Street at the north-east corner of the Site.

3.12. As noted above, link bridges provide vehicular access from Princes Parade to the pontoons for service vehicles to access the cruise ships.

Key Environmental Characteristics

Air Quality

3.13. LCC has designated the whole City of Liverpool as an Air Quality Management Area (AQMA) owing to exceedances of the National Air Quality Strategy objective for annual mean nitrogen dioxide (NO_2). Consequently, the Site is located within the AQMA. An Air Quality Action Plan has been produced by LCC, setting out the policies and measures to be implemented to improve air quality in the City.

3.14. Further details are included within **Chapter 7: Air Quality**.

Noise and Vibration

3.15. The dominant noise source is road traffic noise primarily from Bath Street to the east and to a lesser extent Waterloo Road to the north-east. Noise associated with wave action within the Mersey Estuary is a noise source at night with intermittent contribution from human activity. There are no significant sources of vibration at the Site.

3.16. Although the Site and surroundings are predominantly urban and commercial in nature, there are a number of noise sensitive receptors. These include:

- The residential Alexandra Tower adjacent to the north;

- The residential 1 Princes Dock ('City Lofts') adjacent to the north-east;
- The Malmaison hotel approximately 125m to the east; and
- The commercial Princes Dock Offices at 12 Princes Parade adjacent to the east.

3.17. Further details are provided within **Chapter 8: Noise and Vibration**. Potential effects to residents of buildings in the vicinity of the Site which currently have planning consent but have not been constructed yet are assessed in **Chapter 15: Cumulative Effects**.

Townscape, Views and Built Heritage

3.18. The Site is visible from various locations within Liverpool City Centre and from areas of Wallasey and Birkenhead on the other side of the Mersey Estuary. The southern section of the Site is located within the 'Liverpool Maritime Mercantile City' World Heritage Site (WHS) and the rest of the Site is within the WHS's buffer zone.

3.19. The southern portion of the Site, along part of Princes Parade and St Nicholas Place, is located within the Castle Street Conservation Area. The north-east portion of the Site is adjacent to the Stanley Dock Conservation Area.

3.20. The Memorial to Heroes of the Marine Engine Room (Grade II* Listed) is located within the southern section of the Site, but is excluded from the Site boundary. No listed buildings are located within the Site boundary.

3.21. The Site within the setting of a group of nationally significant listed buildings, collectively known as the Three Graces:

- The Royal Liver Building (Grade I Listed), approximately 50m south of the Site;
- The Cunard Building (Grade II* listed), approximately 125m south; and
- The Port of Liverpool Building (Grade II* Listed), approximately 200m south.

3.22. To the west of the Three Graces is a group of listed monumental statues including:

- Monument to Sir Alfred Lewis Jones (Grade II Listed);
- Monument of Edward VII (Grade II Listed);
- War Memorial in front of Cunard Building (Grade II Listed); and
- Merchant Navy War Memorial (Grade II Listed).

3.23. The derelict Princes Jetty is a non-designated heritage asset because of its historical uses.

3.24. For further details refer to **Chapter 9: Townscape and Visual Impact** and **Chapter 10: Built Heritage**.

Archaeology

3.25. As noted above, the Site includes the non-designated Princes Jetty which is the only surviving element of the original Liverpool Landing Stage, where historically many thousands of people embarked for emigration to North America.

3.26. The northern end of Princes Dock is the site of a former eighteenth-century fort and the Site has the potential to contain palaeo-environmental and riverine deposits from Prehistoric to the present day. Further details are presented in **Chapter 11: Archaeology**.

Ground Condition and Contamination

3.27. Geological maps for the area indicate the anticipated geology underlying the Site is likely to comprise Made Ground of a depth of up approximately 13m, underlain by Tidal Flat Deposits and Glacial Till. These are underlain by the Chester Pebble Beds Formation at depth.

3.28. Historically, the Site has been in use as docks from at least the 1850s where historical mapping indicates substantial modification to the banks of the Mersey Estuary that the Site is located on. Historical uses of the Site are primarily associated with the docks and include warehouses and a railway. Two dock basins, located in the southern section of the Site, appear to have been infilled in the 1890s. By the 1990s all building on Site had been demolished. The historical uses of the Site represent potential sources of contamination the underlying soils and groundwater.

3.29. For further details refer to **Chapter 12: Ground Conditions and Contamination**.

Ecology

3.30. The Site is not located within any current designated sites. However, it is located within an area of the River Mersey which is currently under consultation to be included in the Liverpool Bay Special Protection Area (SPA) which is notified for the bird species it supports such as common tern *Sterna hirundo* and little gull *Hydrocoloeus minutus*.

3.31. Other designated ecological sites within 10km of the Site include:

- The Mersey Narrows and North Wirral Foreshore Ramsar site, SPA and Site of Special Scientific Interest (SSSI), approximately 800m to the west of the Site (on the opposite side of the Mersey);
- The Dee Estuary Special Area for Conservation (SAC), approximately 4.2km north-west
- The Mersey Estuary SPA, approximately 5.3km to the south-east;
- The Sefton Coast SAC and SSSI, approximately 6.3km north; and
- The Ribble and Alt Estuaries Ramsar site and SPA, approximately 6.4km north.

3.32. On-site habitats are considered to be of generally low ecological value.

3.33. Further details on the ecology of the Site and the surrounds can be found in **Chapter 13: Ecology**.

The Mersey Estuary

3.34. The River Mersey flows west towards Liverpool and becomes tidal at Howley Weir. The River Weaver also enters at the head of the estuary. The estuary has a total area of approximately 8,900ha, of which approximately 5,600ha are intertidal sandflats and mudflats.

3.35. The Site is located within 'The Narrows' section of the estuary which extends from Dingle Point to New Brighton. The section is comprised of a narrow (1.5 km wide) entrance channel which is bounded by sandstone outcrops at New Brighton and Liverpool. The Narrows stretch for a distance of approximately 10km with a mean depth of 15m, although it may exceed 20m in certain areas.

3.36. Dredging has been, and continues to be, required in this section of the estuary to maintain water depths in the navigation channels and docks. The water depths in the immediate vicinity of the Site are less than 10m. Towards the main estuary channel, the water depth increases rapidly to between 10 and 11m immediately offshore of the Site. The water depths continue to increase to between 11 and 15m in the centre of the navigational channel.

4. Alternatives and Design Evolution

Introduction

4.1. This chapter, prepared by Waterman in conjunction with the project architects (Stride Treglown) and planning consultants (Jones Lang Lasalle) describes the main alternatives, considerations, opportunities and constraints that have influenced the design of the Development.

4.2. Under the Town and Country Planning (Environmental Impact Assessment) Regulations 2017[1] (the 'EIA Regulations'), an ES is required to provide:

"*a description of the reasonable alternatives studied by the developer, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment*."

4.3. Accordingly, this chapter describes the main alternatives to, and design evolution of, the Development that have been considered by the Applicant and the design team. Key reasons which have led to the final Development are also summarised.

Alternatives to the Development

Alternative Locations

4.4. The Applicant is proposing the replacement of the existing cruise terminal facilities in the south of the Site and adjacent to the south-east of the Site with a new integrated purpose-built facility.

4.5. The existing cruise ship facility consists of a permanent landing stage and 'lower' passenger reception terminal together with a temporary baggage hall, identified as the 'upper' cruise terminal on **Figure 3.1**. As the existing temporary baggage hall is not adequate to cater for the projected growth in passenger numbers over the next decade, the Applicant is proposing to build a new single larger purpose-built cruise ship terminal building to consolidate all operations including a baggage hall.

4.6. This new terminal building must be as close as possible to the existing permanent landing stage for passenger convenience. Ideally, the location should include an area suitable for passenger pick-up and drop-off.

4.7. An options appraisal carried out on behalf of the Applicant[2] identified the key drivers for considering a location for the Development were:

- Proximity to the existing landing stage;
- Amenable river conditions;
- Land ownership;
- Likely cost of delivery;
- Likely delivery timescales; and
- Ensuring the optimum cruise experience for passengers.

4.8. The options appraisal concluded that the existing temporary baggage hall and the undeveloped Plot 11 are not large enough to accommodate a new terminal building and would require passenger walkways over Princes Parade exacerbating technical difficulties with levels and walkway gradients. This option was therefore discounted.

4.9. In considering alternative locations to the north, it is noted that the Liverpool Waters Masterplan outline planning permission (10O/2424) allows for a cruise liner terminal to be located within the Central Docks area, approximately 250m north of Princes Jetty. Therefore, other locations in the

Liverpool Waters Masterplan areas have not been considered. Liverpool City Council have concluded that a cruise terminal location any further north than the existing Princes Jetty would not be suitable for its needs due to technical difficulties with site levels, walkway gradients and the prohibitive distance that passengers would have to travel from the cruise ships at the existing landing stage to the terminal facilities.

4.10. The Applicant requires the new cruise ship terminal facilities to be as close as possible to the existing landing stage and to be delivered by mid-2020 to meet expected demand. Locations further to the north were therefore discounted.

4.11. Locations to the north and south of the Site are constrained due to being within the Liverpool Maritime Mercantile City World Heritage Site (WHS). Locations to the south of the Site generally have environmental constraints such as proximity to buildings of high heritage value (e.g. the Cunard and Liver Buildings).

4.12. Princes Jetty therefore emerged as the most appropriate location for the proposed Development. It affords the opportunity to remove the derelict jetty and replace it with new, fit-for-purpose infrastructure. It avoids the WHS (although it is within the WHS's buffer zone) and is sufficiently removed from the cluster of listed buildings to the south of the Site (refer to **Chapter 10: Built Heritage**). For these reasons, therefore, the Applicant has settled on the proposed location for the cruise ship terminal.

The 'No Development' Scenario

4.13. 'No Development' would entail leaving Princes Jetty in a state of dereliction with consequent negative effects in terms of visual impact and health and safety implications. It would also mean that Liverpool would not be able to accommodate the predicted rise in cruise ship passenger numbers or the larger models of cruise ship that could otherwise access the city. For these reasons, the 'no-development' scenario was not considered to be a viable option for the Applicant.

Design Evolution

4.14. Thirteen design and engineering options were considered by Ove Arup & Partners[3] which concluded that a new cruise terminal at Princes Jetty would be the most appropriate location. The project engineers, Ramboll, have subsequently concluded that the new cruise terminal should be constructed on a new suspended deck structure, rather than a new quay wall structure, at a suspended deck would have fewer adverse effects on the water environment. In addition, a suspended deck would have a shorter construction programme and would be comparatively low maintenance.

4.15. The scheme architects, Stride Treglown, have undertaken an analysis of the Site and its context. The result of this analysis was the development of the following principle features and aims for the design of the new cruise ship terminal:

- Provide a clear entry point for visitors, with safe crossings where necessary;
- Create a welcoming atrium;
- Entice visitors up to the first floor, and then maximise the views;
- Install a publicly accessible cafe above the old jetty – a great place for 'meeters and greeters' to wait for their passengers whilst enjoying the view;
- Lead passengers through a controlled flow, with a 'pre-check' area which gives a first glimpse from the building to the ship;

- Frame a view of the Pier Head area at the south end of the new terminal – to create dialogue with other buildings in the area and to provide a new 'picture' of the evolving city centre;
- Design the building with flexibility to accommodate other year-round uses, such as weddings, parties, conferences and exhibitions;
- Orientate disembarking passengers & create an exciting gateway into the city;
- Provide an interesting link between the historic centre, Princes Dock and the Liverpool Waters developments to the north;
- Minimise conflict between vehicles and pedestrians, by installing holding areas and a one-way route for HGVs and commercial vehicles 'behind' the terminal;
- Use quality materials;
- High quality public realm; and
- Reuse of existing materials from the Jetty in the new terminal.

Indicative Design Options

4.16. The analysis of the Site and its context have led to two indicative design options currently being considered. These two indicative designs are presented as **Figures 4.1** and **4.2**. These figures are adapted from information provided at the recent public consultation events for the proposed Development.

4.17. It is important to note that neither of these two indicative options are being specifically assessed within this EIA process. As explained in **Chapter 2: EIA Methodology**, the EIA assesses a series of 'parameters' within which a final detailed design will emerge in due course. The parameter plans which are being assessed in this EIA are presented and explained in **Chapter 5: The Proposed Development**.

4.18. Option 1 (**Figure 4.1**) is a modern interpretation of the buildings previously occupying Princes Dock. Large-footprint low-rise structures with repetitive roofscapes, such as Liverpool Riverside railway station (which was demolished in the 1990s), gave the area a horizontal emphasis. This direction has been gradually evolving to the vertical, with several nearby high-rise projects completed and others proposed. Option 1 would therefore create a lasting reference to the past roofscape and uses of Princes Dock and of the wider city centre waterfront area, legible on the city skyline.

4.19. Option 2 (**Figure 4.2**) is influenced by Princes Jetty itself, with references to the structure as well as the movement of the marine environment. The strong, simple roof form twists across the building, with it lowering in proximity to the existing Alexandra Tower. Angled views are afforded at either end of the building – to highlight to the visitor the outbound route, and the point of departure. Layered in front of the west facing window are a series of panels to provide solar shading. Their pattern references the existing structures of Princes Jetty and the dock wall.

Public Consultation Events

4.20. Public consultation events to present the proposals were undertaken in the Cunard building on 20th and 21st September 2017 to encourage feedback from interested members of the public on the emerging designs. The pubic were able to leave comments via forms that were available at the event. A total of 96 completed comments forms were received at the exhibition as well as one email response. 100% of the people who responded said that they supported the proposal in principle and all but one said that they thought a permanent cruise terminal would be of benefit to the area.

4.21. A full summary of the consultation comments received and the response from the design team is contained within the Consultation Statement prepared by Jones Lang Lasalle and submitted separately in support of the planning application.

References

1 HMSO (2017); 'Statutory Instrument No. 571 - Town and Country Planning (Environmental Impact Assessment) Regulations 2017'.

2 Ove Arup & Partners Ltd (2016): Liverpool City Council Cruise terminal Liverpool, RIBA Stage 2 – Cost Saving, VE and Alternative Site Assessment, December 2016

3 ibid

5. The Proposed Development

Introduction

5.1 This chapter provides a description of the proposed Development which is defined in the planning application forms as follows:

"Full planning application for the controlled dismantling and removal of the building shown on the Demolition Parameter Plan (Plan No 2), redundant mooring dolphins and dilapidated structures including the (timber framed and concrete decked) Princes Jetty in the River Mersey and;

Outline planning application for the construction of a new Cruise Liner Terminal (to cater for an increase in the number of cruise passengers) on a suspended deck structure in the River Mersey at the Princes Jetty site, together with the erection of a vehicular link span bridge and pedestrian bridge/ walkways (linking the new cruise terminal building and existing floating pontoons which act as the landing stage/berth for cruise ships, naval ships, working ships and prestige vessels); improvements to the existing landing stage (floating pontoons), including modification of existing buildings shown on the Demolition Parameter Plan (Plan No 2) and creation of an ancillary building for storage and for use by cruise related operational staff; improvements to Princes Parade to incorporate pedestrian crossing facilities, provision of terminal parking, pickup and drop off facilities, and supporting development. The new cruise terminal building is intended to be used for city events when not in use for its primary cruise operations/ port related purposes. All matters are reserved."

5.2 A summary of the proposed demolition and construction sequence and programme of works is provided separately in **Chapter 6: Development Programme and Construction**.

Overview of the Proposed Development

5.3 The Applicant is seeking planning consent, a Marine Works Licence and a Harbour Revision Order to construct a new cruise liner terminal facility and supporting infrastructure to replace the existing temporary cruise terminal. The main elements of the proposed Development comprise:

- Demolition of buildings and structures, including the controlled removal of Princes Jetty;
- Construction of a new landing stage and suspended deck;
- Construction of a cruise liner terminal building;
- Modification of the existing cruise liner terminal building to accommodate cruise related ancillary uses, including staff facilities and storage, on completion of the new cruise liner terminal;
- Terminal parking, pickup and drop off facilities;
- Erection of a vehicular and pedestrian linkspan bridge (linking the new terminal building and the existing pontoons); and
- Erection of a passenger boarding bridge.

5.4 The physical characteristics of the proposed Development are set out in a series of Parameter Plans which are being submitted to Liverpool City Council for approval (refer to **Figures 5.1 to 5.5**). These Parameter Plans set out, amongst other things, the location and maximum buildable envelope of the proposed built elements within the Site. The details of the proposed Development's appearance, including fixed building heights and footprints, are reserved for future detailed approval. Elements of the detailed design would be submitted for approval as part of future reserved matters applications and would accord with the relevant Parameter Plans.

5.5 The Parameter Plans submitted as part of the planning application and on which each of the technical assessments within this ES are based comprise:

- Maximum Building Footprint and Heights (**Figure 5.1**);
- Demolition Plan (**Figure 5.2**);
- Movement and Access Plan (**Figure 5.3**);
- Development Parcels Plan (**Figure 5.4**); and
- Site Context Plan (**Figure 5.5**).

5.6 The development of the existing Liverpool cruise liner terminal over the past decade, including the temporary cruise facility at Plot 7, Princes Parade to the south of the Site, has coincided with a large increase in cruise ship and passenger numbers. The existing facility is also used by vessels associated with offshore wind farm development and maintenance, the Royal Navy and foreign naval vessels.

5.7 The Applicant has now identified the pressing need to provide a new permanent facility to accommodate the predicted continued rapid increase in cruise ships visiting Liverpool while maintaining the facilities required by the other types of vessel listed above. Following a recent options appraisal, Princes Jetty in the north-west of the Site has been identified as the appropriate location for the proposed Development.

5.8 The various separate built elements of the proposed Development are described later in this chapter. The primary use of the proposed Development would be the berthing of cruise ships, generally from March through to November, to accommodate the predicted growth in this sector. Additionally, at appropriate times throughout the year and particularly during the off-season, it is proposed to use the new terminal building as conferencing and exhibition space.

5.9 The Development has been designed to ensure the required level of service throughout its operating lifetime. For example, consideration has been given to potential conflicts with the Isle of Man Ferry which currently has its terminal in the south-west of the Site (refer to **Figure 5.5**), if that terminal's planned relocation to a site adjacent to the north of the Site does not occur prior to the opening of the proposed Development.

Overview of Proposed Demolition and Construction

5.10 Refer to **Chapter 6: Development Programme and Construction** for a fuller description of the demolition and construction proposals. The following sections provide an initial overview.

5.11 The buildings and structures to be demolished are identified in **Figure 5.2**. They comprise:

- Princes Jetty: To facilitate the construction of the new terminal building, the existing Princes Jetty structure must be removed. The jetty is currently in a state of disrepair and is unsuitable for safe berthing of vessels;
- The building on Pontoon D; and
- Mooring dolphins between Princes Jetty and Pontoon D.

5.12 The new terminal building would be located in the north-west corner of the Site (refer to **Figure 5.4**) on top of a new suspended deck structure constructed over the River Mersey. The deck would comprise reinforced concrete slabs supported on a grid of precast reinforced concrete beams that would in-turn be supported on steel tubular piles. The pile layout would be coordinated with the new terminal building so that they would support the deck and also act as foundations for the new building.

5.13 It is anticipated that the Site's construction compound would be primarily located on Plot 11 (as indicated on **Figure 5.5**) for most of the construction programme.

Description of the Proposed Development

5.14 **Figure 5.1** shows the maximum footprint and height of the proposed terminal building in the north-west of the Site and the location of the proposed vehicular and pedestrian linkspan bridges. **Figure 5.4** shows the proposed allocation of land use across the Site.

Proposed Cruise Ship Operations

5.15 There would be two types of cruise liner visit:

- Transit (or 'Port of Call') relates to cruises berthing at Liverpool Cruise Terminal to allow passengers to have a day trip ashore locally or beyond.
- Turnaround:
  - Turnaround disembarkation relates to a cruise ship berthed to allow passengers to leave the ship at the end of their cruise (and to replenish ship's stores). This generally takes place in the morning.
  - Turnaround embarkation relates to the same cruise ship remaining berthed to allow passengers to board the ship at the start of their cruise. This generally takes place in the afternoon to avoid overlapping with the disembarkation operations.

5.16 The hours of operations for the proposed Development would remain as existing for the processing of passengers, crew management and security. During non-cruise days, there would be a small number of staff on-site (security etc) operating a standard working day (9am to 5pm).

5.17 Typical hours for turnaround activities would be a 3-hour disembarkation period in the morning (typically between 8am and 11am) and a 4-hour embarkation period in the early afternoon (typically between 12pm and 4pm), although these would vary depending on navigational factors.

5.18 When a cruise ship calls in to Liverpool, passengers on a day trip ashore would be allowed to disembark from 7am with all passengers back on board by 7pm. The majority would board coaches which would leave between 7.30am and 9.30am with the remainder being foot passengers and some limited taxis concentrated in the same period in the morning. Returning passengers would, however, be spread over the day.

5.19 **Table 5.1** sets out the current estimates for the number of cruise vessels predicted to visit the proposed Development per year in 2020 (the predicated year of opening) until 2027. The season would last from March to November and peak-season would be July and August. These figures have been used for the purposes of assessment within the technical chapters of this ES.

Table 5.1: Estimated Cruise Liner Visits 2020-2027

Year	Estimated Transit Vessels	Estimated Turnaround Vessels			Estimated Total Passengers
		Medium	Large	Extra-Large	
2020	37	10	19	1	84,000
2021	38	8	19	4	86,000
2022	39	8	20	4	110,000
2023	39	8	22	5	130,000
2024	40	8	24	6	140,000
2025	42	8	24	6	155,000

Year	Estimated Transit Vessels	Estimated Turnaround Vessels			Estimated Total Passengers
		Medium	Large	Extra-Large	
2026	42	8	24	6	160,000
2027	42	8	24	6	170,000

Cruise Liner Terminal Building

5.20 The Cruise Liner Terminal Building would be built on the suspended deck described above. It would be a predominantly two-storey building comprising:

- Baggage x-ray area;
- Baggage hall;
- Customs area;
- Ground floor entrance atrium and departure lounge; and
- Café at 1st floor level.

5.21 It is proposed to use the terminal building for city events including, but not limited to, conferences and exhibitions when the Development is not in use for its primary port related purposes.

5.22 As indicated on **Figure 5.1**, the terminal building would have a maximum height of 30m above Ordnance Datum (AOD) across most of its footprint, with a maximum height of 24m AOD at the north-east and south-west corners. The detailed design of the terminal building would not exceed the maximum buildable volume denoted by the footprint and height parameters shown on **Figure 5.1**. Options for the detailed design of the Cruise liner Terminal Building are set out in the Design and Access Statement submitted separately in support of the planning application.

Vehicle Linkspans and Pedestrian Walkways

5.23 As shown on **Figure 5.1**, a vehicular link bridge (a 'linkspan') would connect the new suspended deck with the retained floating pontoons to the south. The linkspan would float to adjust for tidal variations and would be supported by a dedicated support pontoon at the southern end. The northern end of the vehicular linkspan would be supported from the new suspended deck.

5.24 To segregate pedestrians from the vehicle access area and ensure a smooth transition of passengers to the varying deck levels of the cruise ships, a pedestrian walkway would be provided as part of the vehicular linkspan.

5.25 A hinged walkway bridge would connect the cruise terminal building to a fixed walkway which would provide access to the cruise ships. The high-level walkway would have a minimum headroom clearance of 5.3m above pontoon deck level to allow safe passage of vehicles beneath.

5.26 At this stage, it is anticipated that the form of construction for the link-bridge and walkways would be structural steel warren trusses with glassed side walls on each side and a solid roof.

Mooring and Berthing Infrastructure

5.27 The two existing mooring piles between the existing timber jetty and Pontoon D would be removed and replaced. At this stage, it is considered likely that there would be one replacement mooring pile, and the potential for two additional berthing piles. These piles would be located in the same approximate location as the two existing mooring piles.

Existing Terminal Building

5.28 As indicated on **Figure 5.4**, once the new terminal building is in operation, the existing 'lower' terminal building on Pontoon A would be modified for cruise-related ancillary uses including storage and operational staff facilities.

Access and Parking

5.29 The following sections provide a summary of the proposed transport infrastructure and parking provision at the Site. More information is provided in the standalone Transport Assessment submitted in support of the planning application.

Means of Access

5.30 Access to the cruise terminal would be similar to the existing arrangements, with vehicles accessing the Site either from Bath Street / Waterloo Road to the north or St Nicholas Place to the south.

5.31 Cruise passengers would use a variety of transport modes to access the Site, including private vehicles, valet parking ('Meet & Greet'), coaches, shuttle buses and taxis. Aside from the coaches which would use off-road coach bays alongside the terminal frontage, a dedicated passenger pick-up / drop-off area would be provided on land opposite the new terminal building, known as Plot 11, to serve other modes of transport to the terminal (refer to **Figure 5.4**).

5.32 As shown on **Figure 5.3**, the principles of access and movement to and from the terminal building have been developed to minimise conflicts between foot passengers crossing Princes Parade between the terminal building and the passenger pick-up / drop-off area. Similarly, routing the service and delivery vehicles along the pontoons in the south-west of the Site would ensure that potential conflicts between terminal users and road users along Princes Parade are minimised.

5.33 Along with a booked slot system for passenger arrivals and departures, it is expected that Intelligent Transport Systems in the form of static signage, variable message signs and/or operational control systems and management would be developed to ensure that terminal traffic is managed with limited impact on the local public highway and along Princes Parade. Taxis would operate a call-forward system and real-time information for shuttle buses and advance information for drop-off / pick-up vehicles would also enable the efficient use of the passenger pick-up / drop-off area.

On-Site Parking Provision

5.34 Twelve coach bays would be provided as chevron bays along the frontage of the terminal building on Princes Parade. An additional eight coach bays would be provided within the passenger pick-up/ drop-off area. This area would also include up to 60 spaces for drop-off and pick-ups by private vehicles and 12 spaces for taxis. There would also be up to three bays for shuttle buses linking with the off-site long-term designated car park(s).

Off-Site Long Term Parking

5.35 There would be no long-term parking for passengers provided within the Site. Passengers wishing to park for the duration of their cruise would be required to use public car parks as is the case at present. There are currently a number of car parks designated for cruise passengers and these would remain for the new terminal. In addition, a new site for up to 1,800 car parking spaces has been identified by Liverpool City Council on land off Sherwood Road which would accommodate the demand from the new terminal in the long-term. The existing and new designated car parks would be served by the shuttle buses linking with the passenger pick-up / drop-off area. Off-site long term parking does not form part of the proposed Development.

Public Transport

5.36 Princes Dock is currently adequately served by public transport services. No improvements or changes to the existing public transport infrastructure and services are proposed as part of the proposed Development.

Pedestrians

5.37 Foot passengers would be required to cross Princes Parade to move between the terminal building and the pick-up / drop-off area. A section of Princes Parade opposite the terminal building entrance would therefore be remodelled as a shared space to prioritise pedestrians over vehicular traffic.

5.38 Only foot passengers disembarking during Turnaround would have the potential to conflict with peak hour vehicular traffic along Princes Parade. It is not proposed to provide a signalised crossing as this would be obsolete for most the time. Nevertheless, at times of high demand it is expected that cruise terminal staff would manage the crossing to ensure the safety of all users.

5.39 For foot passengers wishing to access the terminal by foot (e.g. on Transit days while visiting the city), the existing wide footway along Princes Parade would ensure an adequate and safe route to and from the terminal building. This footway links to existing controlled crossings on the public highway network, including at the St Nicholas Place junction.

Servicing and Deliveries

5.40 Access onto the pontoons would operate as a one-way system in the northbound direction with vehicles exiting onto Princes Parade at a point north of the new terminal building. Whilst there would be no physical restriction to travel in any direction along Princes Parade, it is expected that commercial vehicles on site during berthing would exit north to avoid conflicting with foot passengers crossing Princes Parade.

Landscape, Open Space and Public Realm

5.41 The proposed Development would be at approximately the same level as existing (typically 7.55m AOD). The public realm would be designed in order to provide street level access from the passenger pick-up / drop-off area.

5.42 The Design and Access Statement, submitted separately in support of the planning application, sets out the landscape design principles for the proposed Development. These provide guidance on design aspects such as the streetscape, materials and surfaces, street furniture, trees and planting for the Site.

5.43 The design principles include using the same paving materials as elsewhere around Princes Dock, reusing materials currently existing on-site, particularly those with a historical link to the dock, and having natural stone as the dominant surface material (granite and sandstone), simply and neatly detailed, incorporating discrete drainage and other street furniture.

Drainage Infrastructure

Surface Water

5.44 It is anticipated that surface water from the all areas other than highways areas would be discharged directly to the River Mersey, via interceptors and pollution abatement controls as appropriate. The most sustainable way to drain surface water runoff is through the use of Sustainable Drainage Systems (SuDS). As the Site is located adjacent to and over the River

Mersey, which is a tidal waterbody at this location, there are no requirements to restrict surface water discharge.

5.45 Appropriate treatment would be incorporated using SuDS to ensure that the quality of water discharged is acceptable. Due to the nature of the proposed jetty deck structure, there is limited space and depth for many of the SuDS devices potentially available. Treatment could be achieved through the incorporation of permeable asphalt used in conjunction with a shallow permavoid system fitted with a biomat filtration system (or similar treatment device). The various options are discussed in more detail in the standalone Flood Risk Assessment report submitted in support of the planning application. The final strategy would be confirmed at the detailed design stage.

Foul Water

5.46 It is expected that foul water drainage would be connected to the existing private foul network which runs adjacent to the Site in Princes Parade. It is not anticipated that foul water from vessels would be discharged in to the landward sewerage system.

Energy and Sustainability

Sustainable Design Options

5.47 At this early stage in the design process, the following sustainable design features are planned for the final detailed design of the proposed Development:

- A high standard of thermal performance for the building fabric;
- Use of thermal mass where the architecture allows, to maximise the time lag between incident solar gain and penetration into the occupied space;
- A fenestration area that is sympathetic to cooling load reduction whilst maximising the passage of natural daylight;
- The use of high specification solar glazing which reduces solar energy transmission but allows sufficient natural light through to the building interior;
- Provision of external solar shading, reducing solar gain but enable day light transmission;
- A high standard of air tightness for the building envelope, potentially to a design target of around 3m^3/hr at 50Pa;
- High efficiency heat recovery on mechanical air handling systems via thermal wheels;
- Occupancy / CO_2 / temperature control of ventilation rates by use of variable air volume where appropriate;
- Variable speed supply and extract air distribution systems designed to minimise fan energy consumption and specific fan power which requires larger air handling units and lower velocity ductwork systems;
- Variable speed low temperature hot water heating pipework distribution systems to minimise pump energy consumption;
- Naturally ventilated baggage hall (where possible);
- Use of low energy luminaires;
- Provision of lighting controls to minimise energy usage in unoccupied spaces;
- Daylight dimming to certain areas to reduce the artificial light output when daylight levels permit;
- Automatic metering and targeting system;

- Building management system;
- Selection of low water usage sanitary appliances;
- Provision of rainwater harvesting;
- White goods and fixed equipment with “A” rated energy performance;
- Circular sliding doors (or lobbies) with door air curtains; and
- Lifts specified with regenerative drives.

5.48 Further details are presented in the Energy Statement produced by Ramboll and submitted as a standalone document in support of the proposed Development.

Electricity

5.49 An electrical supply would be required for the proposed Development. The electrical demand of the cruise terminal building is not known at this early stage of the design process although the Energy and Sustainability Statement submitted in support of the planning application sets out possible options for energy efficiency and low carbon technologies. It is understood that Princes Dock currently has limited electricity capacity. Off-site work to nearby transformer stations may therefore be required to provide a suitable power connection.

Shore-Side Power

5.50 The current facility does not provide any electricity for moored vessels. The proposed Development would allow future installation of shore-side power.

Gas

5.51 The final energy strategy for the proposed Development may include the provision of natural gas to the terminal building as part of the heating strategy. If required, the new connection would be into the existing National Grid low pressure mains in Princes Parade.

Other Utilities

Water

5.52 A new potable water connection would be provided to the terminal building from United Utilities. It is anticipated that the Development would be supplied from an existing water main located in Princes Parade. However, further discussions would be held with United Utilities to determine whether any network reinforcement would be necessary.

Shore-Side Water

5.53 The potable water required to replenish moored vessels would be provided via existing facilities. As such, the new terminal building’s water supply would be based upon building use only.

Telecommunications

5.54 Telecommunication and broadband infrastructure would be required for the new terminal building. It is expected that existing connections in Princes Parade would be utilised.

External Lighting

5.55 The external lighting proposals would be designed in accordance with Liverpool City Council’s lighting policies. Detailed lighting strategies would be developed with the agreement of Peel Ports

and LCC to ensure that any navigational risks are minimised or eliminated and measures to minimise obtrusive or nuisance light are incorporated.

5.56 It is envisaged that the existing lighting column and luminaire design used at the existing cruise ship terminal would continue along Princes Parade and the dock edge to the new terminal to provide continuity. The lighting design would be compliant with the Lighting Against Crime criteria (by Secured By Design).

6. Development Programme and Construction

Introduction

6.1. This chapter, which has been prepared with input from the Project Engineers (Ramboll), sets out the proposed programme of the demolition, modification and construction works for the Development (hereafter referred to as 'the Works') together with the key activities that would be undertaken on the Site. The likely significant environmental effects associated with the Works are briefly set out, together with a summary of the proposed mitigation measures, where necessary. Detailed assessments of the likely significant environmental effects resulting from the Works are presented in **Chapters 7 to 14** of this Environmental Statement (ES).

6.2. Planning for demolition and construction is necessarily broad at this stage and may be subject to modification. For example, specific construction activities could vary in frequency depending upon the particular stage of works, seasonal constraints that may result in programme change, and the availability of construction equipment. However, it is considered that sufficient planning has taken place at this stage to enable the likely significant environmental effects relating to the Works to be identified and assessed and that the mitigation measures identified are sufficiently flexible to be applicable to modifications of the Works. In addition, where uncertainty exists, the assessments have assumed a reasonable 'worst-case' situation.

6.3. There are a number of other proposed schemes in the vicinity of the Site whose demolition and construction activities may overlap with that of the Development. Should this be the case, all necessary measures would be taken to ensure the close liaison and co-ordination between all parties involved as and when other schemes emerge. This is considered in more detail in **Chapter 15: Cumulative Effects**.

Programme of Works

Approximate Duration of the Works

6.4. For the purposes of assessment, it has been assumed that the Works would commence in Quarter 1 of 2018 and would be undertaken in a phased manner over approximately 24 months. Completion is therefore estimated to be in the first quarter of 2020.

Sequence, Outline Programme and Summary of Works

6.5. An indicative programme for the Works is presented in **Table 6.1**. Although the exact dates may vary, the estimated period would still apply as an indication for each element / activity of the Works. In addition, it is likely that some of the activities listed in **Table 6.1** would overlap. **Table 6.1** lists the main activities associated with the Works and also provides approximate programme durations for each activity.

Table 6.1: Sequence, Outline Programme and Summary of Works

Activity	Approximate Duration* (months)
Pre-commencement surveys	1
Service diversions/incoming connections – external/site boundary	4
Enabling works (service diversions/temporary works)	2
Mobilisation, demolition and site clearance	6
Suspended deck piling & main beams (marine works)	5

Activity	Approximate Duration* (months)
Secondary beams and slabs (marine works)	5
Building steel frame (Terminal building)	3
First floor slab	2
Roof and envelope	3
Partitions and builders work	3
MEP fit-out	4
General fit-out	5
External works	4
Commissioning and handover	3
Total Duration	**24**

** These activities are not necessarily sequential and some would overlap or be concurrent.*

Description of the Works

Pre-Commencement Surveys

6.6. Prior to commencement of intrusive site works, building and structure recording surveys of Princes Jetty and Princes Dock would be undertaken, as well as structural surveys. In addition, it is likely that a detailed utilities and services survey including penetrating radar would be required.

Service Diversions

6.7. Any existing utilities and other services identified as being problematic to the Works would be diverted as necessary prior to the Works commencing. The need for such diversions is generally due to services being found to encroach beneath the footprint of the proposed building works. In addition to any diversion works, existing services entering the Site that are redundant would be appropriately terminated and capped.

Enabling Works

6.8. Prior to setup of the Site, the project team would engage with all stakeholders to discuss the detailed sequence of Works. Feedback from meetings would be used to develop detailed strategies for managing the Site, public interface and for minimising any potential environmental and other detrimental impacts on the neighbourhood, stakeholders, and the wider public.

6.9. In advance of the Works, the Site would be secured by the installation of a perimeter hoarding with both vehicle access gates and card-operated turnstiles for the workforce incorporated at the locations agreed with Liverpool City Council (LCC). It is anticipated that the hoarding would comprise a 2.4m high close boarded and painted structure, or similar.

6.10. A temporary Site office and compound including staff welfare facilities are anticipated to be located on the Plot 11 area (refer to **Figure 5.5**). Security guards would be employed and CCTV installed to monitor the access gates and the Site perimeter. These measures would be maintained and kept in good order for the full duration of the Works.

6.11. Vehicle off-loading bays including wheel wash facilities if necessary would be established having been agreed in advance with LCC.

6.12. Prior to the commencement of key stages of the Works, it may be necessary to adjust or realign small parts of the Site perimeter. Any amendments to the alignment of the hoarding would be agreed in advance with LCC. The hoarding and other facilities previously described would continue to be maintained in a good condition throughout the works.

Demolition and Dismantling

6.13. The existing concrete-decked Princes Jetty is to be deconstructed and removed. Due to the condition of the existing structure it is anticipated that these works would predominantly take place from within the Mersey Estuary using barges. Once the Jetty has been removed it is anticipated that the existing timber piles shall be removed from the river bed. (It may be that it proves impossible to remove all the existing timber piles. The new piles to support the new jetty will therefore be positioned to avoid the existing timber piles. If the piles can't be appropriately repositioned, the old piles would need to be extracted / ground-out. This would, however, only be done as a last resort.)

6.14. The exiting Building on Pontoon D (refer to **Figure 5.1**) would also be demolished at this stage.

6.15. Removal of Princes Jetty (including its timber piles) and the Pilot Launch Building would be undertaken using methods to minimise noise and vibration and ensure as many demolition materials as possible are recovered and separated for recycling.

Piling and New Jetty

6.16. The new Cruise Liner Terminal building would be constructed on top of a new suspended deck structure constructed over the River Mersey.

6.17. As well as supporting the new building, the proposed suspended slab would support a vehicle link bridge connected to Pontoon D providing access for vehicles, service vehicles and pedestrians as shown on **Figure 5.1**.

6.18. The new deck structure would generally be level with the existing ground at the Princes Dock wall. The deck would comprise a reinforced concrete slab spanning between a grid of precast reinforced concrete beams that would be supported by steel tubular piles.

6.19. Reinforced concrete plugs at the top of the piles would provide the connections between the steel piles and the cross-head beams. The piles would be braced to resist environmental (i.e. wind, waves) and accidental loadings.

6.20. The pile layout would be coordinated with the building so the piles would support the deck while also acting as foundations for the new building.

6.21. It is envisaged that the deck would be constructed using an end-over-end construction technique. The piles adjacent to the land would be installed using a rig based on the land. The first precast beams would be installed and the first section of in-situ deck would be cast. A crawler crane would then track over the newly constructed deck to install more piles followed by the precast beams and another section of in-situ slab and so on until the deck construction is complete.

Buildings and Structures

6.22. The new terminal building is likely to be constructed as a two-storey steel framed building with a full height atrium at the northern end. The main structural frame would be erected starting at a braced bay to ensure stability. If necessary, temporary bracing would be added until the final structure is completed.

6.23. The first floor would be concrete possibly constructed as a composite floor with in-situ concrete on profiled steel decking. Steel decking would be installed to the first floor and possibly to areas of the roof. This would provide safe access until the in-situ concrete is poured on top of the decking to construct the floor slabs.

6.24. It is currently envisaged that the roof would generally be constructed from lightweight insulated panels. The roof cladding would be installed followed by the wall cladding and glazing to provide a watertight building to enable the fit out of the building to proceed.

6.25. The link bridge is likely to be delivered as a prefabricated steel structure, delivered on barges and lifted in to place using cranes on barges.

External Works

6.26. Where practicable, works to the private highways would be undertaken in parallel with the construction works, where programme and phasing permits. These works are likely to comprise minor modifications to the highway, conversion of Plot 11 to provide a passenger drop-off / pick-up area, and public realm improvements.

6.27. In addition, landscaping and public realm areas would be completed and any street lighting, utilities infrastructure items and external signage would also be installed.

Materials and Resource Use

6.28. Where possible, consideration would be given to the use of recycled materials during the Works and LCC would work with the appointed Contractor to develop measures to reduce waste material going to landfill. However, current understanding is that given that the jetty has been in the marine environment for a long period of time it is unlikely reuse or recycling of the much of the jetty structure would be possible.

6.29. The Design and Access Statement, submitted in support of the planning application, sets out indicative materials that would be used within the Development. These would be finalised during the detailed design stage.

Plant and Equipment

6.30. Consideration has been given to the types of plant that would likely be used during the Works. These are outlined in **Table 6.2**.

Table 6.2: Anticipated Plant and Equipment

Plant	Enabling Works	Demolition / Dismantling	Site Preparation	Piling and Substructure	Building & Structures	External Works
Mobile Cranes	✓	✓	✓	✓	✓	
Tower Cranes					tbc	
Piling Cranes				✓		
Concrete Pumps			✓	✓	✓	
Mechanical Access Platforms					✓	
Goods / Passenger Hoists		✓		✓	✓	
Floodlights		✓	✓	✓	✓	
Lorries and vans	✓	✓	✓	✓	✓	✓

Plant	Enabling Works	Demolition / Dismantling	Site Preparation	Piling and Substructure	Building & Structures	External Works
Scaffolding and hydraulic access platforms	✓	✓	✓	✓	✓	
Fork lift truck				✓	✓	✓
Flatbed articulated vehicle	✓	✓	✓	✓	✓	
Mini piling rigs	✓			✓		
Water pumps	✓	✓		✓		
Mechanical Road Sweepers	✓	✓	✓	✓	✓	✓

Hours of Work

6.31. It is anticipated that no noise, vibration or light generating construction works, including engineering and preparatory works, that would be audible or visible at the Site boundary, would be carried out outside of normal construction working hours of:

- 08:00 to 18:00 hours Monday to Friday;
- 08:00 to 13:00 hours Saturday; and
- No working on Sundays or bank holidays.

6.32. Special working outside the hours specified above, such as heavy plant activities, crane and equipment assembly, would be kept to a minimum and would be subject to prior agreement with LCC's Environmental Health Officer (EHO).

Likely Significant Environmental Effects

6.33. Where relevant, detailed assessments of the likely significant effects during the Works are set out in the relevant technical chapter of this ES. Adverse effects can arise from day to day construction operations or from individual instances resulting from poor operation practices or management. However, most potential significant adverse effects can be reduced or offset through the implementation of standard or bespoke management controls, such as those set out in the following sections.

Construction Environmental Management Plan

6.34. In line with industry best practice a Construction Environmental Management Plan (CEMP) would be prepared for the Development and secured by planning condition. The CEMP would be implemented and adhered to throughout the Works.

6.35. The details of the CEMP would be agreed with LCC and the Marine Management Organisation (MMO) prior to the commencement of the Works and would comprise, in effect, an operational manual detailing the management, monitoring, auditing and training procedures to be followed during the Works to ensure compliance with relevant legislation, planning policy, regulations and best practice. It would also set out the specific roles and responsibilities of on-site personnel.

6.36. The CEMP would typically include the following:

- Details of the Works highlighting any operations likely to result in adverse environmental effects, with details of any specific mitigation measures to be implemented;

- Details of the phasing of the Works;
- Prohibited or restricted operations;
- A framework for compliance with relevant legislation and guidance;
- Details of plant to be used;
- Details of proposed routes for heavy goods vehicles (HGVs) travelling to and from the Site;
- Roles and responsibilities of key staff including training of staff, liaison with stakeholders and management of enquiries and complaints;
- Details of emergency procedures which would be implemented on the Site;
- Details of general Site management practices, including working hours, hoarding, access, lighting, Site facilities, energy and water use, waste, materials procurement and storage;
- Details of environmental management and control procedures, covering traffic and access, noise and vibration, dust, archaeology, contamination, hazardous materials, drainage and pollution control;
- Requirements for auditing, monitoring and record-keeping;
- Mechanisms for third parties to register complaints and the procedures for responding to complaints; and
- Provisions for reporting, public liaison and prior notification, especially where dispensations would be required.

6.37. Further detail on the information to be incorporated in the CEMP for key individual topics is provided in the following sections.

Management of Sub-Contractors

6.38. Individual contracts (for example for demolition and waste removal) would be based on standard good working practices and in line with statutory requirements. The Main Contractor would be chosen by the Applicant and would be registered with the correct waste management licences. Any sub-contractors would be required to demonstrate how they would achieve the provisions of the CEMP as well as how targets would be met and how potential environmental effects would be minimised.

External Relations

6.39. Contractors would be required to be a member of the Considerate Constructors Scheme (CCS). The CCS encourages Contractors to carry out their operations in a safe and considerate manner, with due regard to passing pedestrians and road users.

6.40. The Main Contractor would provide a dedicated liaison manager who would communicate the intent and status of the project to LCC, local businesses and other relevant authorities. A priority of this role would be to keep neighbours and LCC informed of the nature of the Works, their duration and programme, together with the principal stages of the Works.

6.41. Contact details for appropriate Site personnel would be posted on a display board visible to the public. Occupiers of properties neighbouring the Site would be provided with regular updates on progress through newsletters. Where practicable, viewing portals would be incorporated into the Site hoarding to allow the public to see progress from a safe viewpoint.

6.42. Any complaints received would be logged on the Site and dealt with in a timely manner, as per the details set out in the CEMP. Where no immediate resolution is found, the complaint would be referred to LCC.

Public Safety, Emergencies and Accidents

6.43. The Contractor would be required to liaise fully with LCC, the police (where necessary) and other relevant parties with regard to maintaining and contributing to a safe environment around the Site.

6.44. A clear and secure demarcation between operational activities (particularly ongoing cruise ship activities in the south of the Site) and other areas would be maintained to ensure public safety. Particular attention would be given to demolition and construction vehicle movements, access gates and security arrangements. A 'clean site' policy would be maintained.

6.45. The Contractor would be required to maintain high safety standards on the Site, and to be fully compliant with current health and safety legislation.

6.46. An Emergency Incident Plan would be in place to deal with any spillages and/or pollution incidents, whether on land or within the Estuary (e.g. during the demolition of Princes Jetty using barges). This would include the provision of on-site equipment for containing spillages, such as emergency booms and chemicals to soak up spillages. Any pollution incidents would be reported immediately to the LCC and regulatory bodies such as the Environment Agency and the MMO.

Noise, Vibration and Dust Management

6.47. To minimise potential noise, vibration and dust nuisance, general best practice measures would be implemented and adhered to by Contractors. In summary, such measures would be likely to include:

- Careful selection of methods and plant to minimise noise at source as far as reasonably practicable;
- Use of modern, quiet and well-maintained machinery such as electric powered plant, where possible and hoists should use the Variable Frequency Converter drive system;
- Vehicles and mechanical plant used for the Works would be fitted with exhaust silencers, which would be maintained in good and efficient working order and operated in such a manner as to minimise noise emissions in accordance with the relevant EU / UK noise limits applicable to that equipment or no noisier than would be expected based the noise levels quoted in BS 5228. Plant should be properly maintained and operated in accordance with manufacturers' recommendations. Electrically powered plant would be preferred, where practicable, to mechanically powered alternatives;
- Establish noise and vibration target levels (a Section 61 agreement under the Control of Pollution Act 1974[1] (COPA)) to reduce noise and vibration to a minimum in accordance with best practicable means, as defined in Section 72 of COPA;
- Where high levels of noise and vibration are predicted, monitoring of noise and vibration levels;
- Where possible, adopt low vibration working methods or alternative working methods, use of cut off trenches, reduction of energy input per blow and reducing resistance to penetration e.g. pre-boring for driven piles; and
- Liaison with the occupants of adjacent properties most likely to be affected by noise or vibration from activities on the Site should also take place. The occupants should be informed

of the nature of the works, proposed hours of work and anticipated duration prior to the commencement of activities.

- Positioning plant as far away from residential property as physically possible and switching off when not in use;
- Switching off plant and vehicle engines when not in use;
- Regular maintenance and servicing of vehicles, equipment and plant;
- Appropriate handling and storage of materials;
- Adherence to agreed operational hours;
- Use of hoarding to the required height and density appropriate to the noise sensitivity of the Site;
- Breaking out of concrete structures would be undertaken using low noise and vibration techniques where possible;
- Damping down surfaces during dry weather;
- Using wheel washing facilities on the Site;
- Implementing measures to reduce dust emissions during transport (for example, sheeting the sides of vehicles carrying fine material);
- Using dust screens and covers and the appropriate location of dusty materials storage;
- Fires would be prohibited on the Site; and
- Restricting drop heights onto lorries.

6.48. Special provisions would apply for any asbestos-containing materials. A safety method statement would outline the control measures necessary to reduce the risks to an acceptable level, and all statutory notices would be placed with the HSE.

6.49. A full assessment of the likely significant noise and vibration impacts resulting from the Works is provided within **Chapter 8: Noise and Vibration**. Dust management issues are addressed in **Chapter 7: Air Quality**.

Construction Traffic

Construction Traffic Flows

6.50. At this stage in the planning process, construction methodology is necessarily outline although it is assumed that Plot 11 would be used as the construction site compound.

6.51. Demolition of Princes Jetty is likely to predominantly take place from within the Mersey Estuary using barges and would therefore have no impact on local roads.

6.52. The new terminal building would be sited on a suspended deck, which itself is likely to be constructed using the end-over-end technique from the landward side. Movements of materials by road would therefore occur during construction although no abnormal loads by road are expected.

6.53. It is not envisaged that traffic movements associated with the demolition and construction phases of the Development would be greater than the movements forecast during the operational phase. Operation of the proposed Development would thus represent a worst case in terms of net traffic impacts on the local road network.

Construction Traffic Management

6.54. The route management strategy for HGVs associated with demolition and construction activities would be set out in the CEMP. During construction, the Contractor would aim to establish and maintain an area for turning vehicles on-site so that all vehicles can enter and leave in a forward gear for as much of the demolition and construction programme as possible. An area for site workers to park on-site would be established although use of public transport to access the Site would be encouraged. If necessary, a wheel-wash facility for the use of all vehicles leaving the Site would be provided.

Waste Management, Recycling and Disposal

6.55. It is expected that the appointed Contractor would be required to develop a Site Waste Management Plan (SWMP), detailing how demolition and construction waste would be managed and disposed of. Targets for waste minimisation and recycling would be set to meet or exceed all policy requirements, and at least meet the Applicant's corporate targets. The SWMP would ensure the Contractor and all sub-contractors investigate opportunities to minimise waste arisings at source and, where such waste generation is unavoidable, to maximise recycling and reuse.

6.56. The appointed Contractor would be required to monitor waste generated during the Works to maximise reduction, reuse and recycling potential. Where recycling or re-use is not possible, the waste would be disposed of in accordance with relevant legislation.

Hazardous Materials

6.57. Any asbestos would be removed by a licensed contractor in accordance with the Control of Asbestos Regulations and the appropriate HSE guidance in Asbestos: The Survey Guide[2].

6.58. In the event that potentially hazardous contaminated soils are identified during the Works they would require suitable treatment. In this event, the Works would cease in this area until the contamination has been investigated and an appropriate strategy implemented for its management.

6.59. Further details of the management of hazardous waste would be provided in the CEMP.

6.60. In accordance with relevant health and safety legislation, all construction staff would be provided with appropriate Personal Protective Equipment (PPE). Welfare facilities would be provided on the Site for washing and changing.

Site Drainage and Water Resources

6.61. The appointed Contractor would hold plans on the Site showing the location of all surface and foul water sewers.

6.62. Surface water runoff during demolition and construction works would need to be captured and treated to ensure no adverse impact on the environment. For construction of the cruise terminal building on top of the new jetty, traditional oil interceptors would probably be unsuitable since the deck is unlikely to be deep enough, although this is subject to confirmation at detailed design stage. However, a filter system could be implemented.

6.63. Normally surface water discharge would be directed to the public sewer. However, for this proposed Development, the landward part of the Site goes to a private drainage system maintained by Peel Ports which would be retained once the Development is operational. This private system ultimately discharges to the River Mersey. The existing jetty discharges directly to the river. The new jetty would be designed to also discharge to the river.

6.64. It is proposed to follow this same principle during the construction phase, i.e. surface water from the landward areas would be treated before draining to Peel Ports' private sewer, and surface water from the new jetty would be treated and drained to the river. This would be set out in the CEMP.

6.65. The CEMP would also state that the following would be implemented:

- Stockpiling of contaminated materials would be avoided, wherever possible. Any stockpiles would be located on areas of hard standing or on plastic sheeting to prevent mobile contaminants infiltrating into the underlying ground; and
- Potentially hazardous liquids on the Site such as fuels and chemicals would be managed and stored in accordance with best practice guidance, such as that published by the Environment Agency. Storage tank and container facilities would be appropriately bunded within designated areas and located away from surface water drains, docks and the Mersey Estuary.

Ground Contamination

6.66. The CEMP would demonstrate how the safety of construction workers and the public would be addressed in terms of potentially harmful substances. Protective measures which may be necessary include:

- The use of hoarding around the perimeter of the Site to contain dust arising from within the Site;
- Using dust screens and covers;
- Damping down surfaces during dry weather;
- Using wheel washing facilities on the Site;
- Restricting drop heights onto barges and lorries; and
- Stockpiling of contaminated materials would be avoided, wherever practicable.

6.67. Before the commencement of any piling works a Foundation Works Risk Assessment would be completed as part of the detailed piling design and methodology.

Protection of Ecological Resources

6.68. Construction works would be carried out according to Best Practice Guidelines[3] with regard to ecology. Measures would be set out in the CEMP to allow future Development proposals to be implemented whilst minimising the impacts on statutory designated ecological sites and all retained habitats on-site. The CEMP would also include measures to prevent disturbance from noise, light, vibration, surface water run-off and dust deposition. Measures within the CEMP would include:

6.69. As stated in **Chapter 13: Marine Ecology, Ornithology and Terrestrial Ecology**, it is proposed that a soft-start piling approach is implemented in order to reduce potential adverse effects to fish and marine mammals. This involves gradually increasing the force of piling, thereby steadily increasing the sound power levels generated over a period of time. This would alert individuals within the area, without exposing them to more intense sound power levels, and provide an opportunity for them to move away from the noise source.

6.70. Where possible, potential noise levels generated during construction would be reduced by using vibro-piling instead of percussion piling.

Protection of Archaeological Resources

6.71. As set out in detail in **Chapter 11: Archaeology**, a programme of archaeological investigation, including building /structure recording prior to demolition, and a watching brief over ground intrusive works associated with demolition of Princes Jetty and the creation of the proposed passenger pick-

up / drop-off area on Plot 11 is recommended. This would serve to mitigate the removal of the existing Princes Jetty and associated infrastructure such as the railway tracks and building footprints within Plot 11, and would also help to establish the paleo-environmental potential of the Site.

References

1 HMSO (1974) Control of Pollution Act, London

2 Health and Safety Executive (2012) Asbestos: The Survey Guide

3 EA; Pollution Prevention Advice and Guidance. Available from http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx

7. Air Quality

Introduction

7.1. This chapter presents an assessment of the likely significance of effects of the Development on air quality. Consideration is given to the effects of potential emissions from demolition and construction activities, as well as the effects of emissions from road traffic and emissions from cruise ships (while travelling to the terminal and while in port) associated with the Development.

7.2. This chapter provides a description of the methods used in the assessment. This is followed by a description of the relevant baseline conditions of the Site and surrounding area, and an assessment of the likely environmental effects of the Development during the demolition and construction works and once the Development is completed and operational. Mitigation measures are identified (where appropriate) to avoid, reduce or offset any significant adverse effects identified, together with the nature and significance of likely residual effects.

7.3. The chapter is accompanied by the following appendices, provided in ES Volume 3:

- **Appendix 7.1:** Consultation; and
- **Appendix 7.2:** Air Quality Modelling Study.

Assessment Methodology and Significance Criteria

Assessment Methodology

7.4. This section outlines the methodology used to assess the likely significant air quality effects arising from the demolition and construction works and the completed and operational Development. In addition to the EIA Scoping process (refer to **Chapter 2: EIA Methodology**) direct consultation was undertaken with the Operations Manager at the Environmental Protection Unit at Liverpool City Council (LCC), Paul Farrell, to agree the methodology prior to the commencement of the assessment. A copy of the consultation response is contained in **Appendix 7.1**.

7.5. In accordance with the agreed methodology, and using professional judgement, this air quality assessment has been undertaken using a variety of information and procedures as follows:

- a review of LCC's air quality Review and Assessment documents to determine baseline conditions around the Site and monitoring data to be used to verify the unadjusted predicted air quality modelled results;
- a review of the local area to identify potentially sensitive receptor locations that could be affected by changes in air quality that may result from the Development;
- a review and use of relevant traffic flow data from the Applicant's transport consultant (Transport Seeds);
- dispersion modelling of pollutant emissions using the ADMS-Roads model[1] and ADMS 5[2] model to predict the potential impacts of the Development (cruise ships while travelling to the terminal and while in port and traffic emissions) on local air quality. The latest NO_2 from NO_x Calculator available from the LAQM Support website[3] was applied to derive the road-related NO_2 concentrations from the modelled NO_x concentrations (further details are provided in **Appendix 7.2**);
- a comparison of the predicted air pollutant concentrations with LCC monitored concentrations and adjustment of modelled results where necessary (model verification details are provided in **Appendix 7.2**);

- a comparison of the predicted air pollutant concentrations with the UK Air Quality Strategy (AQS) objectives;
- determination of the likely significant effects of demolition and construction works and activities, and consideration of the environmental management controls likely to be employed during the Works;
- a determination of the likely significant effects of the operational phase of the Development on air quality, based on the application of the Environmental Protection UK (EPUK) & Institute of Air Quality Management (IAQM) significance criteria[4] to modelled results; and
- the identification of mitigation measures, where appropriate.

7.6. The UK AQS identifies the pollutants associated with road traffic emissions and local air quality as:

- nitrogen oxides (NO_X);
- particulate matter (such as PM_{10} (particles with a diameter up to 10µm) and $PM_{2.5}$ (particles with a diameter up to 2.5µm));
- carbon monoxide (CO);
- 1, 3-butadiene (C_4H_6); and
- benzene (C_6H_6).

7.7. Emissions of total NO_X from motor vehicle exhausts comprise nitric oxide (NO) and nitrogen dioxide (NO_2). NO oxidises in the atmosphere to form NO_2.

7.8. The most significant pollutants associated with road traffic in relation to human health, are NO_2 and PM_{10} and for cruise ship emissions are NO_x. This assessment therefore focuses on NO_2 and particulate matter (PM_{10} and $PM_{2.5}$).

7.9. Additional NO_X emissions from the cruise ship engines have also been considered, to determine their contribution to overall NO_2 concentrations as well as emissions of PM_{10} and $PM_{2.5}$.

Demolition and Construction Assessment Methodology

Dust Emissions

7.10. The assessment of the effects of the construction activities in relation to dust has been based on the guidance published by the IAQM[5] and the following:

- a consideration of planned construction activities and their phasing; and
- a review of the sensitive uses in the area immediately surrounding the Site in relation to their distance from the Site.

7.11. The IAQM guidance identifies that receptors sensitive to emissions and nuisance dust from construction activities are existing and proposed receptors within 350m of the boundary of the Site, and within 50m of construction routes. The location of individual sensitive receptors assessed are detailed in **Table 7.1**. For clarification, **Figure 7.1** shows the area surrounding the Site, where sensitive receptors could be affected, considering the IAQM guidance. The IAQM guidance does not present a method for assessing the individual sensitivity of receptors for the construction phase.

7.12. Following the IAQM guidance, construction activities can be divided into the following four distinct activities:

- demolition – any activity involved in the removal of an existing building;
- earthworks – the excavation, haulage, tipping and stockpiling of material, which may also involve levelling the site and landscaping;

- construction – any activity involved with the provision of a new structure; and
- trackout – the movement of vehicles from unpaved ground on a site, where they can accumulate mud and dirt, onto the public road network where dust might be deposited.

7.13. A summary of the four-step process which has been undertaken for the dust assessment of construction activities as set out in the IAQM guidance is presented in **Table 7.1.**

Table 7.1: Summary of the IAQM Guidance for Undertaking a Construction Dust Assessment

Step		Description
1	Screen the Need for a Detailed Assessment	Simple distance-based criteria are used to determine the requirement for a detailed dust assessment. An assessment will normally be required where there are 'human receptors' within 350m of the boundary of the site and / or within 50m of the route(s) used by construction vehicles on public highway, up to 500m from the site entrance or 'ecological receptors' within 50m of the boundary of the site and/or within 50m of the route(s) used by construction vehicles on public highway, up to 500m from the site entrance
2	Assess the Risk of Dust Effects	The risk of dust arising in sufficient quantities to cause annoyance and/or health or ecological effects should be determined using three risk categories: low, medium and high based on the following factors: • the scale and nature of the works, which determines the risk of dust arising (i.e. the magnitude of potential dust emissions) classed as small, medium or large; and • the sensitivity of the area to dust effects, considered separately for ecological and human receptors (i.e. the potential for effects), defined as low, medium or high.
3	Site Specific Mitigation	Determine the site-specific measures to be adopted at the site based on the risk categories determined in Step 2 for the four activities. For the cases where the risk is 'insignificant' no mitigation measures beyond those required by legislation are required. Where a local authority has issued guidance on measures to be adopted these should be considered.
4	Determine Significant Effects	Following Steps 2 and 3, the significance of the potential dust effects should be determined, using professional judgement, considering the factors that define the sensitivity of the surrounding area and the overall pattern of potential risks.

Demolition and Construction Vehicle Exhaust and Plant Emissions

7.14. The IAQM guidance on assessing construction impacts states that:

"Experience of assessing the exhaust emissions from on-site plant and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed".

7.15. Given the size of the Site (approximately 5.77ha) and the anticipated duration of the demolition and construction programme (estimated completion in 2020), in accordance with IAQM's construction dust guidance, it is considered that a quantitative assessment of the exhaust emissions from construction plant and traffic is not required, and a qualitative assessment is appropriate.

Completed Development Methodology

7.16. The likely effects on local air quality from traffic movements and cruise ship emissions generated from the completed and operational Development have been assessed using the advanced

atmospheric dispersion models ADMS-Roads and ADMS 5 respectively. **Appendix 7.2** presents the details of the dispersion modelling.

7.17. For the purposes of modelling, traffic data for the relevant local road network has been provided by Transport Seeds. Further details are provided in **Appendix 7.2**. Corresponding with the latest full set of air quality data held by LCC the baseline year of 2016 has been assessed together with the 'without Development' and 'with Development' scenarios for the year 2019 and 2029. The proposed opening year of the Development is anticipated to be 2020, however to be consistent with the Transport Assessment (TA) a completion year of 2019 has been used. 2029 has also been assessed as this represents the busiest year for ship emissions.

7.18. The ADMS-Roads dispersion model predicts how emissions from road sources combine with local background pollution levels, taking account of meteorological conditions, to affect local air quality. The ADMS-Roads model has been run for the completion year of 2019 and 2029 and therefore used background data and vehicle emission rates for 2019 and 2029 respectively as inputs. For the verification assessment (referred to later in this chapter), background data and vehicle emission rates for 2016 have been used, which would be higher than the 2019 and 2029 data. The model output allows pollutant concentrations to be quantified at locations representative of nearby sensitive receptors.

7.19. Data relating to the number and type of cruise ships which would access the Development has been provided by the Applicant, as described in **Table 5.1** of **Chapter 5: The Proposed Development**. The ADMS 5 model has been used to assess the emissions from the cruise ships when accessing the cruise ship terminal and from hoteling operations when in port, further details on the assessment of cruise ship emissions are presented in **Appendix 7.2**.

7.20. Full details of the modelling study, including the traffic data and cruise ship data used in the assessment, are presented within **Appendix 7.2**.

Model Uncertainty

7.21. Analyses of historical monitoring data by Defra[6] have identified a disparity between actual measured NO_x and NO_2 concentrations and the expected decline associated with emission forecasts which form the basis of air quality modelling as described above. This is related to the on-road performance of certain vehicles compared to calculations based on Euro emission standards, which inform emission forecasts.

7.22. The Defra note 'Projecting NO_2 Concentrations'[7] provides a number of alternative approaches that can be followed in air quality assessments, in relation to the modelling of future NO_2 concentrations, considering that future NO_x/NO_2 road-traffic emissions and background concentrations may not reduce as previously expected. This includes the use of revised background pollution maps, alternative projection factors and revised vehicle emission factors. However, the Defra note does not form part of statutory guidance and no prescriptive method is recommended for use in an air quality assessment.

7.23. This air quality assessment has been based on current guidance - i.e. using existing forecast emission rates and background concentrations to the completion years of 2019 and 2029, which assume a progressive reduction compared to the baseline year 2016. However, in addition, a sensitivity analysis has been undertaken based on no future NO_x and NO_2 reductions by 2019 and 2029 (i.e. considering the likely significant effect of the Development against the current baseline 2016 conditions, assuming no reduction in background concentrations or road-traffic emissions rates). The sensitivity approach presented in this air quality assessment is now typically agreed and accepted by Local Planning Authorities (LPAs) as being robust and provides a clear method to

account for the uncertainty in future NO_X and NO_2 concentrations in air quality assessments. This approach was agreed with LCC. The results of this sensitivity analysis, which represent a more conservative assessment scenario, are presented in **Appendix 7.2**.

Background Pollutant Concentrations

7.24. ADMS-Roads has been used to model pollutant concentrations due to road-traffic emissions. To estimate the total concentrations due to the contribution of any other nearby sources of pollution, background pollutant concentrations need to be added to the modelled concentrations. Full details in relation to the background data used within the air quality assessment are included in **Appendix 7.2**.

Model Verification

7.25. Model verification is the process of comparing monitored and modelled pollutant concentrations and, if necessary, adjusting the modelled results to reflect actual measured concentrations to give confidence in the accuracy of the modelling results. The model has been verified by comparing the modelled annual mean NO_2 concentrations for 2016 with the results of the LCC diffusion tubes within the vicinity of the Site. The verification and adjustment process is described in detail in **Appendix 7.2**.

Potentially Sensitive Receptors

7.26. The approach adopted by the UK Air Quality Strategy[8] is to focus on areas at locations at, and close to, ground level where members of the public (in a non-workplace area) are likely to be exposed over the averaging time of the objective in question (i.e. over 1-hour, 24-hour or annual periods). Objective exceedances principally relate to annual mean NO_2 and PM_{10}, and 24-hour mean PM_{10} concentrations, so associated potentially sensitive locations relate mainly to residential properties and other sensitive locations (such as schools) where the public may be exposed for prolonged periods.

7.27. **Table 7.2** presents existing potentially sensitive receptors that have been selected due to their proximity to the road network and cruise ship emissions. The position of the receptor locations assessed are presented in **Figure 7.2**. Given the elevated nature of the cruise ship emissions and to assess the worst-case locations in relation to the cruise ship emissions, receptors were modelled at each floor height at each of the receptor locations (i.e. although only four receptor locations are presented in **Table 7.2**, 97 individual receptor locations were modelled).

Table 7.2: Selected Receptor Locations

Receptor ID	Address of Receptor	Receptor Type	Grid Reference	Height Above Ground (m)
R1-45	8-10 Brook Street (West Tower) (Ground – 44th Floor)	Residential	333844, 390798	0-132
R46-61	1 Princes Dock (Liverpool City Lofts) (Ground – 15th Floor)	Residential	333636, 390957	0-45
R62-88	Alexandra Tower (Ground – 26th Floor)	Residential	333539, 390944	0-83
R89-97	Waterside Apartments (Ground – 8th Floor)	Residential	333666, 391083	0-24

Note: Ground floor assumed to be 0m to represent worst-case assessment of exposure as it is the closest location of the receptor to the tailpipe vehicle emissions. For the assessment of the differing floors it was assumed that a floor height would be 3m

7.28. Potential effects to residents of buildings in the vicinity of the Site which currently have planning consent but have not been constructed yet are assessed in **Chapter 15: Cumulative Effects**.

Significance Criteria

Demolition and Construction

Demolition and Construction Dust

7.29. The significance of effects of demolition and construction activities on air quality have been assessed based on professional judgement and with reference to the criteria set out in the IAQM guidance. Appropriate Site-specific mitigation measures that would need to be implemented to minimise any adverse effect have also been considered. Details of the assessors' experience and competence to undertake the dust assessment is provided in **Appendix 7.2**.

7.30. The assessment of the risk of dust effects arising from each of the construction activities, as identified by the IAQM guidance, is based on the magnitude of potential dust emission and the sensitivity of the area. The risk category matrix for each of the construction activity types, taken from the IAQM guidance, is presented in **Table 7.3** to **Table 7.6**. Examples of the magnitude of potential dust emissions for each construction activity and factors defining the sensitivity of an area are provided in **Table A1.16** to **Table A1.20** in **Appendix 9.3**.

Table 7.3: Risk Category from Demolition Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 7.4: Risk Category from Earthworks Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 7.5: Risk Category from Construction Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 7.6: Risk Category from Trackout Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

7.31. The risk category determined for each of the construction activity types is used to define the appropriate, site specific, mitigation measures that should be applied. The IAQM guidance recommends that significance is only assigned to the effect after considering mitigation because it assumes that all actions to avoid or reduce the environmental effects are an inherent part of the proposed Development, and that, in the case of demolition / construction, mitigation measures (secured through planning conditions, legal requirements or required by regulations) would ensure that likely significant adverse residual effects will not occur. However, to maintain consistency with the structure of this EIA and ES, as outlined in **Chapter 2: EIA Methodology**, pre-mitigation significance criteria as outlined in **Table 7.7** have been applied which are based on professional judgement.

Table 7.7: Pre-Mitigation Significance Criteria for Demolition and Construction

Significance Criteria	Definition
Adverse effect of major significance	Receptor is less than 20m from a major active construction or demolition site
Adverse effect of moderate significance	Receptor is 20m to 200m from a major active construction or demolition site, or up to 10m from a minor active construction or demolition site.
Adverse effect of minor significance	Receptor is between 200m and 350m from a major active construction or demolition site or 20m to 200m from a minor active construction site or demolition site.
Negligible	Receptor is over 200m from any minor active construction or demolition site or over 350m from any major active construction or demolition site.

7.32. IAQM outlines that experience of implementing mitigation measures for construction activities demonstrates that total mitigation is normally possible such that residual effects would not be 'significant'. Therefore, it follows that, within this assessment, no post-mitigation matrix of significance criteria is provided for the likely residual effects of the demolition, refurbishment and construction work.

Demolition and Construction Vehicle Exhaust and Construction Plant Emissions

7.33. The significance of the effects from construction vehicle exhaust and construction plant emissions on air quality were based on professional judgement.

Completed Development

7.34. The EPUK / IAQM guidance provides an approach to assigning the magnitude of changes because of a development as a proportion of a relevant assessment level, followed by examining this change in the context of the new total concentration and its relationship with the assessment criterion to provide a description of the impact at selected receptor locations.

7.35. **Table 7.8** presents the IAQM framework for describing the impacts (the change in concentration of an air pollutant) at individual receptors. The term Air Quality Assessment Level (AQAL) is used to

include air quality objectives or limit values, where these exist. The AQS objectives of air pollutants relevant to this assessment are summarised in **Table 7.9**.

Table 7.8: Impact Descriptors for Individual Receptors

Long term average Concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Note:
AQAL may be an air quality objective, EU limit value, or an Environment Agency 'Environmental Assessment Level (EAL)'
The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers.
Changes of 0% (i.e. less than 0.5%) are described as Negligible.
The table is only to be used with annual mean concentrations.

Table 7.9: National Air Quality Strategy Objectives

Pollutant	Objective		Date by which Objective is to be Met
	Concentration	Measured as	
Nitrogen Dioxide (NO_2)	200µg/m^3	1-hour mean not to be exceeded more than 18 times per year	31/12/2005
	40µg/m^3	Annual mean	31/12/2005
Particulate Matter (PM_{10}) [(a)]	50µg/m^3	24–hour mean not to be exceeded more than 35 times per year	31/12/2004
	40µg/m^3	Annual mean	31/12/2004
Particulate Matter ($PM_{2.5}$) [(b)]	Target of 15% reduction in concentrations at urban background locations	Annual mean	Between 2010 and 2020
	25µg/m^3	Annual mean	01/01/2020

Notes: (a) Particulate Matter with a mean aerodynamic diameter of less than 10µm (micrometres or microns).
(b) Particulate Matter with a mean aerodynamic diameter of less than 2.5µm.

7.36. The approach set out in the EPUK / IAQM guidance provides a method for describing the impact magnitude at individual receptors only. The guidance outlines that this change may have an effect on the receptor depending on the severity if the impact and other factors that may need to be considered. The assessment framework for describing impacts can be used as a starting point to make a judgement on significance of effect. However, whilst there may be 'slight', 'moderate' or 'substantial' impacts described at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances.

7.37. Following the approach to assessing significance outlined in the EPUK / IAQM Guidance, the significance of likely residual effects of the completed Development on air quality has been established through professional judgement and the consideration of the following factors:

- the geographical extent (local, district or regional) of impacts;
- their duration (temporary or long term);

- their reversibility (reversible or permanent);
- the magnitude of changes in pollution concentrations;
- the exceedance of standards (e.g. AQS objectives); and
- changes in pollutant exposure.

Baseline Conditions

Liverpool City Council Review and Assessment Process

7.38. Because of work undertaken to date as part of their Review and Assessment of air quality process, LCC has declared the entire City as an AQMA for annual mean NO_2 due to traffic emissions. The Site is located within this AQMA.

Local Monitoring

7.39. LCC currently undertakes monitoring of NO_2 at one location in Liverpool City Centre. The urban roadside automatic monitor on Queens Drive, Walton is located, approximately 5km to the north-east of the Site (OS Grid Reference 336164, 394906). The urban background automatic monitor in Speke monitors NO_2 and PM_{10} and is located approximately 12km to the south-east of the Site (OS Grid Reference 343884, 383601) The most recent monitored concentrations at these monitors are presented in **Table 7.10** below from 2013 to 2016.

Table 7.10: Annual Mean Monitored Concentrations at the LCC automatic monitors (µg/m^3)

Monitor	Pollutant	Averaging Period	AQS Objective	2013	2014	2015	2016
Queens Drive, Walton	NO_2	Annual Mean (µg/m^3)	40µg/m^3	34.0	34.6	34.3	-
		1-Hour Mean (No. of Hours)	200µg/m^3 not to be exceeded more than 18 times a year	0	0	0	-
Speke	NO_2	Annual Mean (µg/m^3)	40µg/m^3	23.0	24.7	22.4	23
		1-Hour Mean (No. of Hours)	200µg/m^3 not to be exceeded more than 18 times a year	0	0	0	0
	PM_{10}	Annual Mean (µg/m^3)	40µg/m^3	14.0	14.0	13.9	15
		24-Hour Mean (No. of Days)	50µg/m^3 not to be exceeded more than 35 times a year	6	2	1	0
	PM2.5	Annual Mean (µg/m^3)	25µg/m^3	11.6	10.8	9.2	10.0

Notes: Data obtained from 2016 Air Quality Annual Status Report for Liverpool City Council [9] and www.airqualityengland.co.uk

7.40. The monitoring results in **Table 7.10** indicate that the NO_2 and PM_{10} objectives were met in each year between 2013 and 2015.

7.41. NO_2 was also measured at locations using 73 diffusion tubes in Liverpool. The results for the 10 NO_2 roadside diffusion tubes closest to the centre of the Site are presented in **Table 7.11**.

Table 7.11: Annual Mean Monitored Concentrations at the LCC automatic monitors (µg/m^3)

Site ID	Location	Distance to Site centre (km)	2015	2016
T38	Covent Garden/Dale Street Lamp Post	0.3	**48**	**44**
T39	Strand Street/Water Street Junction – Road sign L2	0.5	**67**	**67**
T40	Strand Street/Water Street Junction Road sign L2	0.5	**64**	**60**
T41	Strand Street/Water Street Junction Road sign L2	0.5	**67**	**63**
T29	Leeds Street/Pall Mall Road Sign	0.8	**43**	39
T30	Leeds Street/Pall Mall Road Sign	0.8	**41**	40
T31	Leeds Street/Pall Mall Road Sign	0.8	**43**	38
T32	Crosshall Street Downpipe 2nd Along from Dale St.	0.9	**70**	**63**
T33	Crosshall Street Downpipe 2nd Along from Dale St.	0.9	**73**	**65**
T34	Crosshall Street Downpipe 2nd Along from Dale St.	0.9	**80**	**66**

Notes: Data obtained from directly from LCC

7.42. The monitoring results in **Table 7.11** indicate that the annual mean NO_2 objective of 40µg/m^3 was exceeded at all the 10 diffusion tubes in 2015 and at seven diffusion tubes in 2016.

Likely Effects

Demolition and Construction

Nuisance Dust

7.43. Construction activities in relation to the Development have the potential to affect local air quality through demolition, earthworks, construction and trackout activities.

7.44. The Site is in a mixed residential and commercial area. The location of the Site is presented in **Figure 7.1**. As shown in **Figure 7.1** the nearest high sensitivity human receptors are residential properties located within 20m of the Site boundary on Princes Parade to the north and William Jessop Way to the east. The nearest ecological receptor is the River Mersey (designated as a RAMSAR wetland site and currently under consultation to be included in the Liverpool Bay Special Protection Area (SPA) for foraging common tern *Sterna hirundo*), a high sensitivity receptor located 820m to the west of the Site.

7.45. As there are existing and proposed receptors within 350m of the boundary of the Site, and within 50m of the routes that would be used by construction vehicles on the public highway, it is considered that a detailed qualitative assessment is required to determine the likely dust effects, as recommended by the IAQM guidance on construction dust. Results of this assessment are provided for each main activity (demolition, earthworks, construction and trackout).

7.46. The sensitivity of the area to each main activity has been assessed based on the number and distance of the nearest sensitive receptors to the activity, and the sensitivity of these receptors to dust soiling, human health and ecological effects. Based on the criteria set out in **Table A1.18** to **Table A1.22** in **Appendix 7.2**, **Table 7.12** presents the sensitivity of the area.

Table 7.12: Summary of the Sensitivity of the Area

Receptor Sensitivity	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	High	High	High	High
Ecological	Low	Low	Low	Low

Demolition

7.47. It is estimated that the total volume of buildings to be demolished would be below 20,000m^3. Based on this, and considering the criteria in **Table A1.18** in **Appendix 7.2**, the potential dust emissions during demolition activities would be of a **small** magnitude.

Earthworks

7.48. The area of the Site is approximately 5.77ha, or 57,700m^2. Based on this, and considering the criteria in **Table A1.18** in **Appendix 7.2**, the potential dust emissions during earthworks activities would be of **large** magnitude.

Construction

7.49. The estimate for the total volume of buildings to be constructed is greater than 100,000m^3. Based on this, and considering the criteria in **Table A1.18** in **Appendix 7.2**, the potential dust emissions during construction activities would be of **large** magnitude.

Trackout

7.50. At this stage, the exact number of likely HGV movements during demolition and construction phases is not known. It is, however, reasonably estimated that in line with construction schemes of a similar magnitude, peak HGV flows would be likely to be between 10 and 50 outward trips per day, thus the potential for dust emissions due to trackout activities would be of **medium** magnitude when considering the criteria in **Table A1.18** in **Appendix 7.2**.

7.51. The summary of the risk of dust effects based on the emissions magnitude and sensitivity of the area is presented in **Table 7.13**.

Table 7.13: Summary of the Risk of Dust Effects

Potential Effect	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	High	High	Medium
Human Health	Medium	High	High	Medium
Ecological	Negligible	Low	Low	Low

7.52. As outlined in **Table 7.13**, the Site is a **high-risk** site, due to dust soiling and human health effects. Therefore, Site specific mitigation measures would be required to ensure that there are no adverse effects from demolition and construction. However, based on the criteria in **Table 7.7**, in the absence of mitigation, the worst-case nuisance dust from the demolition and construction works would give rise to:

- **temporary**, **short-term**, **local** effects of **major adverse** significance at receptors within 20m from the Site boundary;
- **temporary**, **short-term**, **local** effects of **moderate adverse** significance at receptors within 20m - 200m of the Site boundary;
- **temporary**, **short-term**, **local** effects of **minor adverse** significance at receptors within 200m - 350m of the Site boundary; and
- **negligible** effects at receptors over 350m from the Site boundary.

Construction Vehicle Exhaust and Plant Emissions

7.53. Plant operating on the Site and demolition and construction related vehicles entering and egressing the Site from / to the local road network would have the potential to increase local air pollutant concentrations, particularly in respect of NO_2 and particulate matter (both PM_{10} and $PM_{2.5}$).

7.54. It is estimated that construction traffic would not exceed 100 two-way HGV movements per day during the peak construction phase of the Development (refer to **Chapter 6: Development Programme and Construction**). Therefore, emissions from construction traffic would be relatively small compared to existing road traffic emissions on Bath Street (15,796 daily vehicles including 2.20% Heavy Goods Vehicles (HGVs)) and A5052 New Quay (59,595 daily vehicles including 2.61% HGVs). Further details on existing traffic flows is contained within **Appendix 7.2**. Considering the current traffic movements and background pollutant concentrations around the Site, it is considered that the likely effect of construction vehicles entering and egressing the Site to air quality would, in the worst-case, give rise to a **temporary**, **short-term**, **local** effect of **moderate adverse** significance during the peak construction period. However, at all other times during the demolition and construction works, it is considered that the likely effect would, in the worst-case be **temporary**, **short-term**, **local** and of **minor adverse** significance.

7.55. Any emissions from plant operating on the Site would be very small in comparison to the emissions from traffic movements on the roads adjacent to the Site. It is therefore considered that even in the absence of mitigation, their likely effect on local air quality would be of **negligible** significance.

Completed Development

7.56. Effects on local air quality associated with the completed and operational Development would likely result from changes to road traffic flows and emissions from the cruise ships associated with the Development.

7.57. The results of the air quality modelling of operational road traffic (based on current guidance, i.e. with reduced emission rates and background concentration to the completion year of 2021), and the cruise ship emissions are presented in **Table 7.14** and **Table 7.15**. Full details are provided within **Appendix 7.2**.

7.58. **Table 7.14**, **Table 7.15** and **Table 7.16** presents the worst-case predicted concentrations at each of the relevant receptor locations, results for all 97 receptor locations are presented in **Appendix 7.2**. The results in **Table 7.14** present the total concentrations at each of the receptor locations, **Table A1.16** in **Appendix 7.2** presents the contribution from each source separately.

Nitrogen Dioxide (NO_2)

Table 7.14: Results of the NO_2 ADMS Modelling at Sensitive Receptors (µg/m^3)

ID	Receptor Location	2016 Baseline	2019 Without Development	2019 With Development	2019 Change	2029 Without Development	2029 With Development	2029 Change
R1	8-10 Brook Street (West Tower) Ground Floor	33.8	23.5	23.5	0.0	17.8	18.0	0.2
R46	1 Princes Dock (Liverpool City Lofts) Ground Floor	28.5	25.7	26.2	0.5	18.8	19.3	0.5
R62	Alexandra Tower Ground Floor	27.5	27.5	29.0	1.5	19.8	20.8	1.0
R97	Waterside Apartments Ground Floor	34.5	35.1	35.3	0.2	23.6	23.8	0.2

Note: For accuracy, the changes arising from the Development have been calculated using the exact output from the ADMS-Road model rather than the rounded numbers within Table 7.14.

7.59. The results in **Table 7.14** and **Appendix 7.2** indicate that for 2016, the NO_2 annual mean concentrations are not predicted to exceed the NO_2 objective at any of the sensitive receptors modelled. The highest concentration (34.5µg/m^3) is predicted at Receptor 97. In 2019 and 2029, both 'without' and 'with' the Development, all sensitive receptors modelled are predicted to be below the NO_2 annual mean objective.

7.60. As discussed in **Appendix 7.2**, the 1-hour mean AQS objective for NO_2 is unlikely to be exceeded at a roadside location where the annual mean NO_2 concentration is less than 60µg/m^3. As shown in **Table 7.14**, the predicted NO_2 annual mean concentrations in 2016 and 2019 and 2029 are below 60µg/m^3 at all of the receptors modelled and therefore the 1-hour mean objective is met at these locations.

7.61. Additionally, as shown in **Table A1.10** in **Appendix 7.2** the short-term concentrations for all receptor locations (i.e. non-roadside locations) are well below 200µg/m^3. Therefore, the 1-hour mean objective is also predicted to be met at all receptor locations.

7.62. Using the impact descriptors outlined in **Table 7.8**, and considering all the results in **Appendix 7.2** the Development is predicted to result in a 'negligible' impact at all the sensitive receptors modelled. All the NO_2 annual mean concentrations are below 60µg/m^3, and so it is considered that the Development would have a 'negligible' impact on hourly NO_2 concentrations.

7.63. Using professional judgement, based on the severity of the impact and the concentrations predicted at the existing sensitive receptors (all predicted to be below the annual and 1-hour mean objectives), it is considered that the effect of the Development on NO_2 concentrations would be **not significant**. The Development is not predicted to lead to any new objective exceedences or the designation, or extension, of an AQMA.

Particulate Matter (PM_{10} and $PM_{2.5}$)

Table 7.15: Results of the 2019 ADMS Modelling at Sensitive Receptors (PM_{10} and $PM_{2.5}$)

ID	PM_{10} Annual Mean (µg/m³)				PM_{10} Number of Days >50µg/m³				$PM_{2.5}$ Annual Mean (µg/m³)			
	2016 Baseline	2019 Without Development	2019 With Development	2019 Change	2016 Baseline	2019 Without Development	2019 With Development	2019 Change	2016 Baseline	2019 Without Development	2019 With Development	2019 Change
R1	17.2	15.4	15.4	0.0	1	0	0	0	11.3	10.1	10.1	0.0
R46	16.0	15.9	16.0	0.1	0	0	0	0	10.6	10.4	10.5	0.1
R62	15.8	16.3	16.7	0.4	0	0	1	1	10.5	10.6	10.8	0.2
R89	17.0	17.8	17.8	0.0	1	1	1	0	11.2	11.5	11.5	0.0

Note: For accuracy, the changes arising from the Development have been calculated using the exact output from the ADMS-Road model rather than the rounded numbers within Table 7.15.

7.64. As shown in **Table 7.15** and **Appendix 7.2**, the annual mean concentrations of PM_{10} are predicted to be well below the objective of 40µg/m³ in 2016 and in 2019, both 'without' and 'with' the Development, at all the sensitive receptors modelled. The maximum predicted concentration is 17.8µg/m³ at Receptor 97 in 2019. Using the impact descriptors outlined in **Table 7.8** and considering all the results in **Appendix 7.2**, the Development is predicted to result in a 'negligible' impact at all existing sensitive receptors modelled.

7.65. The results in **Table 7.15** and **Appendix 7.2** indicate that in 2016 and in 2019, both 'without' and 'with' the Development, all existing sensitive receptors are predicted to be below the 24-hour mean PM_{10} objective value of 35 days exceeding 50µg/m³. The maximum predicted concentration is one day.

7.66. The results in **Table 7.15** and **Appendix 7.2** indicate that in 2016 and in 2019, both 'without' and 'with' the Development, all existing sensitive receptors are predicted to be below the annual mean $PM_{2.5}$ objective value of 25µg/m³. The maximum predicted concentration is 11.5µg/m³ at Receptor 89 in 2019.

7.67. Using the impact descriptors outlined in **Table 7.8** and considering all the results in **Appendix 7.2**, the Development is predicted to result in a 'negligible' impact at all sensitive receptors. Using professional judgement, based on the severity of the impact and the concentrations predicted at the existing sensitive receptors modelled, it is considered that the effect of the Development on PM_{10} and $PM_{2.5}$ concentrations would be **not significant**.

Table 7.16: Results of the 2029 ADMS Modelling at Sensitive Receptors (PM_{10} and $PM_{2.5}$)

ID	PM_{10} Annual Mean (µg/m³)			PM_{10} Number of Days >50µg/m³			$PM_{2.5}$ Annual Mean (µg/m³)		
	2029 Without Development	2029 With Development	2029 Change	2029 Without Development	2029 With Development	2029 Change	2029 Without Development	2029 With Development	2029 Change
R1	15.0	15.1	0.1	0	0	0	9.7	9.8	0.1
R46	15.5	15.6	0.1	0	0	0	10.0	10.1	0.1
R62	15.8	16.2	0.4	0	0	0	10.2	10.4	0.2
R89	17.2	17.3	0.1	1	1	0	10.9	11.0	0.1

Note: For accuracy, the changes arising from the Development have been calculated using the exact output from the ADMS-Road model rather than the rounded numbers within Table 7.16.

7.68. As shown in **Table 7.16** and **Appendix 7.2**, the annual mean concentrations of PM_{10} are predicted to be well below the objective of 40µg/m³ in 2029, both 'without' and 'with' the Development, at all the sensitive receptors modelled. The maximum predicted concentration is 17.3µg/m³ at Receptor 89 in 2029. Using the impact descriptors outlined in **Table 7.8**, the Development is predicted to result in a 'negligible' impact at all existing sensitive receptors modelled.

7.69. The results in **Table 7.16** and **Appendix 7.2** indicate that in 2029, both 'without' and 'with' the Development, all existing sensitive receptors are predicted to be below the 24-hour mean PM_{10} objective value of 35 days exceeding 50µg/m³. The maximum predicted concentration is one day at Receptors 89 and 90.

7.70. The results in **Table 7.16** and **Appendix 7.2** indicate that in 2029, both 'without' and 'with' the Development, all existing sensitive receptors are predicted to be below the annual mean $PM_{2.5}$ objective value of 25µg/m³. The maximum predicted concentration is 11.0µg/m³ at Receptor 89 in 2029.

7.71. Using the impact descriptors outlined in **Table 7.8** and considering all the results in **Appendix 7.2**, the Development is predicted to result in a 'negligible' impact at all sensitive receptors. Using professional judgement, based on the severity of the impact and the concentrations predicted at the existing sensitive receptors modelled, it is considered that the effect of the Development on PM_{10} and $PM_{2.5}$ concentrations would be **not significant**.

Nitrogen Dioxide Sensitivity Analysis Results

7.72. The results of the sensitivity analysis in relation to NO_2 (i.e. considering the potential impact of the Development against the 2016 baseline conditions) are presented in **Table 7.17**. The results in **Table 7.17** present the total concentrations at each of the receptor locations, **Table A1.17** in **Appendix 7.2** presents the contribution from each source (cruise ships (moving and while in port) and road traffic) separately.

Table 7.17: Results of the ADMS Assessment Assuming No Improvement in NO_x and NO_2

ID	Receptor Location	2019 Without Development	2019 With Development	2019 Change	2029 Without Development	2029 With Development	2029 Change
R1	8-10 Brook Street (West Tower) Ground Floor	27.7	27.9	0.2	27.7	28.0	0.3
R46	1 Princes Dock (Liverpool City Lofts) Ground Floor	30.6	31.4	0.8	30.7	31.5	0.8
R62	Alexandra Tower Ground Floor	32.9	34.9	2.0	33.0	35.0	2.0
R89	Waterside Apartments Ground Floor	**43.0**	**43.3**	0.3	**43.1**	**43.4**	0.3

Note: For accuracy, the changes arising from the Development have been calculated using the exact output from the ADMS-Road model rather than the rounded numbers within Table 7.17.

7.73. The overall predicted concentrations presented in **Table 7.17**, are higher than those presented in **Table 7.14** owing to the higher background concentrations and vehicle emissions rates in 2016 than 2019 and 2029. The results in **Table 7.17** and **Appendix 7.2** show that the NO_2 annual mean concentrations are predicted to be below the objective value of 40µg/m^3, 'without' and 'with' the Development, at all but two receptor locations (Receptors 89 and 90), when assuming no improvements to NOx and NO_2.

7.74. The predicted annual mean NO_2 concentrations are below 60µg/m^3 at all sensitive receptors modelled, both 'without' and 'with' the Development, when assuming no improvement to NO_x and NO_2. The 1-hour mean objective is therefore likely to be met at these locations. Additionally, as shown in **Table A1.15** in **Appendix 7.2** the short-term concentrations for all receptor locations (i.e. non-roadside locations) are well below 200µg/m^3. Therefore, the 1-hour mean objective is also predicted to be met at all receptor locations.

7.75. Using the impact descriptors outlined in **Table 7.8** and considering all the results in **Appendix 7.2**, the Development in 2019 and 2029 is predicted to result in a 'moderate' impact at one receptor location (Receptor 89) a 'slight' impact at five receptor locations (Receptors 46, 47, 62, 63 and 90) and a 'negligible' impact at the remaining 91 receptor locations.

7.76. Using professional judgement, based on the severity of the impact and the concentrations predicted at the receptor locations (all predicted to be below the annual and 1-hour mean objectives), it is considered that the effect of the Development on NO_2 concentrations, when assuming no improvements to NOx and NO_2, would be **not significant**.

Mitigation Measures and Likely Residual Effects

Demolition and Construction

Nuisance Dust

7.77. As noted earlier in this chapter, the Development would give rise to a high-risk construction site in relation to nuisance dust, accordingly, a range of environmental management controls would be developed to minimise dust nuisance with reference to the IAQM guidance for high-risk sites. The management controls would prevent the release of dust entering the atmosphere and/or being deposited on nearby receptors. The management controls would form an integral part of the site-specific Construction Environmental Management Plan (CEMP) (refer to **Chapter 6: Development Programme and Construction**). The management controls would be likely to include:

- routine dust monitoring at sensitive residential locations with the results used to inform the most appropriate mitigation controls, the effectiveness of which would be monitored and reviewed through a Dust Management Plan;
- damping down surfaces during dry windy weather;
- erection of appropriate hoarding and / or fencing to reduce dust dispersion and restrict public access;
- sheeting of chutes, skips and vehicles removing construction wastes;
- appropriate handling and storage of materials;
- loading and unloading to be permitted in designated areas;
- effective vehicle washing facilities to be provided for vehicles leaving the Site;
- fitting all equipment (e.g. for cutting, grinding, crushing) with dust control measures such as water sprays wherever possible;
- prevention of dust-contaminated run-off water from the Site;
- use of low emission alternative fuelled plant where feasible, and ensuring that all plant and vehicles are well maintained so that exhaust emissions do not breach statutory emission limits;
- switching off all plant when not in use;
- effective screening of dusty activities, such as stone cutting and grinding;
- banning fires on the Site;
- ensuring that cleaning equipment is available to clean mud from hard standing roads and footpaths; and
- close liaison with surrounding sensitive properties during periods that may generate dust as a result of the combination of activities and particular wind conditions (speed and direction).

7.78. In addition, the following could be undertaken:

- recording of any exceptional incidents that cause dust and air quality pollutant emissions, either on or off-Site, and appropriate action taken to resolve the situation.

7.79. Following the employment of appropriate environmental management controls which are routinely and successfully applied throughout the UK, residual effects of **negligible** significance would arise from construction-related dust emissions arising from the Development.

Construction Vehicle Exhaust and Plant Emissions

7.80. The route management strategy for HGVs associated with demolition and construction activities would be set out in the CEMP. During construction, the Contractor would be obliged to establish and maintain an area for turning vehicles on-site so that all vehicles can ideally enter and leave in a forward gear, establish and maintain an area for site workers to park on-site and establish and, if necessary, maintain a wheel-wash facility for the use of all vehicles leaving the Site.

7.81. It is anticipated that following the implementation of mitigation, the likely residual effect of construction vehicles entering and leaving the Site would be at worst **temporary**, **short-term**, **local** and of **minor adverse significance**, during peak construction periods, and of **negligible** significance at all other times, in the context of local background pollutant concentrations and existing local road traffic emissions.

7.82. The likely residual effects of exhaust emissions from plant operating on the Site would be of **negligible** significance in the context of existing adjacent road traffic exhaust emissions.

Completed Development

7.83. As identified earlier in this chapter, even in the absence of mitigation, the contributions of cruise ship emissions and the effect of operational traffic for the Development are predicted to have a potential effect of negligible significance on local air quality at relevant receptors surrounding the Site. Accordingly, mitigation measures would not be required.

7.84. As noted in **Chapter 5: The Proposed Development** the current facility does not provide any electricity for moored vessels which means cruise ships must use their engines to provide power while docked in port. The proposed Development, in line with the recommendations made in the LCC Cabinet Paper (August 2017)[10], would allow future installation of shore-side power should the cruise industry move in that direction and would have the potential to bring about air quality benefits by removing the need for cruise ships to use their engines while in port and therefore reducing pollutant emissions from the cruise ships while they are in port.

7.85. Other measures which could be incorporated into the Development are:

- Provision of extensive green infrastructure;
- All port authority vehicles using electric/ hybrid fuel;
- Incorporation of electric vehicle (EV) infrastructure; and
- Geofencing within the Port to switch hybrid vehicles via GPS to electric mode.

7.86. Accounting for the uncertainty in future NO_x and NO_2 reductions, the likely residual effects of cruise ship emissions and operational traffic associated with the Development at all receptors surrounding the Site (as appropriate), would be of **negligible** significance regarding concentrations of NO_2, PM_{10} and $PM_{2.5}$.

Summary

7.87. In the absence of mitigation, the Development was assessed to have likely effects as follows:

- During demolition and construction, the potential increase in dust emissions on nearby sensitive receptors would at worst have a **temporary, short term, local effect of major adverse significance**;
- During demolition and construction, the increase in heavy good vehicle movements on strategic roads would have a **temporary, short term, local effect of moderate adverse significance**;

- During demolition and construction, the increase in heavy plant operating on the Site would have a **negligible effect**; and
- Once completed the emissions from cruise ships and road traffic emissions will increase pollutant concentrations near the Site and would have a **permanent, local effect of negligible** significance.

7.88. Following the mitigation recommended in this chapter the following residual effects are expected:

- The employment of appropriate environmental management controls during the demolition and construction phase would reduce the potential effect from dust emissions on nearby sensitive receptors to **negligible** significance;
- Following the implementation of mitigation, the likely residual effect of construction vehicles entering and leaving the Site would be at worst **temporary**, **short-term**, **local** and of **minor adverse** significance;
- The likely residual effects of exhaust emissions from plant operating on the Site would be of **negligible** significance in the context of existing adjacent road traffic exhaust emissions; and
- Future proofing the Development for the provision of shore-side power would reduce impact of the Development on pollutant concentrations and the significance of the changes in air quality would remain as **negligible** significance.

References

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4 Environmental Protection UK & Institute of Air Quality Management (2015), 'Land-Use Planning & Development Control: Planning for Air Quality', EPUK & IAQM, London.

5 Institute of Air Quality Management (2014) 'Guidance on the Assessment of dust from demolition and construction.'

6 http://laqm.defra.gov.uk/faqs/faqs.html.

7 Defra (2012) Local Air Quality Management: Note on Projecting NO_2 Concentrations.

8 Defra, 2007. 'The Air Quality Strategy for England, Scotland, Wales & Northern Ireland'

9 Liverpool City Council, 2016 Air Quality Annual Status Report for Liverpool City Council

10 Liverpool City Council, 2017, Cabinet Report 0808 Air Quality

8. Noise and Vibration

Introduction

8.1. This chapter addresses the likely significant noise and vibration effects of the Development on human receptors and listed buildings and structures. It considers the potential impacts of noise and vibration during the construction works and on completion of the Development upon existing sensitive receptors.

8.2. This chapter provides a description of the methods used in the assessment. This is followed by a description of the relevant baseline conditions of the Site and surrounding area, and an assessment of the likely significant effects of the Development during the construction works and once the Development is completed and operational. Mitigation measures are identified, where appropriate to avoid, reduce or offset any adverse effects identified, together with the nature and significance of likely residual effects. Taking account of the mitigation measures, the nature and significance of the likely residual effects are described.

8.3. The chapter is accompanied by the following appendices, provided in ES Volume 3:

- **Appendix 8.1:** Glossary of Acoustic Terms;
- **Appendix 8.2:** Baseline Noise Survey**;**
- **Appendix 8.3:** LPA Consultation;
- **Appendix 8.4:** Demolition & Construction Noise Assessment**;**
- **Appendix 8.5:** Operational Noise Calculations; and
- **Appendix 8.6:** Road Traffic Noise Assessment.

8.4. An assessment of potential effects to ecological receptors from airborne and underwater noise and vibration is presented in **Chapter 13: Marine Ecology, Ornithology and Terrestrial Ecology**.

Assessment Methodology and Significance Criteria

Assessment Methodology

8.5. The assessment of likely significant noise and vibration effects has involved the following:

- identifying potentially existing and future sensitive receptors (SRs) within the surrounding area of the Application Site;
- establishing the baseline noise and vibration conditions currently existing at the Site and at existing SRs surrounding the Site using appropriate noise and vibration surveys;
- assessing likely noise and vibration levels generated during the construction works associated with the proposed Development;
- establishing design aims for plant and services associated with the proposed Development;
- assessing likely noise levels from the completed and operational Development;
- formulating proposals for mitigation (where appropriate); and
- assessing the likely significance of any residual noise and vibration effects.

8.6. In addition to the EIA Scoping process (refer to **ES Chapter 2: EIA Methodology**) direct consultation has been undertaken with the Environmental Protection Unit of Liverpool City Council (LCC) to agree the baseline noise survey strategy and specific aspects of the assessment methodology. Relevant correspondence is provided in **Appendix 8.3.**

Demolition and Construction Noise

8.7. As noted in **ES Chapter 6: Development Programme and Construction**, construction would occur in phases. Exact timing will be determined dependant on a number of external factors, however, it is anticipated that work will commence in 2018 with a completion date of 2020, approximately 24 months in total. Noise levels associated with these works have been estimated based upon the plant typically used for such a development and are based on source noise levels contained within BS 5228-1:2009+A1:2014[1] '*Code of practice for noise and vibration control on construction and open sites –Part 1: Noise*'.

8.8. The demolition and construction works which are considered to be the nosiest can be divided into the following main activities:

- Demolition and dismantling
- Piling (marine work);
- Beams and slabs (marine works);
- Concreting;
- Building steel frame;
- Building floor slab; and
- Pavement works.

8.9. To assess the likely significant effects construction works on existing SRs surrounding the Site the 'ABC Method' provided in BS 5228-1:2009+A1:2014, has been used but with an absolute noise limit of 75dB L_{Aeq} at residential receptors as defined by Condition 45 of Liverpool Waters Planning Permission Decision Notice (planning reference: 10O/2424):

"45. Noise levels at any occupied residential property due to construction or demolition or Site Engineering and Preparation Works shall not exceed 75dB $L_{Aeq\ (10\ hour)}$ measured at 1m from the façade of the nearest occupied property, between the hours of 0800:1800, Monday to Friday, and 75dB $L_{Aeq\ (5\ hour)}$ during the hours of 0800:1300 on Saturday, as controlled through the CEMP, unless such works have the prior approval of Local Authority under S61 of the Control of Pollution Act 1974."

8.10. The ABC method defines category threshold values which are determined by the time of day and existing prevailing ambient noise levels. The noise generated by construction activities is then compared with the threshold value. If the construction noise level exceeds the 'threshold value', a significant effect is deemed to occur.

8.11. Noise threshold levels have been established for the relevant existing SRs based upon the prevailing baseline noise levels. Noise levels associated with the construction works have been predicted using the calculation methodology detailed within BS 5228-1:2009+A1:2014. Calculations representing a worst-case scenario over a one-hour period with plant operating at the closest point to the nearest SR and in the absence of mitigation are presented. In practice, noise levels would tend to be lower owing to greater separation distances, screening effects and periods of plant inactivity.

Demolition and Construction Vibration

8.12. There are two aspects of vibration that require consideration:

- Potential vibration effects on people or equipment within buildings; and
- Potential vibration effects on buildings.

8.13. There are currently no British Standards that provide a methodology for predicting levels of vibration from construction activities other than BS 5228-2[2] '*Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'*, which relates to percussive, or vibratory, rolling and piling only. As stated in BS 5228-2, and as generally accepted, the threshold of vibration perception for humans in residential environments is typically in the PPV range 0.15 to 0.3 mm/s at frequencies between 8 Hertz (Hz) and 80Hz with complaints likely at 1 mm/s. Based on historical field measurements undertaken by Waterman and having regard to information contained within BS 5228-2, **Table 8.1** details the distance at which certain activities may give rise to 'just perceptible' levels of vibration.

Table 8-1: Distance at Which Vibration May Just be Perceptible

Construction Activity	Distance from Activity when Vibration may Just be Perceptible (metres)[1]
Heavy vehicles	5 – 10
Excavation	10 – 15
CFA Piling	15 – 20
Rotary Bored Piling	20 – 30
Vibratory Piling	40 – 60

Note: [1]Distances for perceptibility are only indicative and dependent upon a number of factors, such as the radial distance between source and receiver, ground conditions, and underlying geology.

8.14. **Table 8.2** presents typical levels of vibration with distance from CFA and rotary bored vibration.

Table 8-2: Typical Levels of Vibration Resultant from CFA/Rotary Bored Piling

Distance (m)	Peak Particle Velocity[1] (PPV) mm/s
5	0.54
10	0.38
20	0.30
30	0.03

Note: [1]Indicative. Dependent on ground conditions and underlying geology.

8.15. It is a widely held belief that if vibration can be felt, then damage to property is inevitable. However, vibration levels at least an order of magnitude higher than those for human disturbance are required to cause damage to buildings. It is generally accepted that building damage would not arise at PPV levels below 12.5 mm/s.

8.16. At this stage the detail of the methods and equipment to be used during the construction works is unconfirmed as they will be established in detailed design stages. Therefore, a detailed assessment cannot be undertaken. Consequently, the significance of vibration effects from demolition and construction work cannot be assessed quantitatively and was therefore assessed qualitatively based on typical plant used and distance of works to the SRs. Vibration level data was drawn from BS5228 Part 2.

Demolition and Construction Road Traffic Noise

8.17. A qualitative assessment of potential effects resultant from construction road traffic noise has been undertaken at this stage.

Completed Development: Fixed External Plant & Building Services

8.18. The guidance provided in BS 4142:2014[3] 'Methods for rating and assessing industrial and commercial sound', has been used to assess whether noise from fixed plant and building services associated with the Development, namely the proposed Cruise Terminal Building and Store Building) would be likely to give rise significant adverse impacts for existing SRs. Regard has also been given to the requirements of LCC.

Completed Development: Road Traffic Noise

8.19. The changes in noise levels, attributable to changes in road traffic flows and volumes, resulting from the proposed Development have been calculated using traffic data provided by the Applicant's transport consultants (Ramboll) (refer to **Appendix 8.6**). Traffic flow data has been provided for the 'with' and 'without' proposed Development scenarios for the anticipated year of opening, 2020, and design year, 2029, and includes traffic associated with future committed schemes.

8.20. Basic Noise Levels (BNLs) have been calculated for the road links covered by the Transport Assessment using the calculation methodology of The Calculation of Road Traffic Noise (CRTN)[4]. The calculations use the 18-hour Average Annual Weekday Traffic (AAWT) flow, % HGV composition and average vehicle speed for each road link. The BNLs were calculated using the calculation methodology provided in the CRTN. The likely effects of changes in road traffic noise were evaluated by consideration of the estimated changes in $L_{A10,(18\ hour)}$ road traffic noise level on the local highway network.

Completed Development: Passenger Pick-Up / Drop-Off Area

8.21. There are currently no guidelines in the UK for the assessment of noise from passenger pick-up and drop-off areas, or indeed car park activity, which it is comparable to. The sources include engines operating at low speeds, closing of car doors and, in the case of the proposed Development, human activity; the latter being poorly defined. In the absence of a British Standard, assessment has been undertaken based on the predicted change in noise level during operation of the passenger pick-up and drop-off area.

8.22. Predicted noise level from the passenger pick-up and drop-off area has been based on Waterman noise source data of car parks and bus terminal and projected intensity of usage provided by the project transport engineers, Ramboll.

Completed Development: Operational Noise from Cruise Ships and Associated Operations

8.23. Assessment of the likely noise effects from the change to intermittent operational noise; namely 'transit' and 'turnaround' Cruise Ships and associated operations, is a combination of BS4142 and change in the prevailing noise level during intermittent operations. It should be noted however that location of these operations will remain unchanged from the existing permitted scenario. The only potential change to this resulting from the Development is an increase in the number and potentially type of Cruise Ships received by the new cruise terminal. It is an assessment of this potential change rather than assessment of the existing permitted operations *per se* that has been undertaken.

Significance Criteria

Demolition and Construction Noise and Vibration

8.24. As outlined above, to assess the significance of effects from demolition and construction noise on existing SRs, 'The ABC Method' provided in BS 5228-1:2009+A1:2014 was used. The vibration

assessment has been made against the criteria for human perception as presented in BS 5228-2:2009.

8.25. The criteria in **Table 8.3** were adopted to provide transparency in the definition of the significance of identified effects. Full details are provided in **Appendix 8.4**.

Table 8-3: Significance Criteria for the Assessment of Construction Noise and Vibration

Significance	Level Above Threshold Value dB(A)	Level of Vibration	Definition
Negligible	≤ 0 to 2.9	< 0.14mm/s	The effect is not of concern
Adverse effect of minor significance	3.0 to 4.9	>0.14mm/s to <1mm/s	The effect is undesirable but of limited concern
Adverse effect of moderate significance	5.0 to 10.0 Maximum construction noise value of 75dB $L_{Aeq,T}$	1mm/s to 3mm/s	The effect gives rise to some concern but is likely to be tolerable depending on scale and duration
Adverse effect of major significance	>10	>3mm/s	The effect gives rise to serious concern and it should be considered unacceptable

8.26. With regard to potential damage to utilities and listed buildings/structures, provided vibration is ≤7.5mm/s (derived from BS5228-2 advice) the potential effect is insignificant. For all other buildings, a vibration level of ≤10mm/s is insignificant with regard to building damage.

Demolition and Construction Traffic Noise

8.27. The criteria proposed for road traffic noise generated by the proposed Development as detailed in **Table 8.4** would be appropriate for demolition and construction road traffic noise and has accordingly been adopted in the qualitative assessment.

Completed Development: Fixed Mechanical Plant and Building Services

8.28. The guidance provided in BS 4142: 2014 and the requirements of LCC have been used to determine noise limits for items of fixed plant introduced as part of the proposed Development.

8.29. LCC require that the rating level as defined by BS4142:2014, from any fixed mechanical plant and building services should not exceed background noise levels at the nearest noise-sensitive receptors.

Completed Development: Road Traffic Noise

8.30. The Design Manual for Roads and Bridges, Volume 11 Section 3 Part 7-'*Traffic Noise and Vibration*' (DMRB)[5] provides significance criteria for changes in road traffic noise levels which are reproduced in **Table 8.4** and have been used in this assessment.

8.31. DMRB state that "*a change in road traffic noise of 1 dB $L_{A10,18h}$ in the short term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long term (typically 15 years after project opening) a 3dB $L_{A10,18h}$ change is considered perceptible*". Notwithstanding this, it is generally accepted by acoustic practitioners that subjectively an increase of 3dB in environmental noise is just noticeable, whereas an increase of 10dB, a tenfold increase in intensity, is judged by most people as a doubling of loudness.

Table 8-4: Significance Criteria for Road Traffic Noise Assessment

Significance	Short Term Change or Difference in Noise Level, dB(A)	Long Term Change or Difference in Noise Level, dB(A)
Negligible	0 to 0.9	0 to 2.9
Adverse effect of minor significance	1.0 to 2.9	3 to 4.9
Adverse effect of moderate significance	3.0 to 4.9	5 to 9.9
Adverse effect of major significance	≥ 5	≥10

Completed Development: Passenger Pick-Up / Drop-Off Area

8.32. When assessing the significance of likely effects on SRs from operational noise associated with passenger pick-up and drop-off area, assessment is made against the predicted change in the prevailing noise level. **Table 8.5** presents the significance of effects based on the predicted change in the prevailing noise level.

Table 8-5: Change in Prevailing Noise Level Significance Criteria

Significance	Predicted Change in Prevailing Noise Level dB L_{Aeq}
Negligible	<0 to 1
Adverse effect of minor significance	>1 to ≤3
Adverse effect of moderate significance	>3 to ≤5
Adverse effect of major significance	>5

Completed Development: Operational Noise from Cruise Ships and Associated Operations

8.33. The significance criteria presented as **Table 8.5** have been used to determine the potential effect of changes to operational noise arising from cruise ships and associated operations. Regard has also been given to BS4142:2014 which states:

"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs."

8.34. The 'rating level' is the specific sound level adjusted for acoustic character as described in BS4142. The greater the difference between the rating level and background sound level the greater the potential impact.

8.35. BS4142 states:

"A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."

"A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context."

"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

8.36. Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

Limitations and Assumptions

Demolition & Construction

8.37. The BS 5228 calculation methods allows accurate noise levels to be determined for various demolition and construction activities. However, at this stage specific detail on the construction plant and machinery to be used (make/model) is not known.

8.38. A number of assumptions have therefore made regarding the number and type of plant to be utilised, their location, and detailed operating arrangements. Some of this information would be clarified as the detailed design progresses and later when resources are mobilised and the contractor is appointed, but other information (such as exactly where the plant operates and for how long) would remain uncertain, even after works have commenced. As such, construction noise levels have been based on generic plant detail contained within BS5228-1:2009+A1:2014 and as detailed in **ES Chapter 6: Development Programme and Construction**.

8.39. The available information is considered sufficient to undertake a noise assessment of the demolition and construction work, focussing on key activities operating at the Site, with the aim of identifying whether a significant, albeit temporary, adverse noise effect is likely to arise at the nearest sensitive receptors. Full details of plant complement, distance to receptors are presented within **Appendix 8.4.** In this respect, a medium to high degree of confidence is assigned to the predicted significance of the potential effects.

Completed Development: Plant and Building Services

8.40. At this stage of the design process, the specific type and configuration of fixed plant are not defined although locations are indicated. Consequently, it is not possible to undertake predictions to determine whether appropriate standards would be met, so instead appropriate plant noise emission limits have been set.

Baseline Conditions

Sensitive Receptors

8.41. The area surrounding the Site is urban in nature being a combination of residential and business / commercial use. Existing sensitive receptors (SRs), which were agreed in advance of conducting the baseline noise surveys with LCC, have been identified (refer to **Table 8.6** and **Figure 8.1**) based upon the locations which have the potential to experience significant noise and vibration effects due to the demolition and construction works and / or the operation of the completed Development.

8.42. It is important to note that the main demolition and construction activity will take place in the vicinity of Princes Jetty and Plot 11 in the northern part of the Site. As set out in **Appendix 8.4**, rather than take account of the distance from SRs to the Site boundary, the assessment of potential demolition and construction noise impacts has therefore taken account of the distance from the actual proposed Works to the various SRs. Similarly, the assessment of the potential noise impacts of the cruise liners is based on the distance from the cruise liners to the SRs.

Table 8-6: Sensitive Receptors

SR Ref (Fig 8.1)	Sensitive Receptor	Type
A	Alexandra Tower	Residential
B	Liverpool City Lofts	Residential
C	Princes Reach	Future Residential
D	Malmaison	Hotel
E	Number 12 Princes Dock Offices	Commercial
F[1]	Titanic Memorial	Grade II Listed Structure
G[1]	Royal Liver Building	Grade I Listed Building, Offices
H[1]	Cunard Building	Grade II Listed Building, Offices

Note: 1: Vibration only.

8.43. Potential effects to residents of buildings in the vicinity of the Site which currently have planning consent but have not been constructed yet are assessed in **Chapter 15: Cumulative Effects**. Potential effects to ecological receptors are assessed in **Chapter 13: Marine Ecology, Ornithology and Terrestrial Ecology**.

Baseline Noise Surveys

8.44. A baseline noise survey was undertaken on Thursday 9th and Friday 10th March 2017 to establish the prevailing noise climate within the vicinity of the SRs. The baseline strategy, which was agreed in advance with the Environmental Protection Unit of LCC, included attended short-term noise measurements of 1 hour during the day (0700-1900), 30-minutes evening (1900-2300) and 30-minutes night-time (2300-0700) periods.

8.45. The selected noise monitoring locations are described in **Table 8.7** and illustrated as **Figure 8.1**. The noise survey results are summarised in **Table 8.8** with full details of the baseline survey provided in **Appendix 8.2**.

Table 8-7: Description of Noise Monitoring Locations

Monitoring Location (Fig 8.1)	Representative of Sensitive Receptor	Description	Dominant Source and Observations
ST1	Alexandra Tower	Free-field measurement at ground-floor level of Alexandra Tower, overlooking the proposed cruise terminal dock.	Noise climate dominated by constant distant vehicular traffic on the New Quay (A5052). Contributory noise from intermittent vehicular movements on the access road running through Princes Dock. During the night, when road traffic was at a lull, high tidal noise from the waves hitting the banks of the river were discernible. Human activities (i.e. intermittent pedestrian pass-by) influenced the noise climate throughout the monitoring periods to some extent.

Monitoring Location (Fig 8.1)	Representative of Sensitive Receptor	Description	Dominant Source and Observations
ST2	Liverpool City Lofts	Free-field measurement at ground-floor level of City Loft building, overlooking Princes Dock.	Noise climate dominated by constant distant vehicular traffic on the New Quay (A5052). Noise climate influenced by intermittent vehicular traffic on the access road running through Princes Dock. Occasional human activities, as per monitoring location ST1.
ST3	Malmaison and Princes Reach	Microphone located 1.2m above the ground.	Noise climate dominated by constant distant vehicular traffic on the New Quay (A5052). Noise climate influenced by intermittent vehicular traffic on the access road running through Princes Dock. Occasional human activities, as per monitoring location ST1.
ST4	Number 12 Princes Dock Offices	Microphone located 1.2m above the ground.	Noise climate dominated by constant distant vehicular traffic on the New Quay (A5052). Contributory noise from intermittent vehicular movements on the access road running through Princes Dock. During the night, when road traffic was at a lull, high tidal noise from the waves hitting the banks of the river were discernible. Human activities (i.e. intermittent pedestrian pass-by) influenced the noise climate throughout the monitoring periods to some extent.

Table 8-8: Summary of Baseline Noise Survey

Monitoring Location (Figure 8.1)	Monitoring Period	$L_{Aeq,T}$[1] (dB(A))	L_{AMAX}[2] (dB(A))	$L_{A10,T}$[1] (dB(A))	$L_{A90,T}$[1] (dB(A))
ST1 (SR A)	Day (1415-1515)	54	68	58	49
	Evening (1912-2002)	58	77	59	49
	Night (2306-2336)	54	77	51	44
ST2 (SR B)	Day (1600-1640)	62	77	66	52
	Evening (2049-2119)	57	82	57	47
	Night (0020-0050)	51	69	52	46
ST3 (SR C, D)	Day (1645-1745)	64	77	67	56
	Evening (2010-2040)	57	71	60	52
	Night (2345-0015)	55	67	58	50
ST4 (SR E)	Day (1753-1853)	62	83	65	50
	Evening (1913-2003)	59	77	60	48
	Night (2305-2335)	53	76	52	43

1 Average of 5 minute measurements over the survey period (L_{Aeq} logarithmically averaged, L_{A10} and L_{A90} arithmetically averaged.)
2 Maximum 90th percentile measured over the survey period

8.46. The dominant noise source at all locations was noted to be road traffic noise. Noise levels during the night-time period were typically lower than those experienced during the day and evening time as a result of reduced traffic flows and human activity during this period.

Likely Effects

Demolition and Construction

Noise

8.47. **Table 8.9** presents a summary of the predicted noise levels at the nearest SRs. SR C (Princes Reach future residential blocks) has not been included in this assessment because it would not be completed and occupied during the demolition and construction works associated with the proposed Development.

8.48. It should be noted that the noise levels presented represent worst-case, when works are being conducted at the shortest distance. Further to this, the predicted noise levels are based on an un-mitigated scenario (e.g. no screening or additional acoustic measures assumed). Full calculation details are presented in **Appendix 8.4.**

Table 8-9: Predicted Demolition & Construction Noise Levels (Un-Mitigated)

SR Ref	Description	Dismantling Princes Jetty	Demolition Pilot Launch Bldg	Piling Drop Hammer	Piling Pressed	Beams & Slabs	Concreting	Steel Frame	Floor Slab	Pavement
A	Alexandra Tower	84	63	91	83	81	82	82	83	75
B	Liverpool City Lofts	65	62	73	64	63	64	63	65	60
D	Malmaison	62	65	71	62	61	62	61	62	54
E	No.12 Princes Dock Offices	79	75	91	83	81	82	82	83	66

8.49. **Table 8.10** presents the level of significance of noise effects at the nearest SRs resultant from demolition and construction noise. SR C (Princes Reach future residential blocks) has not been included in this assessment because it would not be completed and occupied during the demolition and construction works associated with the proposed Development. All significant effects identified would be **temporary, local, short-term and adverse**.

Table 8-10: Significance of Demolition & Construction Noise Effects (Un-Mitigated)

SR Ref	Description	Dismantling Princes Jetty	Demolition Pilot Launch Bldg	Piling Drop Hammer	Piling Pressed	Beams & Slabs	Concreting	Steel Frame	Floor Slab	Pavement
A	Alexandra Tower	**Maj**	**Neg**	**Maj**	**Maj**	**Maj**	**Maj**	**Maj**	**Maj**	**Mod**
B	Liverpool City Lofts	**Neg**	**Neg**	**Maj**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**
D	Malmaison	**Neg**	**Neg**	**Mod**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**
E	No.12 Princes Dock Offices	**Maj**	**Mod**	**Maj**	**Maj**	**Maj**	**Maj**	**Maj**	**Maj**	**Neg**

Note: Neg – Negligible; Min – Minor; Mod – Moderate; Maj - Major

8.50. **Negligible** effects are predicted to occur at both Liverpool Lofts and Malmaison due to distance from works, excepting piling should the impact method be adopted where **major and moderate temporary, short-term and local effects** are predicted. This is due to the high noise level generating during this method of piling without mitigation.

8.51. At both Alexandra Tower and No.12 Princes Dock Offices predominantly **major, short-term, temporary, local adverse effects** are predicted for all phase due to the relatively close proximity of works. Phases of construction located at greatest distance, such as demolition of the Pilot Launch Building from Alexandra Tower (circa. 235m) and pavement works from No.12 Princes Parade Dock Offices (circa. 40m), **negligible** effects are predicted.

8.52. It should be noted that, in reality, construction works would be transient in nature, with works for the most part taking place at locations significantly removed from the SRs. Nonetheless, given that some major adverse effects have been predicted, mitigation measures would be required to reduce noise levels from the demolition and construction phase of the proposed Development.

Vibration

8.53. The construction of the Development, namely the suspended deck, would necessitate the use of piling into the river bed although the method required is yet to be determined. Impact piling has the potential to give rise to the greatest levels of vibration with lowest levels generally being associated with rotary bored and CFA. Given the distance at which perceptible vibration may occur, as detailed in **Table 8.1**, qualitatively there is the potential for **temporary, short-term, local minor to moderate adverse effects** at Alexandra Tower (SR A) and No. 12 Princes Parade Dock Office (SR E) depending on the proximity and method of piling works to these properties. With regard to all other receptors, **negligible** effects are anticipated due to the distance separation from the works. The above qualitative assessment would however be dependent on ground conditions.

8.54. Vibration arising from activities other than piling are not anticipated to give rise to perceptible vibration at the SRs due to the type of activities and distance separation.

8.55. In addition to effects associated with human perception as described above, it should be noted that the levels of vibration generated by impact piling are anticipated to have a low probability of building damage at all receptors (except Alexandra Tower and No. 12 Princes Parade Dock Office), including nearby Listed structures and buildings. At Alexandra Tower and No. 12 Princes Parade Dock Office, due to distance separation from works to receptor, there is the potential for adverse effects on the building structures. It is not possible at this stage given the number of unknowns to quantify this, although the potential for adverse effects on the building structures is highest with impact piling. Mitigation measures are, therefore, discussed below.

Demolition and Construction Traffic

8.56. At this stage in the Development specific detail regarding demolition and construction traffic is not known. In order to assess a ‘worst-case’, it has been assumed that the majority of demolition and construction traffic would be by road rather than by sea. Without mitigation, qualitatively there is the potential for **temporary, short-term, localised minor adverse effects** at the SRs adjacent to the construction traffic route. Mitigation measures are, therefore, discussed below.

Completed Development

Fixed Plant and Building Services

8.57. At this stage in the design process detail on location and type of fixed plant and building services associated with the new Cruise Terminal building are unknown. Accordingly, it is not possible to undertake noise predictions to determine the significance of the likely effect from the operation of such plant. Consequently, a plant noise emission limit has been set assuming that all plant would operate continuously throughout the year. The noise limit emission as required by LCC and Condition 51 of Liverpool Waters Planning Permission Decision Notice (planning reference: 10O/2424) is that it does not exceed the prevailing background noise level:

"51. The rating level of the noise emitted from any plant in the development hereby approved, including mechanical ventilation servicing any basement car park, decentralised energy centres or renewable energy generating sources, shall not exceed existing background noise levels. The noise level shall be determined at the nearest noise sensitive premises and the measurements and assessments shall be made according to BS4142…."

8.58. In view of the above, noise limits applicable to fixed plant and building services associated with the Development have been specified and summarised in **Table 8.11**. Taking account of the short-term measured prevailing ambient noise levels together with cumulative effects, the recommended plant noise limit is 5dB below the modal measured background noise level.

Table 8-11: Plant Noise Limits at Nearest Sensitive Receptors

Location	Period	Modal Measured $L_{A90,T}$	Plant Noise Emission Limit $(L_{Ar,Tr})^{1+2}$
SR A: Alexandra Tower	Daytime	49	44
	Evening	48	43
	Night-time	44	39
SR B: Liverpool City Lofts	Daytime	52	47
	Evening	47	42
	Night-time	46	41
SR C: Princes Reach (Future Developments) and SR D Malmaison Hotel	Daytime	56	51
	Evening	52	47
	Night-time	50	45
SR E: No. 12 Princes Dock Offices	Daytime	50	45
	Evening	48	Not Applicable
	Night-time	43	Not Applicable

Notes: 1 If there is determined to be tonal or intermittent content emitting from plant then an acoustic feature correction should be applied in accordance with BS4142:2014.

2 Noise limits apply at a position 1m from the façade of the nearest noise sensitive properties and include the total contribution.

Road Traffic Noise Assessment

8.59. **Table 8.12** presents the results of the short-term assessment, year of opening 2020 with and without Development.

Table 8-12: Predicted Change in Road Traffic Noise Level (Short-Term)

Road Link	2020 Without Development dB $L_{A10,18h}$	2020 With Development dB $L_{A10,18h}$	Change	Significance
1.A5053 Leeds Street	70.7	71.0	0.3	Negligible
2.Great Howard Street	70.2	70.2	0.0	Negligible
3.A5052 New Quay (S of Leeds St)	58.8	59.2	0.3	Negligible
4.Paisley St	63.4	63.4	0.0	Negligible
5.Waterloo Road	71.3	71.3	0.0	Negligible
6.Bath St	67.9	67.9	0.0	Negligible
7.Princes Parade (S of Bath St)	64.2	65.3	1.0	Minor
8.Princes Parade (S of LCT)	56.2	59.0	2.8	Minor
9.St Nicholas Place	50.6[1]	57.5	6.9	Major[2]
10.New Quay A5052 (N of Chapel St)	73.8	73.8	0.0	Negligible
11.Chapel St	62.6	62.8	0.1	Negligible
12.The Strand A5036	73.9	74.0	0.1	Negligible
13.Southern Link Road (SLR)	69.8	70.1	0.4	Negligible

Note:
1 Low flow CRTN predicted number unreliable.
2 Significance of effect should be treated with caution due to low flow on St Nicholas Place forecast in 2020 with no Development.

8.60. The predicted change in noise level with Development in the opening year is predominantly negligible, with predicted change in road traffic noise being less than 1dB. On Princes Parade both south of Bath Street and south of LCT the predicted permanent, localised effect is of **minor** significance.

8.61. On St Nicholas Place a 6.9dB increase in road traffic noise is predicted which is according to DMRB is of major significance. This result should however be treated with caution as the flow on this road link for the 2020 no Development scenario is outside the accuracy of CRTN methodology. There are no residential receptors within the vicinity of St Nicholas Place that could be affected by the predicted increase in noise level as a result of the Development. Further to this, the noise emissions from the other nearby road links, namely New Quay (A5052) are significantly higher than those from St Nicholas Place so it would be unlikely that the predicted increase in road traffic noise from St Nicholas Place would be discernible. On this basis, the significance of effect is reduced to **negligible** as no receptors are affected.

8.62. **Table 8.13** presents the results of the long-term assessment, 2020 no Development compared with design year of 2029 with and without Development.

Table 8-13: Predicted Change in Road Traffic Noise Level (Long-Term)

Road Link	Noise Level Change 2029 Without Development dB	Significance	Noise Level Change 2029 With Development dB	Significance
1.A5053 Leeds Street	0.1	Negligible	0.4	Negligible
2.Great Howard Street	0.1	Negligible	0.1	Negligible
3.A5052 New Quay (S of Leeds St)	0.0	Negligible	0.4	Negligible
4.Paisley St	0.0	Negligible	0.0	Negligible
5.Waterloo Road	0.0	Negligible	0.0	Negligible
6.Bath St	0.0	Negligible	0.0	Negligible
7.Princes Parade (S of Bath St)	0.0	Negligible	1.0	Minor
8.Princes Parade (S of LCT)	0.1	Negligible	2.9	Minor
9.St Nicholas Place	0.2	Negligible[1]	6.9	Moderate[1]
10.New Quay A5052 (No of Chapel St)	0.1	Negligible	0.1	Negligible
11.Chapel St	0.1	Negligible	0.2	Negligible
12.The Strand A5036	0.1	Negligible	0.1	Negligible
13.Southern Link Road (SLR)	0.0	Negligible	0.4	Negligible

Note:
1 Significance of effect should be treated with caution due to low flow on St Nicholas Place forecast in 2020 with no Development.

8.63. The results of the long-term assessment indicate that under the No-Development scenario, only taking account of traffic associated with the SLR and committed developments, traffic changes would result in negligible effects. With-Development, the predicted effects are predominantly **negligible**, with permanent **minor adverse** localised effects on Princes Parade. Moderate effects are predicted on St Nicholas Place but, as previously discussed, the results for this link should be treated with caution as it is outside the accuracy of CRTN methodology. Furthermore, there are no sensitive receptors within the vicinity of this road link and the noise climate is likely to be dominated by emissions from New Quay which is significantly higher. On balance, the effects are reduced to **negligible** for this road link.

Passenger Pick-Up / Drop-Off Area

8.64. Noise emissions from the passenger pick-up and drop off area (Plot 11) during Port of Call Disembarkation, Turnaround Disembarkation and Turnaround Embarkation, has been predicted based on forecast data provided by Ramboll.

8.65. Noise source data for car movements, closing car doors, bus and shuttle bus movements have been used to predict noise levels at the nearest sensitive receptors.

8.66. Comparison between the predicted and measured daytime noise levels has been undertaken to determine the potential increase in prevailing noise level during the operational periods; namely three hours in the morning 07:30-12:30 for Port of Call Disembarkation, Turnaround Disembarkation and four hours in the afternoon 12:30-16:30 for Turnaround Embarkation. Full calculation details are presented within **Appendix 8.5**.

8.67. **Table 8.14** presents the predicted noise levels at the nearest receptors to Plot 11; namely SR A Alexandra Tower and SR B Liverpool City Lofts during operational hours of the passenger pick-up and drop off area together with potential increase in the prevailing daytime noise level and significance of this.

Table 8-14: Significance of Effects from Passenger Pick-Up Drop Off Area

Scenario	Predicted Noise Level dB $L_{Aeq,1h}$	Prevailing Noise Level dB $L_{Aeq,1h}$	Change in Noise Level	Significance
SR A (15m)				
Port of Call Disembarkation	50	54	+1	Negligible
Turnaround Disembarkation 07:30-08:30	57	54	+5	Moderate
Turnaround Disembarkation 08:30-09:30	55	54	+3	Minor
Turnaround Embarkation 12:30-13:30	56	54	+4	Moderate
SR B (75m)				
Port of Call Disembarkation	38	62	0	Negligible
Turnaround Disembarkation 07:30-08:30	46	62	0	Negligible
Turnaround Disembarkation 08:30-09:30	43	62	0	Negligible
Turnaround Embarkation 12:30-13:30	44	62	0	Negligible

8.68. During operational hours of the passenger drop-off and pick-up area, based on the forecast number of vehicles and shortest distance to the receptor, effects ranging from **negligible** to **moderate adverse** are predicted at SR A Alexandra Tower. The effects will be permanent, localised, but not constant only occurring during the operational hours of the passenger drop-off and pick-up zone, which is 3 hours during the morning 07:30 to 10:30 for disembarkation and 4 hours during the afternoon 12:30 to 16:30 for embarkation.

8.69. At SR B Liverpool City Lofts, **negligible** effects are predicted due to distance and higher prevailing noise levels at this location due to its proximity to Bath Street and A5052.

8.70. It should be borne in mind that predicted adverse effects would only occur when Cruise Ships are scheduled, which is forecast to be up to 67 vessels in 2020 increasing up to 80 by 2027.

Operational Noise Cruise Ships and Associated Operations

8.71. Cruise Ships currently dock adjacent to Pontoons A to D (refer to **Figure 3.1**). It is understood that there will be no significant change to this current arrangement. The potential changes as a result of the new proposed Cruise Terminal building is that the frequency of Cruise Ships using the proposed Development would increase and larger Cruise Ships would be received in addition to current types.

8.72. Only one Cruise Ship would be docked at the proposed Development at any one time, as is the current arrangement, therefore all things being equal the noise emissions from Cruise Ships and associated operations should remain unchanged from current operations. Noise from the Cruise Ship's engine and generators (used when docked) does however vary between vessels and the expectation is that newer larger vessels would potentially be quieter due to technological advances. There is also variation in type and length of on-shore operations between Cruise Ship types.

8.73. Notwithstanding the above, noise measurements of key existing on-shore operations, Cruise Ship generator, and engine noise arriving and leaving from the existing cruise ship terminal location was

undertaken on Thursday 28th September and Friday 29th September when Amadea transit and Marco Polo turn-around Cruise Ships were docked at the Site.

8.74. **Table 8.15** presents a summary of the measured noise levels standardised to a distance of 10 metres with full details presented in **Appendix 8.5**. **Table 8.16** presents a summary of the predicted noise levels at each of the five SRs based on the shortest distance to the cruise ship docking location and 6dB attenuation per doubling of distance from the source.

Table 8-15: Summary of Measured Cruise Terminal Operational Source Noise Measurements

Source / Operation	Measured Noise Level (dB L_{Aeq}) Standardised to 10m
Amadea Cruise Ship fans front end	65-70
Amadea Cruise Ship fans/plant rear	74-76
Amadea Cruise Ship fans/plant rear side	74-75
Amadea Cruise Ship rear side engines operational	78
Amadea Cruise Ship rear engines operational	79
Skip moved using JCB and fork-lift truck	81
Marco Polo Cruise Ship docking (Pontoon B)	63
Marco Polo Cruise Ship docked mid ship (generator)	73-76
Marco Polo Cruise Ship baggage unloading (including trailer)	59
Baggage trailer (empty) pass by	73
Marco Polo Cruise Ship unloading from HGV to ship's hatch	76
Marco Polo Cruise Ship loading provisions ramp up and in	68
Marc Polo Cruise Ship loading ramp out and down	72
Marco Polo Cruise Ship general loading operations near loading hatch/ramp	67
FLT Toyota L_{WA} 99dB reversing	54
JCB 525-60 tele handling reversing L_{WA} 104dB reversing	76
JCB 525-60 L_{WA} 104dB pass by	66

8.75. The predicted operational noise levels at SRs presented as **Table 8.16** indicate that slight increases in the prevailing ambient noise levels are likely to occur during docking and leaving operations when the Cruise Ship's engines are operational. Slight increases may also occur during loading/unloading operations of provisions. At Alexandra Tower, temporary increases may also occur due to the Cruise Ship's generator, but this is likely to be dependent on ship type and location of generator.

Table 8-16: Summary of Predicted Operational Noise Levels at SRs

Source / Operation	SR A	SR B	SR C	SR D	SR E
Measured Daytime Noise Level dB L_{Aeq}	54	62	62	62	64
Measured Evening Noise Levels dB L_{Aeq}	58	57	59	59	57
Cruise Ship Generator	48	48	60	60	51
Cruise Ship Engine	51	51	64	64	54
Unloading Baggage (conveyor belt/generator)	31	31	44	44	34
Unloading/loading provisions	48	48	60	60	50
Skip – moved using JCB and FLT	53	53	65	65	56

Source / Operation	SR A	SR B	SR C	SR D	SR E
FLT Toyota L_{WA} 99dB reversing	26	26	39	39	29
JCB 525-60 tele handling reversing L_{WA} 104dB reversing	48	48	60	60	50
JCB 525-60 L_{WA} 104dB pass by	38	38	50	50	40

8.76. **Appendix 8.2** presents a time history plot of the long-term unattended measured noise levels from Thursday 15:50 to Friday 09:40 within the eastern area of Pontoon B. The time history plot illustrates that when the Amadea Cruise Ship was docked the noise level from the generator dominated the noise at the measurement location. After the Amadea left LCT, at approximately 23:00 the level reduced significantly. An increase in the prevailing noise level with no Cruise Ship docked occurred from 06:00 due to increase in road traffic noise on the local road network. This further increased on arrival of the Marco Polo due to generator noise and loading operations.

8.77. Given there are no proposed significant changes to Cruise Ship operations in terms of noise emissions, the significance of effect will remain unchanged to those that currently exist. On this basis, the significance of effects from Cruise Ships and associated operations as a result of the Development is considered to be **negligible**.

Mitigation Measures

Demolition and Construction

Noise, Vibration & Traffic

8.78. In accordance with Planning Condition 39 of the Liverpool Waters Masterplan Decision Notice (planning reference: 10O/2424), a Construction Environmental Management Plant (CEMP) would be developed in accordance with LCC's requirements. With regard to noise and vibration this is likely to include:

- Use of hoarding to the required height and density appropriate to the noise sensitivity of the Site;
- Use of modern, quiet and well-maintained machinery such as electric powered plant, where possible and hoists should use the Variable Frequency Converter drive system;
- Vehicles and mechanical plant used for the Works would be fitted with exhaust silencers, which would be maintained in good and efficient working order and operated in such a manner as to minimise noise emissions in accordance with the relevant EU / UK noise limits applicable to that equipment or no noisier than would be expected based the noise levels quoted in BS 5228. Plant should be properly maintained and operated in accordance with manufacturers' recommendations. Electrically powered plant would be preferred, where practicable, to mechanically powered alternatives;
- Establish noise and vibration target levels (a Section 61 agreement under the Control of Pollution Act 1974[6] (COPA)) to reduce noise and vibration to a minimum in accordance with best practicable means, as defined in Section 72 of COPA;
- Where high levels of noise and vibration are predicted, monitoring of noise and vibration levels;
- Changing, where possible, methods and processes to keep noise and vibration levels low;
- Positioning plant as far away from residential property as physically possible and switching off when not in use;

- Works would be limited to the specified hours as specified in **Chapter 6: Development Programme and Construction**;
- Where possible, adopt low vibration working methods or alternative working methods, use of cut off trenches, reduction of energy input per blow and reducing resistance to penetration e.g. pre-boring for driven piles; and
- Liaison with the occupants of adjacent properties most likely to be affected by noise or vibration from activities on the Site should also take place. The occupants should be informed of the nature of the works, proposed hours of work and anticipated duration prior to the commencement of activities.

8.79. With regards to traffic management during the demolition and construction works, all traffic logistics would be agreed between LCC, contractors and the Applicant. Such measures would be set out within a Construction Traffic Management Plan. Consideration would also be given to the avoidance (or limited) use of road during peak hours, where practicable.

Completed Development

Fixed Plant and Building Services

8.80. Mitigation for building services and fixed plant may include the following measures:

- Procurement of 'quiet' non-tonal plant;
- Locate plant and air vents away from SRs;
- Acoustic enclosures;
- In-duct attenuators;
- Acoustic louvres; and
- Isolation of plant from building structures.

8.81. Specific details of mitigation would be finalised when design specifics are known.

Road Traffic Noise

8.82. Effects from changes in road traffic noise due to the proposed Development are predicted to be negligible for all links excepting Princes Parade where minor adverse effects are predicted. Although noise level increases are predicted on St Nicholas Road, these are also considered to be negligible due to the noise climate at this location being dominated by road traffic noise from New Quay (A5052) and that there are no SRs. On this basis, no mitigation is proposed.

Passenger Drop-Off / Pick-Up Area

8.83. Effects from predicted changes in noise level due to operation of the passenger drop-off and pick-up area are not continuous and would only occur on days where Cruise Ships are scheduled at the proposed Development. The predicted effects are localised, potentially only affecting Alexandra Tower, ranging from minor to moderate adverse. Taking account of the potential effect not being continuous and with overall predicted noise level from passenger drop-off and pick-up area being a maximum of 57dB $L_{Aeq,1h}$ (07:30-08:30 disembarkation) reducing to 54dB $L_{Aeq,1h}$ (08:30-09:30 turn-around disembarkation and 12:30-13:30 turnaround embarkation), mitigation is not proposed.

Operational Noise from Cruise Ships and Associated Operations

8.84. Mitigation is not proposed with regard to operational noise from Cruise Ships and associated operations as essentially, they remain unchanged from current conditions once the Development is operational.

8.85. Only one Cruise Ship docks at any one time and they would continue to dock along Pontoons A to D. Although the frequency of Cruise Ships is predicted to increase from the current schedule, up to 80 per annum in 2027 from 61 per annum in 2018, as stated previously only one Cruise Ship can be accommodated at any one time and therefore the noise emission during Cruise Ship operations would remain unchanged although there would be variation in noise emissions between different vessels and length of time for various operations such as unloading/loading baggage and provisions depending on the type of Cruise Ship.

8.86. Once the Development is operational, larger Cruise Ships would be accommodated. Noise emissions from the larger modern Cruise Ships are anticipated to be quieter with advances in modern technology, while noise emissions from on-shore operations are unlikely to change significantly.

Likely Residual Effects

Demolition & Construction

Noise

8.87. Accounting for the implementation of mitigation, as set out above, which should afford 10dB(A) reduction, the likely residual noise levels associated with the demolition and construction works are presented in **Appendix 8.4** and summarised in **Table 8.17** with significance of residual effects, which would be localised short-term and temporary in nature, presented as **Table 8.18**. It should be noted that 20dB reduction has been assumed should impact piling be undertaken proximate (within 30m) to SR A (Alexandra Tower) and SR E (No. 12 Princes Parade Dock Office) through enhanced mitigation measures or adoption of a different method

Table 8-17: Predicted Demolition & Construction Noise Levels (Mitigated)

SR Ref	Description	Dismantling Princes Jetty	Demolition Pilot Launch Bldg	Piling Drop Hammer	Piling Pressed	Beams & Slabs	Concreting	Steel Frame	Floor Slab	Pavement
A	Alexandra Tower	74	<55	71[1]	73	71	72	72	73	65
B	Liverpool City Lofts	55	<55	63	<55	<55	<55	<55	55	<55
D	Malmaison	<55	55	61	<55	<55	<55	<55	<55	<55
E	No.12 Princes Dock Offices	69	65	71[1]	73	71	72	72	73	56

Note:
1: 20dB attenuation assumed due to employment of enhanced mitigation or change of method during impact piling when in vicinity of Alexandra Tower and No. 12 Princes Dock Offices.

Table 8-18: Significance of Demolition & Construction Noise Effects Mitigated)

SR Ref	Description	Dismantling Princes Jetty	Demolition Pilot Launch Bldg	Piling Drop Hammer	Piling Pressed	Beams & Slabs	Concreting	Steel Frame	Floor Slab	Pavement
A	Alexandra Tower	**Mod**	**Neg**	**Mod**	**Mod**	**Mod**	**Mod**	**Mod**	**Mod**	**Neg**
B	Liverpool City Lofts	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**
D	Malmaison	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**	**Neg**
E	No.12 Princes Parade Dock Offices	**Min**	**Neg**	**Mod**	**Mod**	**Mod**	**Mod**	**Mod**	**Mod**	**Neg**

Note: Neg – Negligible; Min – Minor; Mod – Moderate; Maj - Major

8.88. With the implementation of mitigation, **negligible** effects are predicted to occur at both Liverpool City Lofts and Malmaison, both of which benefit from distance attenuation effects. At the closer located Alexandra Tower and No. 12 Princes Parade Dock Offices potential effects are predicted to range from **negligible** to **short-term, temporary localised moderate adverse**. Should the method of piling be impact, then consideration would need to be given to additional mitigation when these works occur close to either Alexandra Tower and No. 12 Princes Parade Dock Offices.

Vibration

8.89. Vibration limits would be set to ensure compliance with national standards and, hence, minimise the risk of complaints or building damage. These limits would be controlled through the implementation of the CEMP.

8.90. Following the implementation of appropriate mitigation measures construction generated residual vibration effects at Alexandra Tower and No. 12 Princes Parade Dock Office during piling works are anticipated to reduce to **temporary, short-term, local minor adverse effects**. Vibration effects on all other receptors are anticipated to be **negligible** due to distance separation, although this would ultimately be dependent on ground conditions.

8.91. Vibration effects arising from all other demolition and construction operations would remain **negligible** due to the type of activities and distance separation.

8.92. The potential for damage to nearby listed buildings (e.g. Royal Liver Building, Cunard Building) and structures (e.g. the Titanic Memorial) remains **negligible** due to distance from works to receptors. At Alexandra Tower and No. 12 Princes Parade Dock Office, due to distance separation from Works to receptor, there is the potential for adverse effects on the building structures. As previously stated, it is not possible at this stage given the number of unknowns to quantify this, although the potential for adverse effects on the building structures is highest with impact piling. Provided appropriate mitigation is implemented the residual effect of building damage would be **negligible**.

Demolition and Construction Traffic

8.93. Through implementation of a Construction Traffic Management Plan, it is qualitatively considered that the potential for adverse effects would be reduced to **negligible**.

Completed Development

Fixed Plant and Building Services

8.94. Provided the recommended noise criteria presented as **Table 8.11** are satisfied, residual effects would be **negligible**.

Road Traffic Noise

8.95. Mitigation is not proposed; residual effects are therefore predominantly **negligible** with **permanent short-term localised minor adverse residual effects** on Princes Parade. It should be borne in mind that the adverse effects would only occur when Cruise Ships are scheduled at the proposed Development. It would not be a daily occurrence.

Passenger Pick-Up / Drop-Off Area

8.96. Noise effects, when the passenger pick-up and drop-off area is operational, are predicted to be predominantly negligible with some minor to moderate adverse effects at Alexandra Tower due to its relative proximity to the Site. Given predicted adverse effects are not continuous only occurring on days where Cruise Ships are scheduled at the proposed Development and taking account of the overall predicted noise levels not considered to be excessive compared to prevailing conditions, mitigation is not proposed. Residual effects are therefore predominantly **negligible** with **permanent localised minor to moderate adverse effects** at Alexandra Tower due to its close proximity.

Operational Noise from Cruise Ships and Associated Operations

8.97. Noise effects from operational Cruise Ship noise and associated operations are predicted to remain unchanged from current as there would be no significant changes. Effects as a result of the Development would therefore be **negligible**.

Summary

8.98. In the absence of mitigation, the Development was assessed to have likely effects as follows:

- During site preparations and construction temporary increases in the prevailing ambient noise levels are predicted to occur which would have a **temporary, local effects of up to major adverse significance** at receptors proximate to the Site. Receptors proximate to the Site would also have **temporary, local adverse** effects of up to **moderate significance** from vibration generated during piling operations;
- During the construction phase, the increase in heavy plant movements on strategic roads would have a **temporary, district effect** up to **minor adverse significance**;
- Once completed the noise from associated fixed plant and building services would have a **negligible effect** on the basis that relevant Liverpool Waters Masterplan Planning Conditions are complied with;
- Noise effects from changes in road traffic noise would be predominantly **negligible** with **permanent local effects** of up to **minor significance** on Princes Parade. It should be noted that any adverse effects would not be continuous, only occurring when Cruise Ships are scheduled at the proposed Development;
- Noise from the drop-off and pick-up area are predicted to be **permanent, local** of up to **moderate adverse significance** during turnaround embarkation and disembarkation. Again,

the predicted effects would only occur when Cruise Ships are scheduled at the proposed Development and for part of the daytime period only;

- Noise effects from Cruise Ship operations are not anticipated to change significantly from the current situation and therefore effects would be **negligible**.

8.99. Following the mitigation recommended in this chapter the following residual effects are expected:

- Implementation of a CEMP would reduce noise effects during the construction phase to **temporary, local residual effect** up to **moderate adverse** with vibration effects of **minor adverse significance**. Implementation of a Construction Traffic Management Plan would result in **negligible** effects;
- It is likely that mitigation would be inherent in the completed Development to allow plant and building service noise to have **negligible** residual effect;
- Mitigation is not proposed for road traffic or the drop-off and pick-up area therefore residual effects would be predominantly **negligible** with **local minor adverse** residual effects on Princes Parade due to road traffic and up to **local moderate adverse** during peak usage of the drop-off and pick-up area. It should be borne in mind that effects are not continuous, only occurring when Cruise Ships are scheduled at the proposed Development;
- **Negligible** effects would occur from Cruise Ships and associated operations as these would not significantly change from the current situation as only one ship can be docked at any one time. Although larger Cruise Ships would be accommodated within the proposed Development, it is anticipated that newer vessels would benefit from technological advances and would therefore be potentially quieter than the older vessels which currently use the existing cruise terminal.

References

1 British Standard (BS) (2014) 5228:1 +A1 2014: Code of practice for noise and vibration control on construction and open sites, Part one: Noise, BSI, Great Britain

2 British Standard (BS) (2019) 5228:2 Code of practice for noise and vibration control on construction and open sites, Part Two: Vibration, BSI, Great Britain.

3 British Standard (BS) (2014) BS414 'Methods for rating and assessing industrial and commercial sound. BSI. Great Britain.

4 DoT (1988) Calculation of Road Traffic Noise, HMSO

5 Highways Agency (2011) Design Manual for Road and Bridges, Volume 11 Environmental Assessment, Section 3, Environmental Assessment Techniques, Part 7 Noise and Vibration, The Stationery Office.

9. Townscape and Visual Impact Assessment

Introduction

9.1. This chapter presents an assessment of the likely townscape and visual effects of the Development. It provides a description of the methods used in the assessment. This is followed by a description of the relevant baseline conditions of the Site and surrounding area, together with an assessment of the likely potential effects of the Development during the Site preparation and construction works and once the Development is completed and operational. Mitigation measures are identified where appropriate to avoid, reduce or offset any adverse effects identified and / or enhance likely beneficial effects. Taking account of the mitigation measures, the nature and significance of the likely residual effects are described.

9.2. The chapter is accompanied by the following appendices, provided in **ES Volume 3**:

- **Appendix 9.1:** Policy Context;
- **Appendix 9.2:** Viewpoint Baseline Assessment Sheets; and
- **Appendix 9.3:** Wireframes.

Assessment Methodology and Significance Criteria

Assessment Methodology

9.3. The approach and methodology used in the preparation of this Townscape and Visual Impact Assessment (TVIA) is based on guidance provided in the Guidelines for Landscape and Visual Impact Assessment Third Edition (GLVIA3)[1].

9.4. Townscape is defined as the physical, aesthetic and perceptual characteristics of the build built-up area, including the buildings, the relationships between them, the different types of urban open spaces, including green spaces, and the relationship between buildings and open spaces. It is this mix of characteristics and how people perceive them that contribute to townscape character and create a 'sense of place' or identity. Townscape impacts can arise from physical change to the townscape, such as changes associated with the demolition of the existing buildings on the site and the development of the new structures. These physical changes may result in changes to the distinctive character of the townscape and how it is experienced. With respect to townscapes designated or valued for their aesthetic or townscape quality, such changes can affect the purpose of the designation or their perceived value.

9.5. Visual impacts are changes to the composition of peoples' views or visual amenity caused by the appearance and prominence of the proposed development in those views.

9.6. The visual assessment considers the potential impacts on views for specified receptor groups during the day. Impacts during the night, in a well-lit urban environment, are expected to be broadly analogous with day time impacts and are therefore not considered further.

9.7. The assessment was informed by previous studies, feedback from Liverpool City Council (LCC) and site visits. A circa 1.5km radius study area has been identified and agreed with LCC as appropriate for the TVIA which includes the Site, the Mersey Waterfront, parts of the city centre and the Birkenhead side of the River Mersey. Scoping consultations with LCC have identified that the TVIA should be focused on terrestrial effects only and as such this assessment does not include seascape effects nor, as agreed with LCC, does it include the temporary visual effects of the cruise liners using the new terminal. Nevertheless, the TVIA does include some passing comments of the character of these likely temporary transient effects.

9.8. The EIA Regulations[2] are clear that when preparing a TVIA, the emphasis should be on likely significant effects and stress that the assessment should be in proportion to the scale of the project and the nature of its likely effects. This does not mean that effects should be ignored or their importance minimised, rather that the assessment should be tailored from the outset.

Viewpoint Assessment

9.9. Visual aspects of the TVIA are principally based on assessment from 21 viewpoints which have been agreed with LCC planning officers as being representative and were selected from the zone of theoretical visibility (ZTV). These viewpoints are illustrated in **Appendix 9.2** and include a range of view and receptor types that are deemed representative viewpoints from which to represent the Site and the proposed Development for EIA purposes. They are all publicly accessible and most are viewpoints described as important within the World Heritage Site Supplementary Planning Document[3].

Zone of Theoretical Visibility

9.10. The ZTV has been determined from a desk top study and site survey to identify the broad areas from where the Development would potentially be visible. Other intervening features, such as trees and tall streetscape elements have been used to identify other areas from where the Development would not be visible and the ZTV refined accordingly.

Wireframes

9.11. The assessment is accompanied by a series of wireframes and visual representations from the selected viewpoints showing how the changes would appear with the Development, i.e. 'before' and 'after' views. They are presented in **Appendix 9.3**. The photographs on which these 3D visualisations are rendered, and the methodology for the preparation of these visualisations are in accordance with recognised guidance.

Approach to Assessment

9.12. As informed by best practice guidance the TVIA adopts a four step process which is set out below.

Step 1 – Baseline Description and Sensitivity of Receptors

Townscape Baseline

9.13. The objective of the baseline townscape study is to provide an understanding of the townscape within and surrounding the Site – its constituent elements and features, its character and the way this varies spatially, its history, condition, the way it is experienced and the value attached to it. The baseline describes the townscape as it appears now, together with any known changes which would arise with or without the proposed Development.

9.14. The townscape baseline is established using existing townscape assessment studies (where available, of relevant scale and up-to-date) or additional studies may be undertaken in accordance with current guidelines to identify new Townscape Character Areas (TCAs). Where existing information is to be used this is verified on site to ensure that the information is accurate and appropriate for the purposes of the TVIA.

9.15. Visual baseline conditions are established through identification and analysis of the existing visual resource that may be affected including the nature and extent of key views to the proposed Development from visual receptors in the area.

9.16. The baseline study also establishes the relative value of the Site and the wider area.

9.17. The value of townscape receptors to a degree reflects the presence of any townscape designations, but may be moderated by consideration of the range of criteria set out in **Table 9.1.** In the same vein, a non-designated townscape may be given a higher value based on consideration of the factors in **Table 9.1**.

Table 9.1: Indicative Criteria for Assessing Townscape Value

Category	Criteria
Very High	Very attractive, rare, outstanding townscape with clearly distinctive characteristics, features and elements. Very strong urban structure, legibility characteristic patterns and balanced combination of built form and open space. Widespread use of quality materials. Very good condition/ very well-managed and intact. Historic interest of designated national or international importance and which contributes significantly to townscape character. Very high recreational value which contributes significantly to recreational/ visitor experience. Rich and valued cultural associations. Unique sense of place. No detracting features.
High	Attractive townscape with some distinctive characteristics, features and elements. Recognisable urban structure, legibility, characteristic patterns and combinations of built form and open space. Good condition/ well-managed and largely intact. Historic interest which contributes to townscape character. Recreational value which contributes to recreational/ visitor experience. Valued cultural associations. Strong sense of place. Occasional detracting features.
Medium	Typical, commonplace and unremarkable townscape with limited variety or distinctiveness. Distinguishable and urban structure, characteristic patterns and combinations of built form and open space. Average condition with some intactness but scope to improve management for land use. Limited historic interest. Limited recreational value and few visitors. No or very few recorded cultural associations. Some features worthy of conservation. Some dominant detracting features.
Low	Townscape degraded or in obvious decline, with poor sense of place. Weak or degraded urban structure, characteristic patterns and combination of built form and open space. Lack of management has resulted in degradation and poor condition. Limited to no historic interest. Limited to no recreational value. No recorded cultural associations. Frequent dominant detracting features. Disturbed or derelict land requires treatment.

Visual Baseline

9.18. The aim of the visual baseline is to establish:

- The type and relative numbers of people (visual receptors) likely to be affected;
- The location, nature and characteristics of the viewpoints;
- The location, nature and characteristics of the existing views; and
- The value attached to particular views.

9.19. The value attached to a particular view depends on:

- Recognition of the value attached to particular views, for example in relation to heritage assets, or through planning designations;
- Indicators of the value attached by visitors, for example through appearances in guidebooks or on tourist maps, provision of facilities for their enjoyment and references to them in literature or art.

9.20. Each viewpoint was visited and at each location a judgement was made about the value of the view in that location. The value of a view is assessed as very high, high, medium or low by applying professional judgement and the indicative criteria listed in **Table 9.2**.

Table 9.2: Indicative Criteria for Assessing Visual Receptor Value

Category	Criteria
Very High	View of national or international importance, or is associated with nationally designated landscapes/ townscapes or important heritage assets, or is promoted as a visitor designation for its scenic beauty. The view is widely known and well-frequented. (For example public open spaces where focus is on views, public rights of way through highly valued townscapes, views from important tourist routes or promoted viewpoint, popular visitor attractions where the view forms a recognised part of the visitor experience, or which have important cultural associations).
High	View of regional or local importance. The view may be valued locally but is not widely known or well-frequented. (For example a public right of way through townscapes of moderate value, setting for elements of local and/ or regional cultural heritage value or national value whose settings are already compromised).
Medium	Although the viewpoint may be valuable to local people, the location has no formal planning status, is in an area of ordinary townscape value, or reasonably good townscape value but with detracting elements or features. People are unlikely to visit the viewpoint to experience the view.
Low	Viewpoint is within an area of very low townscape quality (e.g. industrial estate/ busy main road) that has very few positive characteristics).

Step 2: Townscape and Visual Sensitivity

Townscape Sensitivity

9.21. The first step in assessing the significance of townscape effects is to determine the sensitivity of the townscape receptors (on the Site and in the wider townscape) to the Development. This comprises judgements about the:

- Value attached to the receptor – as explained above, this is determined as part of the baseline conditions of the assessment. It is a professional judgement made separately from the context of the specific proposals; and,
- Susceptibility of the receptor to change – this is the ability of the townscape receptor (whether it be the overall character or quality/ condition of a particular townscape area, or an individual element and/ or feature, or a particular aesthetic and perceptual aspect) to accommodate the proposed Development without undue consequences for the maintenance of the baseline situation and/ or the achievement of landscape planning policies and strategies.

9.22. Susceptibility varies depending on the character of the townscape and the nature of the development being proposed. Generally, proposals that fit well with the scale and character of the townscape are less likely to be adverse.

9.23. Townscape susceptibility is assessed as high, medium or low by applying professional judgement and the indicative criteria listed in **Table 9.3**.

Table 9.3: Indicative Criteria for Assessing Townscape Receptor Susceptibility

Category	Criteria
High	The townscape receptor is less able to accommodate the type of development proposed without undue negative consequences for the baseline situation. Attributes that make up the character of the townscape offer limited opportunities for accommodating the change without its key characteristics being fundamentally altered, leading to a different landscape character. The proposed development does not accord with planning policies and strategies.
Medium	The townscape receptor has some ability to accommodate the proposed development without undue negative consequences for the baseline situation. Attributes that make up the character of the townscape offer some opportunities for accommodating the change without key characteristics being fundamentally altered. There would be some consequences for the achievement of townscape planning policies and strategies.
Low	The townscape receptor is more able to accommodate the proposed development without undue negative consequences for the baseline situation. Attributes that make up the character of the townscape are more resilient to being changed by the type of development proposed. Only individual elements and/ or features, or a particular aesthetic and perceptual aspect may be affected. The proposed development accords with planning policies and strategies.

9.24. An overall assessment of townscape sensitivity using a three-point scale of high, medium and low is made for each townscape receptor (refer to **Appendix 9.2**) based on professional judgement. High value/ high susceptibility receptors are likely to be highly sensitive to change, with lower value/ low susceptibility receptors likely to be of low sensitivity to change.

Visual Sensitivity

9.25. The first step in assessing the significance of townscape effects is to determine the sensitivity of the visual receptors (on the Site and in the wider townscape) to the Development. This comprises judgements about the:

- Value attached to the view – as explained above, this is determined as part of the baseline conditions of the assessment. It is a professional judgement made separately from the context of the specific proposals, and,

- Susceptibility of the receptor to change – this is a function of the occupation or activity of people experiencing the view at a particular location and the extent to which their attention or interest may therefore be focused on the view and the visual amenity they experience.

9.26. The sensitivity of visual receptors is always determined based on site specific conditions, e.g. a driver within an urban area would be considered of low sensitivity but if the road was part of a scenic route the sensitivity would increase.

9.27. The susceptibility to change of visual receptors is assessed as high, medium or low by applying professional judgement and the indicative criteria contained in **Table 9.4**.

Table 9.4: Indicative Criteria for Assessing Visual Receptor Susceptibility

Category	Criteria
High	People with high quality rural views, leisure users whose attention or interest is likely to be focused on the view and viewpoints within nationally or regionally designated townscapes. The viewpoint location may be in a nationally designated townscape or have been specifically created to for its view and/ or is experienced by people, whether residents or visitors, whose attention or interest is likely to be focused on the view. Examples include: • Residents at home • People engaged in outdoor recreation whose interest is likely to be focused on the landscape • Visitors to identified viewing places or heritage assets where the surrounding landscape makes an important contribution to the experience • Communities where views contribute to the townscape setting.
Medium	The view may be experienced by people who are drawn to the view yet do not feel compelled to stop and take it in. Examples include: • Pedestrians and recreational motorists on minor roads, rail or other transport routes • People taking part in outdoor sport or residential receptors in the urban area.
Low	The viewpoint location may be transient and/ or experienced only in passing by people, whether residents or visitors, whose attention or focus is on other activities, not on their surroundings. Examples include: • Commuting pedestrians and motorists • People at their place of work where the setting is not important to the quality of working life.

9.28. Paragraph 6.35 of GLVIA3 notes that:

'These divisions are not black and white and in reality there will be gradation in susceptibility to change. Each project needs to consider the nature of the groups of people who will be affected and the extent to which their attention is likely to be focused on views and visual amenity.'

9.29. An overall assessment of visual sensitivity using a three-point scale of high, medium and low is made for each visual receptor (refer to **Appendix 9.3**) based on professional judgement. High value/ high susceptibility receptors are likely to be highly sensitive to change, with lower value/ low susceptibility receptors likely to be of low sensitivity to change.

Step 3: Magnitude of Effect

Townscape

9.30. Determination of the magnitude of townscape effect comprises judgements about the size and scale of the effect, the geographical extent of the area affected and the duration of effect and its reversibility.

9.31. Paragraph 5.37 of GLVIA3 sets out the criteria which should be used in reaching a judgement on the nature or magnitude of effect. These include but are not necessarily restricted to:

- the degree to which the proposal fits with existing character; and
- the contribution to the landscape that the development may make in its own right, usually by virtue of good design, even if it is in contrast to existing character.

9.32. The magnitude of change is assessed as high, medium, low or negligible by applying professional judgement and the indicative criteria listed in **Table 9.5**.

Table 9.5: Indicative Criteria for Assessing Likely Magnitude of Townscape Change

Category	Criteria
High	Large-scale removal or addition of townscape features or removal of localised but unusual or distinctive townscape features and/ or addition of new conspicuous features and elements which may alter the character of the townscape (with uncharacteristic features being negative and characteristic features being positive). Physical loss of townscape features that are not replaceable or are replaceable only in the long term. The duration of this effect may be permanent and irreversible.
Medium	Medium-scale removal or addition of townscape features and/or addition of new noticeable features and elements which would be clearly visible but would not alter the overall character of the townscape (with uncharacteristic features being negative and characteristic features being positive). Physical loss of townscape features that are replaceable in the medium term. The duration of this effect may be semi-permanent and irreversible.
Low	Small-scale removal or addition of townscape features and/ or addition of new discrete features and elements which would be perceptible within but would not alter the overall character of the townscape (with uncharacteristic features being negative and characteristic features being positive). The duration of this effect may be temporary and reversible.
Negligible	Barely perceptible removal or addition of landscape features would occur and the proposed development would be barely perceptible in visual/ townscape character terms.
No change	No change to townscape

9.33. Magnitude is also assessed as being either a beneficial or adverse where for:

- Beneficial change the Development, or part of it, would appear in keeping with existing townscape character and would make a positive visual and/ or physical contribution to key characteristics. Removal of uncharacteristic or unsightly features would also be a beneficial change; and
- Adverse change the Development, or part of it, would be perceived as an uncharacteristic or intrusive component in the context of existing townscape character and would have a negative visual and/ or physical effect on key characteristics.

Visual

9.34. Each of the visual effects is assessed in terms of its size or scale, the geographical extent of the area influenced, its duration and whether it is reversible.

9.35. The likely changes in views from identified viewpoints are systematically identified and include consideration of the following factors:

- Extent – the extent of the baseline view that would be occupied by the Development – full (unobstructed by vegetation, topography or intervening structures) or partial (obstructed to some extent) or glimpsed;
- Proportion of Development visible – full (all), most (more than 75%), half (50%), small amount (<25%) or none;
- Contrast – how would the visible parts of the Development relate to the surrounding baseline features: high, medium or low levels of contrast;
- Angle of view – direct (head on or close to), oblique (45° to head on) or peripheral (>45° i.e. on the edge of vision);
- Distance – between the site and the receptor: close (0 to100m), middle (100 to 500m) and long (0.5km or more); and
- Duration and reversibility – the relative time over which the view is experienced (short term <12 months, medium term 1 to 3 years or long term 3 years plus), temporary or permanent, intermittent or continuous e.g. transient (views which are normally experienced when in motion) and seasonal (views which would be subject to seasonal leaf cover).

9.36. Other considerations include the level of activity in a scene, presence of noise or lighting, traffic movement, peoples' likely preferences and expectations, quality of the existing view (inevitably a point of judgement), nature of scene (open and directionless, or closed and bounded) and any other elements that affect human perception.

9.37. Based on the above considerations, the likely magnitude of change is assessed as high, medium, low or negligible by applying professional judgement to the indicative criteria listed in **Table 9.6**.

Table 9.6: Indicative Criteria for Assessing Likely Magnitude of Visual Change

Category	Criteria
High	The development, or part of it, would cause a dominant or complete change or contrast to the view, resulting from the loss or addition of substantial new features in the view. It would substantially alter the appreciation of the view. The duration of this effect may be permanent and non-reversible.
Medium	The development, or part of it, would result in a clearly noticeable change or contrast to the view but would not materially alter its composition or appreciation of the view. The duration of this effect may be temporary and reversible.
Low	The development, or part of it, would cause a perceptible change or contrast to the view, but would not materially affect the composition or appreciation of the view. The duration of this effect may be temporary and reversible.
Negligible	The Proposed Development, or part of it, would cause a barely perceptible change or contrast to the view. It would not affect the composition or appreciation of the view. The duration of this effect may be temporary and reversible.
No change	No change to the view

9.38. Magnitude is assessed as being either a beneficial or adverse change where:

- For beneficial change the Development, or part of it, would be perceived as a positive addition in the context of the existing view; and
- For adverse change the Development, or part of it, would be perceived as an uncharacteristic or intrusive component in the context of the existing view.

Step 4: Significance Criteria

9.39. A key part of the assessment process is the identification of the significance of townscape and visual effects. In making judgements about significance, the separate judgements on receptor sensitivity and magnitude are combined to arrive at a judgement on the importance of the effect and whether or not it should be considered significant. This step is carried out through sequential combination of all possible effects looking at individual criteria and applying professional judgement.

9.40. The significance of townscape and visual effects are classified as being major, moderate, minor and negligible. Where magnitude is determined as 'no change', no effect is stated. Effects are also described as being beneficial, neutral or adverse.

9.41. Within this judgement there is a distinction between levels of significance, expressed as a 'word scale' in **Table 9.7**. This applies to both townscape and visual elements. Where townscape effects are assessed as being between these extremes a judgement is made as to whether they are significant or not and an explanation provided.

Table 9.7: Definition of Significance Scale

Category	Criteria
Beneficial effect of major significance	The proposed development would be in keeping with and would provide a major improvement to the townscape character or the value of the existing view.
Beneficial effect of moderate significance	The proposed development would be in keeping with and would provide a noticeable improvement to the townscape character or the value of the existing view.
Beneficial effect of minor significance	The proposed development would be in keeping with and would provide a perceptible improvement in the townscape character or the value of the existing view.
Negligible	The proposed development would be barely perceptible and have very little effect on townscape character or the value of the existing view.
Adverse effect of minor significance	The proposed development would cause a perceptible deterioration in the townscape character area or the value of the existing view.
Adverse effect of moderate significance	The proposed development would cause a noticeable deterioration in the townscape character area or the value of the existing view.
Adverse effect of major significance	The proposed development would be the dominant feature and cause a major deterioration in the townscape character or the value of the existing view.

9.42. As noted in GLVIA3 (para. 6.44), there are no hard and fast rules about what makes an effect significant and there isn't a standard approach. The final judgment on whether each effect is significant or not relies on informed professional judgement, with the criteria used in reaching a decision clearly supported by narrative text to draw out the key issues, describe the effects and explain the underlying rationale

Limitations and Assumptions

9.43. Site assessment has been undertaken from publicly accessible viewpoints in accordance with guidelines. In accordance with recognised guidelines, the visual assessment relies on a series of representative viewpoints, in this case from 21 locations. These are not intended to illustrate every possible location from where there might be a view of the Development, but rather to present a selection of views from a variety of angles and distances to inform decisions about the Development's likely townscape and, in particular, visual effects.

9.44. Whilst it is not unusual to provide an assessment of effects at different stages during the operational life of a scheme, because the Development is in the urban area and does not rely on new planted landscaping to provide screening, the assessment of operational effects would be at the year of opening and it is assumed that it would not alter or be mitigated at later stages of its operational life.

Existing Baseline Conditions

Townscape Designations

Liverpool Maritime Mercantile City World Heritage Site

9.45. As indicated on **Figure 9.1** the southern part of the Site is within the WHS. The location of the proposed cruise terminal building is within the WHS Buffer Zone. Castle Street Conservation Area forms part of the WHS and also overlaps the southern part of the Site.

Conservation Areas

9.46. Conservation Areas are defined in the Planning Act 1990 (Listed Buildings and Conservation Areas) as areas of "special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance ". There are 35 designated Conservation Areas within Liverpool, and a large amount of the City Centre is protected by this policy designation.

9.47. The Site is partially within the Castle Street Conservation Area. The Castle Street Conservation Area, which includes the 'Three Graces' on the Mersey waterfront, extends inland along Water Street and Dale Street, the majority of the area lying to the south of the Site. Immediately to the north of the Site is the Princes Half Tide Dock which is both within the WHS and the Stanley Dock Conservation Area which abuts the Site to the north and east. To the east is the busy thoroughfare of Waterloo Road and Bath Street which, bounded by the massive listed dock boundary wall, is also in the WHS and the Stanley Dock Conservation Area.

Townscape Character Areas

9.48. The Liverpool Draft Local Plan (2016)[4] divides the city centre into seven character areas. The Site falls within the Waterfront Character area which extends from West Waterloo Dock in the north to Brunswick Dock in the south and is bounded inland by Sefton Street and the Strand in the south and by Waterloo and Regent Road in the north.

9.49. Dominated by the 'Three Graces', the waterfront is almost entirely within the WHS or its buffer zone. The WHS SPD further divides the WHS into constituent Character Areas, the closest to the site being Area 2: Pier Head and Area 3: Stanley Dock. These townscape character areas are identified on **Figure 9.2** and referenced through the townscape assessment.

Visual Baseline

9.50. As described, 21 viewpoints have been identified through collaboration with LCC and agreed as representative to illustrate views of the proposed Development in the study area. These viewpoints are listed in **Table 9.8** below and the baseline descriptions and photos are shown on the Viewpoint Baseline Sheets at **Appendix 9.2.**

9.51. These representative viewpoints, and some of the reasons for selection, include:

- Areas of high heritage value such as the Liverpool World Heritage Site and Conservation Areas;
- Viewpoints that may have wide panoramic views or by contrast focused views;
- Viewpoints at different distances;
- Viewpoints at different elevations;
- Viewpoints from different aspects;
- Viewpoints from which there would only be partial views of proposed Development; and
- Sequential views, for instance along the River Mersey.

9.52. Receptors represented by these selected viewpoints include views from residences, travellers on roads or recreational points where visitors may experience the townscape and viewpoints where viewers would likely to be stationary or moving through the townscape.

Table 9.8: List of Viewpoint Locations

Ref	Viewpoint Location	Reason for Selection
VP01	Magazine Promenade, New Brighton	Long distance view across the Mersey identified as a key view in Liverpool WHS SPD
VP02	Egremont Promenade, Egremont	View near Wallasey Town Hall across the Mersey identified as a key view in Liverpool WHS SPD
VP03	Seacombe Promenade, Wallasey	Long distance view across the Mersey on a waterfront walk
VP04	Woodside Ferry Terminal, Birkenhead	View across the Mersey identified as a key view in Liverpool WHS SPD
VP05	Port Sunlight River Park, Wirral	Long distance view from elevated area within country park
VP06	Albert Dock	Area popular with visitors and within the Albert Dock Conservation Area
VP07	Museum of Liverpool	Area popular with visitors and within the Albert Dock Conservation Area
VP08	Canada Boulevard	Location outside the 'Three Graces' within the WHS
VP09	King Edward Street	Close proximity view located within the WHS Buffer Zone
VP10	Princes Parade North	Close proximity view looking west from Princes Parade within WHS Buffer Zone
VP11	Everton Park	Elevated long distance view identified as a key view in Liverpool WHS SPD
VP12	Echo Arena	Long distance view along waterfront from
VP13	Pier Head	View along the waterfront from Pier Head Ferry Terminal within the WHS

Ref	Viewpoint Location	Reason for Selection
VP14	Princes Parade South	Close proximity view looking north from Princes Parade within WHS Buffer Zone
VP15	Leeds Street/King Edward Street	View within the WHS Buffer Zone identified by LCC
VP16	Metropolitan Cathedral	Long distance view identified as a key view in Liverpool WHS SPD
VP17	Anglican Cathedral	Long distance view identified as a key view in Liverpool WHS SPD
VP18	Bidston Hill, Wirral	Elevated long distance view identified as a key view in Liverpool WHS SPD
VP19	Holt Hill, Birkenhead	Long distance view identified as a key view in Liverpool WHS SPD
VP20	Waterloo Dock	View along the waterfront within the WHS buffer zone
VP21	Victoria Tower	View within the WHS Buffer Zone identified by LCC

Likely Effects

Demolition and Construction

Sources of Effect

9.53. The Development is at a relatively early stage in relation to the construction programme. It is therefore difficult to predict with certainty the precise methodology or construction programme that would be adopted for construction and site management. However, the demolition and construction works are broadly as described in **Chapter 6: Development Programme and Construction.**

9.54. The broad impacts that may arise during the demolition and construction phase and are likely to give rise to potential adverse townscape and visual effects are summarised in **Table 9.9** below. It has been assumed that construction would be undertaken over an approximate 24 month period.

Table 9.9: List of Potential Demolition and Construction Effects

Feature / Nature of Impact
The visual impact of HGV movement, barges and general construction works
The visual impact of site lighting around construction areas
The visual and landscape impacts of remodelling ground levels/cut and fill operations
The landscape impacts of incorporating services and utilities
The landscape and visual impacts of temporary parking, on-site accommodation and work areas
The visual impacts of temporary screening measure and protective fencing
The landscape and visual impact of material stockpiles

Townscape Effects

9.55. As is commonplace with major building works, the scale of the activities involved in the construction of the planned Cruise Liner Terminal and its associated infrastructure, including local demolitions, dock wall reconstruction and jetty construction, would potentially be visible from many locations

including the opposite side of the Mersey. These would have the potential to give rise to a range of visual effects that cannot practicably be mitigated that would vary over the construction period depending on the scale and intensity of the Works. However, the effects would be predominantly visual and it is not anticipated that there would be any significant townscape effects during demolition and construction. There would be **temporary, local effects of minor adverse significance** to the Waterfront Character Area and Pier Head Character Area.

Visual Effects

9.56. Following a combination of desk based studies, a series of field investigations have verified the main visual receptors where demolition and construction operations would be visible. In accordance with the assessment methodology they have been considered against the 21 viewpoints listed at **Table 9.8** and identified in **Appendix 9.3**. **Table 9.10** below provides a summary of those effects and their significance. All effects are considered **temporary**.

Table 9.10: Summary of Construction Visual Effects

Ref	Viewpoint Location	Sensitivity	Magnitude of Construction Effect	Geographic Range	Significance of Impact
VP01	Magazine Promenade, New Brighton	High	Negligible	Regional	**Negligible**
VP02	Egremont Promenade, Egremont	High	Minor	Regional	**Minor adverse**
VP03	Seacombe Promenade, Wallasey	High	Minor	Regional	**Minor adverse**
VP04	Woodside Ferry Terminal, Birkenhead	High	Minor	Regional	**Minor adverse**
VP05	Port Sunlight River Park, Wirral	High	Negligible	Regional	**Negligible**
VP06	Albert Dock	High	Minor	District	**Minor adverse**
VP07	Museum of Liverpool	High	Minor	District	**Minor adverse**
VP08	Canada Boulevard	High	Minor	Local	**Minor adverse**
VP09	King Edward Street	Low	Medium	Local	**Minor adverse**
VP10	Princes Parade North	Low	Medium	Local	**Minor adverse**
VP11	Everton Park	High	Negligible	District	**Negligible**
VP12	Echo Arena	High	Minor	District	**Minor adverse**
VP13	Pier Head	High	Minor	District	**Minor adverse**
VP14	Princes Parade South	Medium	Minor	Local	**Minor adverse**
VP15	Leeds Street/King Edward Street	Low	Negligible	Local	**Negligible**
VP16	Metropolitan Cathedral	Medium	No change	District	**No effect**
VP17	Anglican Cathedral	Medium	No change	District	**No effect**
VP18	Bidston Hill, Wirral	High	Negligible	Regional	**Negligible**
VP19	Holt Hill, Birkenhead	High	Negligible	Regional	**Negligible**
VP20	Waterloo Dock	Low	Negligible	District	**Negligible**
VP21	Victoria Tower	Medium	Negligible	District	**Negligible**

Completed Development

Sources of Effect

9.57. The design of the Cruise Liner Terminal is being developed through an iterative process involving assessment and consultation. This process has allowed site constraints and opportunities to directly influence the evolution of the proposals including the landscape and public realm. As a result, mitigation measures are embedded within the scheme and therefore, in terms of the assessment methodology, considered an inherent part the Development that would be considered when assessing the likely effects of the Development.

9.58. During design and as described in **Chapter 4: Alternatives and Design Evolution**, consideration has been given to alternative designs for the terminal building and a number of iterations have been amended in order to take account of feedback from the design team and through the stakeholder engagement. With respect to the mitigation of townscape and visual impacts this design evolution has focussed on the height, scale and massing of the proposed building works and whilst landscape measures are proposed these would not influence the overall assessment of townscape and visual effects.

9.59. Some of the key principles incorporated into the indicative scheme designs include:

- Scale, massing and height of building responds guidance within the WHS SPD and Regeneration frameworks for this part of the city. In particular the form, scale and architectural expression of the building is responsive to its Mersey waterfront location.
- To assist in the implementation of statutory planning control the choice of building materials, comprising large areas of glazing provides reflective facades that would not compete with the solidity and opaqueness of a number of other buildings within the area.
- The building addresses and helps to improve activity in this area.
- Design of movement and linkages prioritising pedestrian movement. Vehicular access and servicing will be carefully considered and controlled to minimise impact.

9.60. The operational phase is likely to give rise to a number of potential townscape and visual effects. These are summarised in **Table 9.11** below.

Table 9.11: List of Potential Operational Effects

Feature / Nature of Impact
The visual impact of the new Development (including terminal building, jetty works and highway modifications)
The effect of increased traffic movements (vehicle and passenger)
Night time illumination

Townscape Effects

9.61. Please refer to **Chapter 10: Built Heritage and Chapter 11: Archaeology** for a full assessment of heritage impacts.

Townscape Designations

9.62. The Site partially lies within the WHS and associated Castle Street Conservation Area, close to the 'Three Graces'. No significant Works are proposed in the part of the Site that overlaps with the WHS. The main part of the Development including the main building, jetty and linkspan bridges are

outside any designated areas and there are no listed buildings or other assets in close proximity. Consequently, assessment relating to effects on heritage are concerned with the setting of designated heritage assets rather than any direct impact on their fabric or physical remains. Therefore, understanding likely effects of the proposed Development on townscape heritage requires the consideration of the visual relationship of the scheme and features of the Site which make up the value of the World Heritage Site Buffer Zone. These include the dock boundary wall, the setting of the Princes Dock, areas of historic surfacing and the key views in and around Princes Dock of the WHS.

9.63. The WHS designations and UNESCO accept that new development can be compatible with the conservation of the WHS provided that it does not involve the loss of heritage assets or damage their setting. It is further stated that location, appropriate scale and high quality design are key to conserving the fabric and setting of the WHS. The development would regenerate a derelict section of the waterfront, would be of an appropriate scale and, complementing other recent developments, would introduce new high quality architecture into Princes Dock. The Development would not adversely affect heritage designations and is assessed as providing a **permanent, local effect of moderate beneficial significance** to the nearby heritage designations.

9.64. The skyline of Liverpool, particularly from the Wirral side of the River Mersey, is one of the city's most characteristic townscape features. Whilst the visual assessment later in this chapter considers in detail the visual effect of the proposed Development on a number of key views, including many listed as important in the Liverpool WHS designation, the city skyline is an important townscape feature. The Three Graces at Pier Head represent an iconic image that symbolises the city of Liverpool. The substantial scale and mass of these buildings and the grandeur of their architecture sets them apart from the more utilitarian forms of the dock warehouses which add a more horizontal emphasis along the water front. The exception to this is the huge presence of the Tobacco Warehouse at Stanley Dock that dominated the northern docks. Away from the waterfront the Anglican and Catholic cathedrals are important built elements and the St Johns Beacon the most visible structure in the city centre. In addition there is new development that is starting to introduce taller buildings into the city centre and some, such as the Alexandra Tower and Liverpool City Lofts (No 1 Princess Dock) are very close to the Site to the immediate north and on the opposite side of the dock respectively.

9.65. The new Cruise Liner Terminal would introduce development into a gap site on the waterfront. The height of the new building would not interrupt or impose on any skyline views from across the River Mersey and would, in urban form and scale terms, be complementary to the local townscape and waterfront skyline. **Figure 9.3** illustrates building heights in the wider context and local to the Development. Building heights vary within the vicinity of the Site from between 7m up to 140m. The proposed Cruise Liner Terminal would be a maximum of 22.45 metres high (from ground/jetty level) and whilst significantly lower in height than its immediate neighbours such as the Alexandra Tower development (95m high), would be of a scale and height in keeping with the locality and its important waterfront location being of a similar height to the buildings along Princes Parade.

9.66. With specific reference to the Site's waterfront location the WHS SPD states that the following riverside features of the WHS and buffer zone are of particular importance:

- The importance of views of the Pier Head buildings as the focal point for Liverpool's and the WHS's river frontage
- The varied skyline of city centre, in particular views to the cathedrals, other landmark buildings and the ridge of higher ground to the east of the city centre
- The careful juxtaposition of buildings of different periods along the waterfront, which demonstrates the evolution of the waterfront and can create an exciting visual interplay

9.67. The proposed Development would not adversely affect any of these townscape/waterfront features. Moreover, the development of a derelict waterfront site would positively affect the local waterfront skyline. As a consequence, the overall effect on the city and waterfront skyline is assessed as being a **permanent, local effect of moderate beneficial significance**.

Townscape Character

9.68. The Site occupies a derelict section of the Mersey waterfront and is a gap site on the western edge of Princess Dock where, in recent years, there has been considerable investment in new development forming part of the early phases of the consented Liverpool Waters development. As illustrated at **Figure 9.2** the Site occupies an important area within the Waterfront Townscape Character Area and the proposed Cruise Liner Terminal would be complementary with the maritime lands uses and townscape character of the local area.

9.69. The proposed scheme would develop a gap site on the Mersey waterfront and Princess Dock and its development would be in keeping with the urban grain of the locality which is framed by the orientation of the waterfront and dock. The new Cruise Liner Terminal would present an enclosing edge to the dock serving to frame views within the dock that would be in keeping with recent development in the dock and local area.

9.70. Clearly as an important terminal it is envisaged that there would be significant traffic (maritime and terrestrial) to the terminal (refer to the Transport Assessment submitted in support of the planning application for more detail).

9.71. With specific respect to the townscape effects of new movement and linkage infrastructure associated with the terminal there would be increased maritime and terrestrial traffic to the new terminal and this would help animate and give activity to this part of Princes Dock and, more generally, to the Northern Liverpool Docks which in recent years have been in decline and lacked inward investment and activity. The land access to the new terminal would mostly use the existing road network. As such it is not envisaged that local vehicular and pedestrian linkages would be adversely affected; indeed the new Development offers the opportunity to gain access to a formerly inaccessible section of the Mersey water front and improve access to pedestrians along the Mersey.

9.72. As a consequence, the overall effect on townscape character is assessed as being a **permanent local effect of moderate beneficial significance**.

Visual Effects

9.73. An aerial view of the proposed Development in the context of the local area is provided in **Figure 9.4**.

9.74. In accordance with the assessment methodology, the operational effects of the Development have been considered against the 21 viewpoints listed in **Table 9.8** and outlined in detail at **Appendix 9.2.** The potential operational effects of the Development on these viewpoints are set out in detail at **Appendix 9.3 Viewpoint Assessment** and summarised in **Table 9.12** below.

Table 9.12: Operational Effects on Viewpoints

Ref	Viewpoint Location	Sensitivity	Magnitude of Operation Effect	Geographic Range	Significance of Impact
VP01	Magazine Promenade, New Brighton	High	Low	Regional	**Minor beneficial**
VP02	Egremont Promenade, Egremont	High	Low	Regional	**Minor beneficial**

Ref	Viewpoint Location	Sensitivity	Magnitude of Operation Effect	Geographic Range	Significance of Impact
VP03	Seacombe Promenade, Wallasey	High	Low	Regional	**Minor beneficial**
VP04	Woodside Ferry Terminal, Birkenhead	High	Low	Regional	**Minor beneficial**
VP05	Port Sunlight River Park, Wirral	High	Negligible	Regional	**Negligible**
VP06	Albert Dock	High	Low	District	**Minor beneficial**
VP07	Museum of Liverpool	High	Low	District	**Minor beneficial**
VP08	Canada Boulevard	High	Negligible	Local	**Negligible**
VP09	King Edward Street	Low	Medium	Local	**Minor adverse**
VP10	Princes Parade North	Low	Moderate	Local	**Minor adverse**
VP11	Everton Park	High	Negligible	District	**Negligible**
VP12	Echo Arena	High	Low	District	**Minor beneficial**
VP13	Pier Head	High	Low	District	**Minor beneficial**
VP14	Princes Parade South	Low	Medium	Local	**Minor beneficial**
VP15	Leeds Street/King Edward Street	Low	Low	Local	**Minor adverse**
VP16	Metropolitan Cathedral	Medium	No change	District	**No effect**
VP17	Anglican Cathedral	Medium	No change	District	**No effect**
VP18	Bidston Hill, Wirral	High	Negligible	Regional	**Negligible**
VP19	Holt Hill, Birkenhead	High	Negligible	Regional	**Negligible**
VP20	Waterloo Dock	Low	Medium	District	**Minor beneficial**
VP21	Victoria Tower	Medium	Low	District	**Minor beneficial**

9.75. Generally, views across the River Mersey towards the Development would have **permanent, regional effects of minor beneficial significance** (VP01, VP02, VP03 & VP04). The Development would not break the skyline and is of a similar height to those properties on Princes Parade. The Development would screen a number of the existing buildings of varying styles and materials, simplifying the massing on the waterfront.

9.76. Longer distance views across the River Mersey towards the city centre from elevated areas (VP05, VP18 & VP19) would have **effects of negligible significance** as the Development would blend into the wider cityscape.

9.77. Views to the south of the Development along the waterfront would have **permanent, district effects of minor beneficial significance** (VP06, VP07, VP12, VP13 & VP14). The Development would extend the skyline into the Mersey, but would be seen in the context of a wide range of building forms and would be a positive addition to the waterfront. This would be the same for

viewpoints from the north along the waterfront (VP20 & VP21) as again it would be a positive addition to the waterfront. Views from Canada Square (VP08) would have **effects of negligible significance** as the Development would be nearly entirely screened by existing buildings.

9.78. Effects from within the city centre would be limited, most views of the Development screened by existing built form and therefore would have **no effects** or **effects of negligible significance** (VP11, VP16 & VP17).

9.79. The only adverse effects on views come from views in close proximity to the Development. Since the Development would fill an existing gap in built form on the waterfront, views across the River Mersey would be screened (VP09 & VP15) having **permanent, local effects of minor adverse significance**. This would be most evident from the entrance to Princes Parade (VP10) as the Development would screen views towards Birkenhead Town Hall and Hamilton Square Station on the Wirral. It should be noted, however, that these adverse effects are for low sensitivity receptors only.

Mitigation Measures and Likely Residual Effects

Demolition and Construction

9.80. As stated above the Development incorporates mitigation measures that are embedded within the scheme design and are therefore deemed an inherent part of the Development that would be considered when assessing the likely effects of the Development. These measures include landscape and public realm measures (indicative hard and soft landscaping and public realm design are provide in the standalone Design and Access Statement submitted in support of the planning application).

9.81. Given that the assessment of the townscape and visual effects has determined temporary local effect of minor adverse significance or negligible effects on the majority of the viewpoints, it is not envisaged that any additional mitigation measures beyond those provided by the Development would be required to avoid, reduce or offset any likely adverse effects. As such, and in accordance to the EIA assessment methodology and terminology therein, the residual effect would remain the same as the potential effect.

9.82. However, to mitigate against potential construction phase impacts a Construction Environmental Management Plan (CEMP) would be prepared to establish and enact good site management, maintenance and housekeeping. As indicated in **Chapter 6: Development Programme and Construction**, the CEMP would ensure that temporary deterioration to landscape resources, character and visual amenity would be kept to a practicable minimum.

Completed Development

Townscape Effects

9.83. As there are no additional mitigation measures proposed the residual effects would remain the same as the predicted potential effects set out above with **permanent, local effects of moderate beneficial significance** for townscape designations and character.

Visual Effects

9.84. As there are no additional mitigation measures proposed the residual effects would remain the same as the predicted potential effects set out in **Appendix 9.3** and summarised at **Table 9.12** above.

Summary

9.85. In the absence of mitigation, the Development was assessed to have likely effects as follows:

- During site preparations and construction there would be **temporary, local effects with minor adverse significance** to the WHS and WHS Buffer Zone, Waterfront Character Area and Pier Head Character Area;
- During construction, activities along the waterfront would draw the eye to the Development and would have **temporary, district and regional effects of minor adverse significance** for views along the waterfront and across the River Mersey;
- Once completed the Development would have a mainly positive effect on the Liverpool waterfront. The Development is in scale with the existing built form on Princes Parade and for viewpoints and there would be a **permanent, district effect of minor beneficial significance** for views along the waterfront and across the River Mersey;
- There would be some **permanent, local effects of minor adverse significance** for views in close proximity to the Development during operation where views across the River Mersey are screened, but these effects are very limited in geographic area and pertain only to views of low sensitivity.

9.86. Since no mitigation is considered necessary for townscape or visual effects, the residual effects are as listed above.

References

1 Landscape Institute and Institute of Environmental Management & Assessment, 2013, Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3)

2 HMSO, 2017, Statutory Instrument 2017 No. 571 – Town and Country Planning (Environmental Impact Assessment) Regulations 2017

3 Liverpool City Council (2009): 'Liverpool Maritime Mercantile City World Heritage Site Supplementary Planning Document', Liverpool City Council, Liverpool

4 Liverpool City Council (2016): 'Liverpool Draft Local Plan', Liverpool City Council, Liverpool

10. Built Heritage

Introduction

10.1. This chapter presents an assessment of the likely significant effects and likely residual effects of the Development on built heritage assets within the Site, and those in its surroundings.

10.2. This chapter first outlines the methodology used in the assessment and then provides a description of the relevant baseline conditions of the Site and immediate surrounding area. This is followed by an assessment of the likely significant effects of the Development during the demolition and construction works and once the Development is completed and operational. Where appropriate, mitigation measures are identified to avoid, reduce or offset any significant adverse effects. Taking account of the mitigation measures, the nature and significance of the likely residual effects of the Development are also described.

10.3. The preparation of this chapter has been informed by a Built Heritage Statement, which is presented in **Appendix 10.1.**

Assessment Methodology and Significance Criteria

Assessment Methodology

10.4. This assessment follows best practice procedures produced by Historic England[1,2], the Chartered Institute for Archaeologists[3] and policy contained in Section 12 of the National Planning Policy Framework (NPPF) 'Conserving and Enhancing the Historic Environment'[4]. At local level, relevant policy regarding heritage is contained within the Liverpool Unitary Development Plan (2002)[5] and the Liverpool Maritime Mercantile City World Heritage Site Supplementary Planning Document (2009)[6]. Further details of these documents are provided in the accompanying Built Heritage Statement, contained within **Appendix 10.1**.

10.5. The assessment methodology is based on that outlined in the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3 Part 2, in the amended document HA 208/07 issued by the Highways Agency in August 2007[7]. Although this guidance was written for road schemes in particular, it is widely accepted as a general best-practice approach to heritage impact assessment.

10.6. The methodology and data sources used to prepare this assessment are set out in detail in the accompanying Built Heritage Statement, presented in **Appendix 10.1**, but in summary this included the following:

- Identification of any designated or non-designated built heritage assets potentially affected by the proposed Development;
- Desk-top research using online resources and research in relevant archives was undertaken. For this assessment, the Liverpool City Archives were visited to obtain information from historic maps, documents and secondary sources. Historic maps and images are reproduced where appropriate in this report. Where maps and images have been reproduced from material held in Liverpool City Library, Waterman were advised that these were in the public domain and reproducible with reference to the library;
- A walk-over survey of the Site and immediate surrounding area;
- Assessment of the heritage significance of the Site and the identified heritage assets potentially affected by the proposed development;

- Assessment of the contribution that the Site makes to the heritage assets assessed;
- Assessment of the impact that the proposed Development (as known) would have on the significance of the heritage assets; and
- Consultation of local and national planning policy and guidance pertaining to heritage.

10.7. The Site was visited on 11th September 2017. The aim of the visit was to identify and gain an understanding of any heritage assets within the Site, or its surroundings, that may be affected by the proposals.

Consultation

10.8. EIA Scoping responses were received from Historic England and Liverpool City Council (LCC) in August 2017 and September 2017 respectively. The reports set out that the Environmental Statement (ES) should assess the potential impacts of the Development on designated and non-designated heritage assets, as well as the potential impacts of the cruise liners themselves. The scoping reports also identify that a separate Heritage Impact Assessment (HIA) analysing the potential impacts on the Outstanding Universal Value of the World Heritage Site should be undertaken (complying with ICOMOS Guidance on HIA), with the findings incorporated into this ES. The ICOMOS Statement that accompanies this assessment is submitted as a standalone report in support of the planning application.

Limitations and Assumptions

10.9. The assessment below was undertaken through consultation of available datasets from Historic England and LCC, and is therefore dependent on their completeness and accuracy. It is assumed that the available datasets are current and up-to-date, reflecting the best information available about the historic environment on the Site and immediate surrounding area.

Significance Criteria

10.10. Heritage significance in a planning policy context is a specific concept which is distinct from the Environmental Impact Assessment meaning of "Significance of Effect". Heritage significance is defined in Annex 2 of the NPPF as "*The value of a heritage asset to this and future generations because of its heritage interest…[and]…derives not only from a heritage asset's physical presence, but also its setting*." It is the sum of tangible and intangible values which make a heritage asset important to society. This may consider the evidential and aesthetic qualities of an asset as well as intangible qualities such as associations with historic people or events, or the importance of an asset to a local community. It is therefore describing the *value* of a heritage asset or its setting.

10.11. In the context of an EIA, the term 'significance' is used in relation to likely environmental effects on, or change to, a value. To avoid confusion, when referring to the NPPF context, the term 'heritage significance' (rather than just significance) is used within this assessment.

10.12. To assess the heritage significance of the Site and the relevant heritage assets, this report has drawn guidance from Historic England, which recommends making assessments under the categories of: Evidential, Historical, Aesthetic and Communal Values.

- **Evidential Value**: "Evidential value derives from the potential of a place to yield evidence about past human activity";
- **Historical Value**: "Historic value derives from the ways in which past people, events and aspects of life can be connected through a place to the present";

- **Aesthetic Value**: “Aesthetic value derives from the ways in which people draw sensory and intellectual stimulation from a place”; and
- **Communal Value**: “Communal value derives from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory” [8].

10.13. Taking into account the sum of evidential, historical, aesthetic and communal value of a heritage asset, the overall heritage significance (value) was assessed using a number of ratings, which are set out in **Table 10.1.**

Table 10.1: Heritage Significance of Asset

Level of Significance	Description of Criteria
Very High	• Heritage Assets identified as having Outstanding Universal Value, such as World Heritage Sites • Other structures or sites of recognised international importance
High	• Scheduled Monuments with standing remains • Grade I and II* Listed Buildings • Grade I and II* Registered Parks and Gardens • Other listed buildings that can be shown to have exceptional qualities in their fabric or historical associations not adequately reflected in the grade of listing. • Conservation Areas containing high grade or very important listed buildings/historic parks and gardens • Non-designated structures of clear national importance
Medium	• Grade II Listed Buildings • Grade II Registered Parks and Gardens • Non-designated heritage assets that can be shown to have exceptional qualities in their fabric or important historical associations • Conservation Areas • Non-designated historic townscapes or built-up areas with important historic integrity in their buildings, or in their settings (including surviving street furniture or other structures)
Low	• Non-designated heritage assets such as Locally Listed Buildings, with modest quality in their historic fabric or historical associations • Historic townscapes or built up areas of limited historic integrity in their structures or setting
Neutral	• A building, feature, or area which has no cultural significance but is also not considered intrusive to heritage value
Unknown	• Structures or features with some hidden or inaccessible potential for heritage significance
Intrusive	• A building, structure or area which detracts from heritage significance

Impact Assessment Methodology

10.14. To establish the likely significant effects of the Development on heritage assets, the assessment provides a comparable analysis of the heritage significance against the magnitude of impact. Criteria based on the Design Manual for Roads and Bridges[9] (DRMB) and the International

Council on Monuments and Sites (ICOMOS)[10] were used to determine the heritage significance of the asset, the magnitude of impact and the significance of effect (the overall impact) of the Development upon heritage significance (value).

10.15. The criteria for assessing the magnitude of impact are set out in **Table 10.2**.

Table 10.2: Magnitude of Impact

Magnitude of Impact	Description
Major Beneficial	The proposed changes will significantly improve the overall setting and character of heritage assets, revealing and/or enhancing important characteristics which were previously unknown or inaccessible. There would be a substantial improvement to important elements of the asset.
Moderate Beneficial	The proposed changes will considerably improve the setting or overall character of the heritage asset. There may be an improvement in key uses and beneficial change (e.g. the creation of coherency) to the characteristics of the asset.
Minor Beneficial	The proposed changes may cause a minor improvement to the setting or overall character of a heritage asset.
Negligible	The proposed changes will have a minimal positive or negative impact on the heritage asset or its setting.
Neutral	The proposed changes will have no impact on the heritage asset or its setting.
Minor Adverse	The proposed changes will have minor impact on the setting or overall character of a heritage asset. Change of this magnitude may be acceptable if suitable mitigation is carried out.
Moderate Adverse	The proposed changes will negatively alter the setting or overall character of the heritage asset. It will likely disturb key features and detract from the overall heritage significance. Change of this magnitude should be avoided where possible, but can be minimised or neutralised through positive mitigation.
Major Adverse	The proposed changes will significantly damage the overall setting and/or character of heritage assets. They will cause a notable disruption to, or in some cases, complete destruction of, important features. Change of this magnitude should be avoided.

10.16. The significance of the likely effects of the Development on the significance of heritage assets was determined by considering the combination of the heritage significance (value) of the heritage assets and the magnitude of the impact to the environment resulting from the Development. To consider these in combination, a matrix of significance of likely effects was used to provide a transparent and objective assessment, as shown in **Table 10.3**.

10.17. The assessment of the potential impacts of the proposed Development upon the setting of identified heritage assets has been undertaken using the guidance detailed in Historic England's Historic Environment Good Practice Advice in Planning: 3 The Setting of Heritage Assets (HE 2015)[11]. This recommends that an assessment should consider the following factors when assessing a development's impact:

- Location and Siting;
- Form and Appearance;
- Additional Effects; and

- Permanence.

Table 10.3: Significance of Effect

Criteria		Sensitivity/ Value				
		Neutral	Low	Medium	High	Very High
Magnitude of Impact	Major Beneficial	Slight	Slight / Moderate	Moderate / Large	Large / Very Large	Very Large
	Moderate Beneficial	Neutral / Slight	Slight	Moderate	Moderate / Large	Large
	Minor Beneficial	Neutral / Slight	Neutral / Slight	Slight	Slight / Moderate	Moderate
	Negligible	Neutral	Neutral / Slight	Neutral / Slight	Slight	Slight/Moderate
	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
	Negligible	Neutral	Neutral / Slight	Neutral / Slight	Slight	Slight/Moderate
	Minor Adverse	Neutral / Slight	Neutral / Slight	Slight	Slight / Moderate	Moderate
	Moderate Adverse	Neutral / Slight	Slight	Moderate	Moderate / Large	Large
	Major Adverse	Slight	Slight / Moderate	Moderate / Large	Large / Very Large	Very Large

Baseline Conditions

10.18. A description of the current land uses and activities on the Site and its surrounding area are provided in **Chapter 3: Existing Land Uses and Activities**.

10.19. A detailed description of the Site, its historical development and the heritage assets assessed as being potentially affected by the proposed Development is provided in **Appendix 10.1.** A summary of this is provided below.

Designated Heritage Assets

World Heritage Site

10.20. The Liverpool Maritime Mercantile City World Heritage Site was inscribed by UNESCO in July 2004 under the 1972 World Heritage Convention. The majority of Site is not within the World Heritage Site, but is located adjacent to its boundary and within the Buffer Zone. A small section of the Site along St Nicholas Place and also including a section of the Liverpool Landing Stage is within the World Heritage Site.

Conservation Areas

10.21. The southern portion of the Site, along part of Princes Parade and St Nicholas Place, is located within the Castle Street Conservation Area. The north-east portion of the Site is adjacent to the Stanley Dock Conservation Area. The boundaries of these conservation areas follow the same alignment as that of the World Heritage Site, and therefore they are not considered separately to the World Heritage Site in terms of understanding the Site's contribution to their significance.

Listed Buildings

10.22. The Memorial to Heroes of the Marine Engine Room (Grade II* Listed. List Entry Number: 1209973) is located within the southern section of the Site, but is excluded from the Site boundary. No listed buildings are located within the Site boundary.

10.23. The Site is in the vicinity of a number of listed buildings. The following listed buildings are considered relevant to the assessment:

- The Royal Liver Building (Grade I Listed. List Entry Number: 1356370);
- The Cunard Building (Grade II* listed. List Entry Number: 1052283); and
- The Port of Liverpool Building (Grade II* Listed. List Entry Number: 1068223).

10.24. Together, the three listed buildings above comprise the trio of heritage assets that are known as 'The Three Graces' of Liverpool.

10.25. In addition, to the west of the Three Graces there is a group of four monumental statues which, for the purposes of this assessment, are included as a group. These are:

- Monument to Sir Alfred Lewis Jones (Grade II Listed. List Entry Number: 1068225);
- Monument of Edward VII (Grade II Listed. List Entry Number: 1068224);
- War Memorial in front of Cunard Building (Grade II Listed. List Entry Number: 1052301); and
- Merchant Navy War Memorial (Grade II Listed. List Entry Number: 1393706).

10.26. Also considered relevant to the assessment is the Church of Our Lady and St Nicholas (Grade II Listed. List entry Number: 1205993). This is located on the site of an earlier church, and is in the vicinity of the south-east section of the Site that encompasses St Nicholas Place. There is also a retaining wall to the west of, and railings to the south of the Church of Our Lady and St Nicholas (Grade II Listed. List Entry Number: 1356312) and the Simpson Fountain (Grade II Listed. List Entry Number: 1280434) located within the retaining wall.

10.27. Located adjacent to the church to the south east, and opposite to the Liver Building, is the Tower Building (Grade II* Listed. List Entry Number: 1360220).

10.28. On the eastern side of Princes Dock is the remaining section of Princes Dock Wall, as well as the gates that historically provided access to the dock. These are listed Grade II (List entry Numbers: 1322045, 1068397 and 1280755).

10.29. Also considered in this assessment, are a number of listed structures that are related to the Princes Half Tide Dock and the Waterloo Dock. These include:

- The Princes Half Tide Dock (Grade II Listed. List entry Number: 1252907);
- Entrance to Princes Half Tide Dock (Grade II Listed. List entry Number: 1208892); and
- Waterloo Warehouse (Grade II Listed: List entry Number: 1062576).

10.30. However, it is considered that any impact on these structures would be related to the relationship between the Site and views towards these structures from across the River. As this element of the assessment will also consider the Liverpool Maritime Mercantile City World Heritage Site, these structures will not be considered individually.

Other Designated Heritage Assets

10.31. There are no other types of designated heritage asset, such as Scheduled Monuments, Registered Park and Gardens and Battlefields, or Protected Wrecks, within the Site or its surroundings.

Non-Designated Heritage Assets

10.32. There are no buildings or structures formerly identified by LCC as non-designated heritage assets located within the Site. The site visit, however, identified Princes Jetty within the Site as potentially being of heritage interest and therefore a non-designated heritage asset. Princes Jetty is assessed within **Chapter 11: Archaeology**.

10.33. In addition, the site visit identified the following buildings within the vicinity of the Site as potentially being of heritage interest and therefore non-designated heritage assets:

- West Africa House, The Strand; and
- Wellington Buildings, The Strand.

10.34. Due to the shared age and architectural character of these buildings, they are considered jointly as part of this assessment.

Historical Overview

10.35. A summary of the Site's history is provided here, and a full and detailed history provided in **Appendix 10.1.**

10.36. The Site comprises part of the Princes Dock which, until the early nineteenth century, was part of the River Mersey foreshore on the north-western side of Liverpool. By the beginning of the nineteenth century, Liverpool's growth was such as that it was the second port city of the UK, behind only London in terms of tonnage and trade value. New markets had opened between the city and places such as South America, India, the Far East and Australia, while the existing trade with North America continued to grow[12].

10.37. This growth required new dock space for larger ships, and the Princes Dock, named after the Prince Regent (later King George VI) is one of the historical 'Central Docks' of Liverpool built at the turn of the nineteenth century and intended to facilitate even greater trade and security for shipping which entered the port. The development of steam technology enabled not only increased connectivity with productive regions inland, but also enabled the construction of larger enclosed dock spaces[13]. A 1795 Plan of Liverpool shows the city just before the construction of the Princes Dock, and indicates its proposed location, as well as the fort and other buildings along New Kay (sic) that formerly occupied the space.

10.38. Although first proposed in the eighteenth century and approved by Act of Parliament in 1800, problems with raising funds and securing land for development meant that work did not commence until 1810. These problems were compounded by the French Revolutionary Wars and Napoleonic Wars which limited the supply of men and horses for moving materials. By 1810, the full complement of land was still not available so work began on the construction of a dock which was now much reduced in size from the original proposal. At the same time, the sea wall that now forms the boundary of the current marine parade was also being built. Stone for the works was shipped across the river from quarries at Runcorn. By July 1811, the name of Princes Dock had been bestowed by the Dock Committee.

10.39. Work to construct Princes Dock involved the construction of a new river wall and ground reclamation. The Dock was completed in 1821 by Dock Engineer John Foster. Until 1832, it was the largest dock in Liverpool, and was the flagship dock for Liverpool's trade with North America.

10.40. The dock covered an area of 4.6 hectares, with a lock at the southern end connecting it to Georges Dock. At the north end was a second lock leading through to Princes Dock Basin, providing access to the Mersey. It was intended originally to build another dock on the north side of Princes Basin (shown on Thomas Kaye's Map and Walker's Plan of 1821) but this area was not developed until the 1830s. A swing bridge provided access to the island forming the western side of the dock and a series of transit sheds, as well as the Dock Master's and Pier Master's offices. Further buildings, such as a police station were located on the east side of the dock.

10.41. Access to Princes Dock from the town was controlled by a dock boundary wall, the first to be built in Liverpool, begun in 1816 and completed in 1821 when the dock opened. Also built by Foster, the wall was of red brick, four courses thick, with sandstone copings and a gateway with sandstone piers in the Greek Revival style. Originally the wall extended around the dock but only the east side now survives in-situ.

10.42. Princes Dock proved to be insufficient for the growing needs of the city, and dock extensions soon took place to the north, with the opening of the Clarence Dock in 1830, and the completion of the Waterloo, Victoria and Trafalgar Docks by Foster's successor Jesse Hartley in the mid-1830s.These and later docks could accommodate the larger steamships, and the Princes Dock therefore became the principal dock for high value and low bulk goods such as coffee and spices.

10.43. In 1868 the Princes Basin was modernised to serve as a Half Tide Dock, which provided access to the remodelled Waterloo Dock to the north and the Princes Dock to the south. This work was carried out by G F Lyster, Hartley's successor, who also infilled the Georges Basin, allowing for the construction of a long floating roadway that led down to the Liverpool Landing Stage that served the ferries and cross-river traffic at Princes Dock and the Pier Head.

10.44. In the 1880s the port of Southampton began to take trade away from Liverpool. One of the reasons for this was the Southampton passenger railway facilities that had been developed close to ship berths. At Liverpool, the trans-Atlantic liners used a floating landing stage extending the length of Princes Dock from close to the Pier Head. This was located roughly in the location of the current floating landing stage. The wharf was the first reinforced concrete structure in the docks, and is one of the earliest surviving examples of the Hennebique system, designed by French engineer Louis Gustave Mouchel.

10.45. Unlike Southampton, all of the major railway termini were located away from the riverside in Liverpool, and passengers with their luggage transferring between trains and ships had to be transported by road. The Mersey Docks & Harbour Board (MD&HB), dissatisfied with passenger liner trade moving to Southampton, decided to build a passenger station adjacent to the Princes Landing Stage. The station, which was named Liverpool Riverside, opened on 12 June 1895[14].

10.46. In April 1917, the United States entered the Great War. During the following months over 844,000 US servicemen and nurses passed through Liverpool, and the Riverside Station handled a large proportion of them. The London and North Western Railway (LNWR) ran 1,684 trains for the US forces from Riverside Station at Princes Dock[15].

10.47. The Princes Dock continued in use for coastal and Irish traffic throughout the twentieth century, hosting large steam cargo vessels. One of the independent White Star Line's (The company was merged with Cunard in 1934) last large liners, RMS Britannic, left on its maiden voyage from the wharf in 1931.

10.48. During World War Two, Liverpool Riverside Station was even busier with troop trains than it had been in the First World War. After the USA entered the war their troops were again brought into Great Britain, primarily through Liverpool and via Riverside Station. During the war period 4,648 special trains ran to and from the station and 1,707,545 soldiers passed through it. Liverpool's strategic importance for the import of men and materials led it to become a regular target for Luftwaffe raids.

10.49. After the war, trade remained good until the advent of the shipping container in the early 1960s, which spelled the end of bulk trade for the smaller Liverpool Docks, including Princes Dock. Despite the decline, a "roll on/roll off" terminal for the Belfast ferry was installed in 1967 at the southern end of the dock in the area, which now contains the temporary cruise liner terminal. Continuing declines in passenger numbers and the construction of the new terminal at Victoria Dock made it redundant in 1981.

10.50. Princes Dock had fallen into decline by 1988, when the dock passed into the ownership of the Merseyside Development Corporation. At this time, the buildings within the Site were cleared and the eastern quay widened. Princes Dock was regarded as a potential area for new office development, and in 1988 Merseyside Development Corporation commissioned a masterplan for its regeneration.

10.51. The results of this masterplan are visible today and the area is regenerating from the low point of the late 1980s. In 1992 development was commenced under the direction of The Princes Dock Development Company. The transit sheds and other buildings were cleared, the east quay was widened to create larger development sites, and the dock walls were rebuilt. The first phases included the Crowne Plaza Hotel, and a section of Princes Parade extending northwards on the western side of the dock.

Heritage Significance

10.52. A detailed assessment of the heritage significance of heritage assets within the vicinity of the Site that could potentially be affected by the Development, can be found in **Appendix 10.1**. This information is summarised in **Table 10.4**.

Table 10.4: Heritage Assets within the Vicinity of the Site Potentially Affected by the Development

Heritage Asset Name	Heritage Asset Type	Level of Heritage Significance
Liverpool Maritime Mercantile City	World Heritage Site	Very High
Memorial to Heroes of the Marine Engine Room	Grade II* Listed Building	High
Royal Liver Building	Grade I Listed Building	High
Cunard Building	Grade II* Listed Building	High
Port of Liverpool Building	Grade II* Listed Building	High
Tower Building	Grade II* Listed Building	High
Church of Our Lady and St Nicholas	Grade II Listed Building	High
Dock Wall and Dock Wall Gates	Grade II Listed Buildings	High

Heritage Asset Name	Heritage Asset Type	Level of Heritage Significance
Listed Statues in and Around Pier Head	Grade II Listed Buildings	High
Princes Half Tide Dock, Entrance to Princes Half Tide Dock and Waterloo Warehouse	Grade II Listed Buildings	Medium
Castle Street Conservation Area	Conservation Area	High
Stanley Dock Conservation Area	Conservation Area	High
West Africa House and Wellington Buildings	Non-designated heritage assets	Low

Likely Significant Effects

Demolition and Construction

Direct Effects

10.53. Primary direct effects include the material alteration to a built heritage asset, such as its extension, alteration to fabric or design or its demolition. There would be no such primary direct effect to any heritage assets of high heritage significance, namely the listed buildings which fall outside of the Site boundary.

Indirect Effects

10.54. The indirect effects of the demolition and construction phase relate to the potential for noise, dust and additional traffic vibration to have a detrimental effect on the setting of the heritage assets identified. These effects are summarised in **Table 10.5**.

Table 10.5: Significance of Effect of Demolition and Construction Phase: Indirect Effects

Heritage Asset	Level of Heritage Significance	Magnitude of Impact	Significance of Indirect Effect
Liverpool Maritime Mercantile City WHS	*Very High*	Minor Adverse	**Temporary adverse effect of moderate adverse significance**
Memorial to Heroes of the Marine Engine Room	*High*	Minor Adverse	**Temporary adverse effect of slight/moderate significance**
Royal Liver Building	*High*	Negligible	**Temporary adverse effect of slight significance**
Cunard Building	*High*	Negligible	**Temporary adverse effect of slight significance**
Port of Liverpool Building	*High*	Negligible	**Temporary adverse effect of slight significance**
Tower Building	*High*	Negligible	**Temporary adverse effect of slight significance**

Heritage Asset	Level of Heritage Significance	Magnitude of Impact	Significance of Indirect Effect
Church of Our Lady and St Nicholas	*High*	Negligible	**Temporary adverse effect of slight significance**
Dock Wall and Dock Wall Gates	*High*	Negligible	**Temporary adverse effect of slight significance**
Listed Statues in and Around Pier Head	*High*	Negligible	**Temporary adverse effect of slight significance**
Princes Half Tide Dock, Entrance to Princes Half Tide Dock and Waterloo Warehouse	*Medium*	Negligible	**Temporary adverse effect of neutral/slight significance**
Castle Street Conservation Area	*High*	Minor Adverse	**Temporary adverse effect of slight/moderate significance**
Stanley Dock Conservation Area	*High*	Negligible	**Temporary adverse effect of slight significance**
West Africa House and Wellington Buildings	*Low*	Negligible	**Temporary adverse effect of neutral/slight significance**

Completed Development

Direct Effects

10.55. As the proposed Development would involve the demolition of Princes Jetty, located within the north-west corner of the Site, there would be no heritage assets on the Site at completed Development stage. Therefore there would be no direct effects to heritage assets once the proposed Development is completed and operational.

Indirect Effects

10.56. The indirect effects of the proposed Development relate to the change within the setting of heritage assets, if any, caused by the completed Development. The indirect effects of the completed Development upon the heritage significance of the heritage assets located within the Site environs are set out in **Table 10.6** below.

10.57. The indirect effects of the cruise liners themselves upon the heritage significance of the heritage assets located within the Site environs are dealt with separately. These effects are considered upon the heritage assets collectively, rather than upon each heritage asset individually.

Table 10.6: Significance of Effect of Completed Development Phase: Indirect Effects

Heritage Asset	Level of Heritage Significance	Magnitude of Impact	Significance of Indirect Effect
Liverpool Maritime Mercantile City	*Very High*	Minor Beneficial	**Permanent beneficial effect of moderate significance**
Memorial to Heroes of the Marine Engine Room	*High*	Minor Beneficial	**Permanent beneficial effect of slight/moderate significance**

Heritage Asset	Level of Heritage Significance	Magnitude of Impact	Significance of Indirect Effect
Royal Liver Building	*High*	Minor Beneficial	**Permanent beneficial effect of slight/moderate significance**
Cunard Building	*High*	Minor Beneficial	**Permanent beneficial effect of slight/moderate significance**
Port of Liverpool Building	*High*	Minor Beneficial	**Permanent beneficial effect of slight/moderate significance**
Tower Building	*High*	Negligible	**Permanent beneficial effect of slight significance**
Church of Our Lady and St Nicholas	*High*	Negligible	**Permanent beneficial effect of slight significance**
Dock Wall and Dock Wall Gates	*High*	Negligible	**Permanent beneficial effect of slight significance**
Listed Statues in and Around Pier Head	*High*	Minor Beneficial	**Permanent beneficial effect of slight/moderate significance**
Princes Half Tide Dock, Entrance to Princes Half Tide Dock and Waterloo Warehouse	*Medium*	Negligible	**Permanent beneficial effect of neutral/slight significance**
Castle Street Conservation Area	*High*	Minor Beneficial	**Permanent beneficial effect of slight/moderate significance**
Stanley Dock Conservation Area	*High*	Minor Beneficial	**Permanent beneficial effect of slight/moderate significance**
West Africa House and Wellington Buildings	*Low*	Neutral	**Neutral**

10.58. As described in the methodology section, the assessment of setting includes factors other than the impact on views. The impact of the proposed Development on the setting of each heritage asset is described below to provide context to **Table 10.6** above.

Liverpool Maritime Mercantile City (World Heritage Site – Very High Significance)

10.59. As identified in **Appendix 10.1**, the majority of the Site is located within the buffer zone of the World Heritage Site (WHS), with a small section of the southern part of the Site located within the WHS. The proposed Development would therefore result in a change to the WHS and its buffer zone, which forms a fundamental part of its visual setting. The World Heritage Site SPD outlines that development proposals within the buffer zone need to be carefully considered, to ensure that they do not adversely affect the setting of the WHS. It also states that: "*Developments are also considered for their potential positive effects on the townscape, such as by re-instating a street frontage, utilising derelict or disused land and re-connecting different parts of the city, as well as their positive economic benefits in providing investment and activity.*" [16]

10.60. It has been established that in its current condition, the Site forms an essential part of the dockland landscape in this part of Liverpool, which contributes to the Outstanding Universal Value (OUV) of the WHS; however, the largely derelict state of the Site and the limited activity within it

has resulted in a loss of one of the principal elements of its former character, which has a negative effect on its contribution to the OUV of the WHS. Therefore, the proposed Development would enhance the Site's contribution to the OUV of the WHS through re-establishing a greater use of the Site and utilising the disused land within the Site. In addition, the proposed cruise terminal would be situated in the northern section of the Site, in the location of the existing Princes Jetty, which would reinstate commercial trade and its associated activity in the location that would have historically formed the hub of intense economic and passenger activity. This would allow an appreciation of the former use of the Site and would restore the activity that would have formed a significant part of the setting of the WHS historically.

10.61. In relation to important views into the WHS, the view along the waterfront of Princes Dock towards the royal Liver Building, which is identified as an important view in the World Heritage Site SPD, would be retained, with the proposed Development within the Site concentrated to the west of this view. The proposed Development would alter the existing views towards the WHS from the opposite side of the River Mersey, resulting in these views of the WHS being experienced in conjunction with the new built form of the proposed Development; however, this change would reinstate the historic use of the Site, consistent with Liverpool's dockland history.

10.62. Overall, it is considered that the completed Development would have a **permanent beneficial effect of moderate significance** on the heritage significance of the Liverpool Maritime Mercantile City World Heritage Site.

Memorial to Heroes of the Marine Engine Room (Grade II Listed Building – High Significance)*

10.63. The grade II* listed Memorial to Heroes of the Marine Engine Room is encircled by the southern section of the Site, but excluded from the Site boundary. As such, the proposed Development would result in a change to its immediate setting. Importantly however, the grassed area and integrated hard landscaping that directly surrounds the memorial would remain unaltered and therefore the proposed Development would not result in a loss of an element of setting that contributes positively to the heritage asset's significance.

10.64. The Site has been identified as making a limited positive contribution to the significance of the listed memorial as a continuation of the dockland waterfront cityscape, and due to the continued use of the modern ferry terminal and existing cruise terminal operation, which forms part of the historic function of the Site. As the level of activity within the Site has been considerably reduced since the late twentieth century however, it is considered that the reinstatement of the historic use of the Site and an increase in associated activity would enhance the contribution that the Site makes to the significance of the listed memorial.

10.65. The proposed cruise terminal would be located within the northern section of the Site, at a distance from the memorial. It is therefore considered that this built form would not impair views towards the listed monument, particularly views along the waterfront towards the Three Graces within which the memorial is a focal point. Overall, it is considered that the completed Development would have a **permanent beneficial effect of slight/moderate significance** on the heritage significance of the Memorial to Heroes of the Marine Engine Room.

Royal Liver Building (Grade I Listed Building – High Significance)

10.66. The grade I listed Royal Liver Building is located directly adjacent to the southern section of the Site, and therefore the proposed Development would result in a change to its immediate setting. The listed building is a prominent feature within views along and across the waterfront, and in an important identified view from the northern access road within the Site along the waterfront of

Princes Dock. It also has an important relationship with the other two Graces, which contribute to its significance.

10.67. The proposed Development would include a new cruise liner terminal located within the northern section of the Site. This would be situated at a distance from the Royal Liver Building and crucially, it is considered that it would not detract from the appreciation of the listed building or hinder important views towards it, nor would it alter the assets relationship with the other two Graces.

10.68. The Site contributes to the significance of the Royal Liver Building as it provides an element of continuity to the waterfront and as the use of the modern ferry terminal and existing cruise terminal operation continues the function that has existed historically within the Site. It is acknowledged however, that historically the Site would have been a hub of immense activity due to the former presence of the Princes Dock and Riverside Station. Re-establishing the use of the Site and the resultant activity would therefore enhance the Site's contribution to the significance of the Royal Liver Building. As such, it is considered that there would be a **permanent beneficial effect of slight/moderate significance** on the heritage significance of the Royal Liver Building.

Cunard Building (Grade II Listed Building – High Significance)*

10.69. The proposed Development would result in a change to the wider setting of the Cunard Building, which is located to the south of the Site, beyond the Royal Liver Building. Although the listed building's relationship with the Site is less visually direct than the Royal Liver Building, it has considerable historical associations with the Site, as the Site was historically the location of the principal transatlantic liner departure and arrival jetty for Cunard. This historical association continues to some extent today with the continued use of the modern ferry terminal and existing cruise terminal operation, however has been considerably reduced since the late twentieth century. Therefore the proposed Development would enhance the contribution that the Site makes to the significance of the Cunard building and allow an appreciation of its former function, through the reinstatement of the use and associated activity that was historically extant on the Site.

10.70. In addition, it is considered that the proposed Development would not alter the important relationship of the listed building with the other of the Three Graces and the key views of the listed building along and across the waterfront would not be significantly impaired by the proposed Development, due to the built form being concentrated towards the northern end of the Site. Therefore it is considered that the completed Development would have a **permanent beneficial effect of slight/moderate significance** on the heritage significance of the Cunard Building.

Port of Liverpool Building (Grade II Listed Building – High Significance)*

10.71. The grade II* listed Port of Liverpool Building is located to the south of the Site, beyond the Royal Liver Building and the Cunard Building. The proposed Development would therefore result in a change to the wider setting of the listed building. As with the Royal Liver Building, the Site, although further removed physically from the Port of Liverpool Building, provides a continuation of Liverpool's dockland cityscape and has historical associations with the listed building. These associations are lessened, however, by the lack of surviving historic structures within the Site and as there has been a significant reduction of activity within the Site, largely due to the loss of the former Princes Dock and Riverside Station. As such, it is considered that the reinstatement of commercial trade and associated activity within the Site would be an improvement on its existing, largely derelict, state and would enhance the Site's contribution to the significance of the Port of Liverpool Building.

10.72. The proposed cruise terminal would be located within the northern section of the Site, at some distance from the listed building, and therefore it is considered that it would not detract from the appreciation of the significance of the Cunard Building. It would also not impede significant views of the listed building, enabling it to continue to be appreciated as part of the dockland landscape in views across the River Mersey and in conjunction with the other two Graces. Overall, it is considered that there would be a **permanent beneficial effect of slight/moderate significance** on the heritage significance of the Port of Liverpool Building.

Tower Building (Grade II Listed Building – High Significance)*

10.73. As identified in **Appendix 10.1**, Tower Building is located in close proximity to the southern section of the Site, to the opposite side of the busy junction of The Strand/St Nicholas Place. As such, there is a degree of inter-visibility between the listed building and the Site, as well as views towards the waterfront from the heritage asset.

10.74. It has been established that the Site has no direct historical or functional relationships with the listed building and also that there is a contrast between the formal architecture and character of Tower Building and the industrial nature of the Site, meaning that the link between the Site and the listed building is largely visual, based on the Site forming part of the historic context of the listed building. Due to the proximity of the Site to the listed building, the proposed Development would result in a change to its immediate setting, however the proposed cruise terminal would be concentrated to the northern section of the Site, and therefore it is likely that inter-visibility between this built form and the heritage asset would be limited. It is considered that the proposed Development would not have a significant effect on the particular significance of the listed building, however, it would provide a renewed use and the associated dockside activity that would have existed historically within the locality of the listed building. As such, it is considered that the effect of the proposed Development on the significance of Tower Building would be a **permanent beneficial effect of slight significance**.

Church of Our Lady and St Nicholas (Grade II Listed Building – High Significance)

10.75. The grade II listed Church of Our Lady and St Nicholas is located in close proximity to the Site to its east, although now disconnected physically from the Site and detached from its historic riverside context, with its setting predominantly defined by the busy junction of New Quay with Chapel Street and St Nicolas Place.

10.76. As identified, the Site forms an important part of the nineteenth century context of the church, and therefore the re-established use and associated activity on the Site resulting from the proposed Development would reinstate a historic element of the setting of the listed building. It is considered, however, that due to the degree of separation between the listed building and the Site, this would not have a significant effect on the significance of the church. In addition, as is the case with the Tower Building located adjacent to the church, it is likely that the inter-visibility between the built form of the proposed cruise terminal within the northern section of the Site and the listed church would be limited, due to the separation distance and interposing built form. It is therefore considered that overall there would be a **permanent beneficial effect of slight significance** on the heritage significance of the Church of Our Lady and St Nicholas.

Dock Wall and Dock Wall Gates (Grade II Listed Structures – High Significance)

10.77. The proposed Development would result in a change to the wider setting of the listed dock wall and dock wall gates, which are located to the east of the Site. The heritage assets are somewhat separated from the Site by the modern development along Princes Parade and William Jessop

Way, although there are views of the assets from the Site across Princes Dock, and glimpsed views from the opposite side of the River Mersey.

10.78. It has been established that the contribution of the Site to the significance of the dock wall and dock wall gates has changed over time, from the former intense activity around the dock to today's largely disused character. Therefore the proposed Development would reinstate the use and associated activity that existed historically on the Site and formed part of the assets historic context.

10.79. Due to the built form of the proposed cruise terminal being located within the northern section of the Site, it is likely that the views of the heritage assets that exist currently from the Site and across the River Mersey would be obscured, resulting in the principal views of the dock wall and gates being from the city centre along Bath Street. It is considered, however, that overall the understanding and appreciation of the historic function of the heritage assets would be retained. As such, it is considered that there would be a **permanent beneficial effect of slight significance** on the heritage significance of the dock wall and dock wall gates.

Listed Statues in and Around Pier Head (Grade II Listed Structures – High Significance)

10.80. The Built Heritage Statement in **Appendix 10.1** establishes that the setting of the listed statues is characterised by the public open space that surrounds them, the Three Graces and the Liverpool waterfront, all of which contribute positively to their significance. Importantly, it is considered that the proposed Development on the Site, which is located to the north of the heritage assets, would not compromise the relationship between the statues and the elements of setting that contribute positively to their significance, and therefore the proposed Development would not detract from the appreciation of the heritage assets.

10.81. In addition, the Site contributes to the significance of the listed statues as a continuation of the dockland waterfront cityscape and as part of the assets historic context, albeit that this has been diminished by the lack of surviving historic structures on the Site and the loss of its former intense level of use and activity. Therefore re-establishing the use and greater level of activity that existed historically on the Site will enhance its contribution to the significance of the heritage assets. Consequently, it is considered that there would be a **permanent beneficial effect of slight/moderate significance** on the heritage significance of the listed statues.

Princes Half Tide Dock, Entrance to Princes Half Tide Dock and Waterloo Warehouse (Grade II Listed Structures – Medium Significance)

10.82. The grade II listed Princes Half Tide Dock, Entrance to Princes Half Tide Dock and Waterloo Warehouse are located directly adjacent and to the north of the Site. As such, the proposed Development would result in a change to the immediate setting of the listed structures. The structures are visible in views from the Site, as well as across the River Mersey, and therefore the proposed cruise terminal, which would be located adjacent to the heritage assets, would block views towards the listed structures.

10.83. It is considered, however, that the relationship of the heritage assets with elements of setting that contribute positively to their significance, most notably the docks to their north and the River Mersey, would not be compromised. In addition, it has been established that the Site contributes to the significance of the listed structures by virtue of their shared historic functions; however, this contribution has been lessened by the loss of the dockland activity, particularly at the northern end of the Site. As such, the proposed Development would reinstate commercial trade and its associated activity in the location that would have historically formed the hub of intense economic and passenger activity. Overall, it is considered that the appreciation of the significance of the

heritage assets would be retained and there would be a **permanent beneficial effect of neutral/slight significance** on the heritage significance of Princes Half Tide Dock, Entrance to Princes Half Tide Dock and Waterloo Warehouse.

Castle Street Conservation Area (High Significance)

10.84. As identified in **Appendix 10.1**, the southern portion of the Site, along part of Princes Parade and St Nicholas Place, is located within the Castle Street Conservation Area. As the conservation area follows the same alignment as that of the WHS, it is considered that the effect of the proposed Development on the heritage significance of the conservation area would be consistent with the effect on the WHS i.e. that the reinstatement of a more intense use and associated dockland activity on the Site would enhance the Site's contribution to the heritage significance of the conservation area. As such, it is considered that there would be a **permanent beneficial effect of slight/moderate significance** on the heritage significance of Castle Street Conservation Area.

Stanley Dock Conservation Area (High Significance)

10.85. The northeast portion of the Site is encircled by the Stanley Dock Conservation Area. As with the Castle Street Conservation Area, the boundary of Stanley Dock Conservation Area follows the same alignment as that of the WHS, and therefore the effect of the proposed Development on the heritage significance of the conservation area would be consistent with the effect on the WHS. As such, it is considered that there would be a **permanent beneficial effect of slight/moderate significance** on the heritage significance of Stanley Dock Conservation Area.

West Africa House and Wellington Buildings (Non-designated Heritage Assets - Low Significance)

10.86. The proposed Development would result in a change to the wider setting of West Africa House and Wellington Buildings, which are located to the south east of the Site, beyond the Royal Liver Building. It has been established that the Site makes a neutral contribution to the significance of the non-designated heritage assets, due to the inter-visibility between the two rather than any historical or functional associations.

10.87. It is considered that the proposed Development would not alter the assets' relationship with any elements of setting that contribute positively to their significance and would not affect the appreciation of the non-designated heritage assets. Therefore the effect of the proposed Development on the heritage significance of West Africa House and Wellington Buildings would be **neutral**.

Indirect Effects of the Cruise Liners

10.88. The proposed Development would allow the continuation of an already established use on Liverpool's waterfront, but would also enable cruise ships of a larger scale to dock in the city than previously. As such, the indirect effects of the cruise liners on the heritage significance of the heritage assets located within the Site environs need to be assessed. These effects are considered upon the heritage assets collectively.

10.89. In general terms, this element of the proposed Development would result in a temporary change to the setting of the heritage assets. As identified, there is already an established use on the Site, with cruise ships consistently docking along this section of Liverpool's waterfront. The proposed Development would result in a small increase in the number of cruise ships and ships of a larger scale. As such, it is considered that this would alter the experience of a number of the heritage assets and, in some cases, detract from the appreciation of the heritage assets, particularly those along the waterfront. In addition, the cruise liners would block views towards the heritage assets

from across the River Mersey. This is particularly significant in the case of the Three Graces, the listed memorials and the Church of Our Lady and St Nicholas, which are clearly visible in these views, and therefore the cruise liners would detract from the prominence of these heritage assets and the appreciation of the character of the memorials as focal points along the waterfront.

10.90. Nevertheless, it is acknowledged that the proposed Development continues an established and historic use that forms a fundamental and continued part of Liverpool's dockland history, as well as part of the city's continued changing economic fortunes, which is reflected in the character and built form of the waterfront. The heritage assets also have a continued historical association with the riverside and its associated activity and were always intended to be seen and appreciated in kinetic views from vessels moving along the River Mersey or docking at Liverpool, such as the Royal Liver Building which served a practical function due to the presence of its large clock faces. In addition, the views towards the heritage assets from across the River Mersey have historically been experienced in conjunction with ships and the associated dockside activity.

10.91. Overall, it is considered that the proposed Development would continue the established and historic use of the Site, however, the increase in the number and size of cruise liners would detract from the appreciation of a number of the heritage assets. As such, there would be **temporary, intermittent, minor adverse indirect effects** on the heritage significance of the heritage assets resulting from the cruise liners.

Mitigation Measures and Likely Residual Effects

Demolition and Construction

10.92. Through the implementation of a site-specific Construction Environmental Management Plan, care would be taken during the demolition and construction phase to limit the extent of vibration and dust, reducing the significance of adverse effects upon the surrounding heritage assets as follows:

- Liverpool Maritime Mercantile City WHS: **Temporary adverse effect of slight adverse significance**;
- Memorial to Heroes of the Marine Engine Room: **Temporary adverse effect of neutral/slight significance**;
- Royal Liver Building: **neutral significance**;
- Cunard Building: **neutral significance**;
- Port of Liverpool Building: **neutral significance**;
- Tower Building: **neutral significance**;
- Church of Our Lady and St Nicholas: **neutral significance**;
- Dock Wall and Dock Wall Gates: **neutral significance**;
- Listed Statues in and Around Pier Head: **neutral significance**;
- Princes Half Tide Dock, Entrance to Princes Half Tide Dock and Waterloo Warehouse: **neutral significance**;
- Castle Street Conservation Area: **Temporary adverse effect of neutral/slight significance**;
- Stanley Dock Conservation Area: **neutral significance**; and
- West Africa House and Wellington Buildings: **neutral significance**.

Completed Development

10.93. Once the proposed Development is completed and operational, effects to nearby heritage assets would be uniformly beneficial. There is, therefore, no need for mitigation measures to be proposed and the residual effects would be as per those reported in the Likely Effects section.

10.94. There are no mitigation measures for the cruise liners. As such, the residual effects would be as per those reported in the Likely Effects section.

Summary

10.95. In the absence of mitigation, the demolition and construction phase was assessed to have likely temporary adverse effects on built heritage assets in the vicinity of the Site ranging from neutral to moderate adverse significance. With the implementation of a site-specific Construction Environmental Management Plan, the residual effects are predicted to be no worse than of slight adverse significance.

10.96. Once the Development is completed and operational, effects on built heritage assets in the vicinity of the Site would range from neutral to moderate beneficial significance. Therefore, no mitigation measures are required.

References

1 Historic England (2015): 'Historic Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets', Historic England, London.

2 Historic England (2008): 'Conservation Principles, Policies and Guidance for the sustainable management of the historic environment', Historic England, London.

3 Chartered Institute for Archaeologists (2014): 'Standard and Guidance: Historic Environment Desk-based Assessments'

4 Department for Communities and Local Government (2012): 'National Planning Policy Framework'

5 Liverpool City Council (2002): 'Liverpool Unitary Development Plan', Liverpool City Council, Liverpool.

6 Liverpool City Council (2009): 'Liverpool Maritime Mercantile City World Heritage Site Supplementary Planning Document', Liverpool City Council, Liverpool.

7 The Highways Agency (2007): 'Design Manual for Roads and Bridges, Volume 11, Section 3, Part 2 HA 208/ 07 Cultural Heritage'

8 Historic England (2008): 'Conservation Principles, Policies and Guidance for the sustainable management of the historic environment', Historic England, London.

9 The Highways Agency (2007): 'Design Manual for Roads and Bridges, Volume 11, Section 3, Part 2 HA 208/ 07 Cultural Heritage'

10 International Council on Monuments and Sites (ICOMOS) (2010): 'Guidance on Heritage Impact Assessments for Cultural World Heritage Properties'

11 Historic England (2015) 'Good Practice Advice in Planning Note 3: The Setting of Heritage Assets', Historic England, London.

12 Stammer, M (1999) 'Images of England: Liverpool Docks'

13 Ibid

14 http://www.disused-stations.org.uk/l/liverpool_riverside/. Accessed 07/04/2017

15 Ibid

16 Liverpool City Council (2009): 'Liverpool Maritime Mercantile City World Heritage Site Supplementary Planning Document', Liverpool City Council, Liverpool.

11. Archaeology

Introduction

11.1. This chapter presents an assessment of the likely effects of the Development on the historic environment (below ground archaeology). In particular, consideration is given in the assessment to known and potential below ground heritage assets.

11.2. This chapter provides a description of the methods used in the assessment. This is followed by a description of the relevant baseline conditions of the Site and surrounding area, together with an assessment of the likely potential effects of the Development during the Site preparation and construction works and once the Development is completed and operational. Mitigation measures are identified where appropriate to avoid, reduce or offset any adverse effects identified and / or enhance likely beneficial effects. Taking account of the mitigation measures, the nature and significance of the likely residual effects are described.

11.3. The chapter is accompanied by the following appendix, provided in ES Volume 3:

- **Appendix 11.1: Archaeological Desk-Based Assessment**.

Assessment Methodology and Significance Criteria

Assessment Methodology

11.4. This assessment has included the following:

- Identification of known heritage assets likely to be affected by proposals;
- Identification of potential heritage assets likely to be affected by proposals;
- Desk-top and archival research;
- A walk-over survey of the Site and its immediate surroundings;
- Assessment of the Site's (below ground) heritage significance; and
- Consultation of local and national planning policy and guidance pertaining to the historic environment (set out in **Appendix 11.1**).

11.5. The Merseyside Historic Environment Records (HER) were consulted within a radius of 250 metres from the boundary of the Site.

11.6. The Site was visited on 3rd April 2017. The weather was dry and overcast. The aim of the visit was to identify and gain an understanding of any features of heritage interest within the Site that may be affected by the proposals, and gain an understanding of the ground conditions. Some of the resultant images from this inspection are reproduced in **Appendix 11.1**.

11.7. The Liverpool Archives were visited in order to obtain information from early maps, documents and secondary sources. Historic maps and images are reproduced where appropriate in **Appendix 11.1**.

11.8. Background research included a review of the relevant Regional Research Framework[1], as well as a range of online sources referenced throughout **Appendix 11.1**.

11.9. The assessment reported in this chapter relies on third party data, interpretation and/or advice. Although every care was taken to verify sources and resulting interpretations, Waterman cannot take responsibility for the accuracy of third party data, interpretation or advice.

Consultation

11.10. As mentioned above, the Merseyside HER were consulted within a radius of 250 metres from the boundary of the Site).

11.11. An EIA Scoping Report was submitted to Liverpool City Council (LCC). In order to formulate a response, LCC consulted with their statutory advisers on matters related to heritage: Historic England and the Merseyside Environmental Advisory Service (MEAS).

11.12. In response to the consultation, and specifically with regards to below ground historic environment assets, Historic England stated:

"We would also expect the Environmental Statement to consider the potential impacts on non-designated features of historic, architectural, archaeological or artistic interest, since these can also be of national importance and make an important contribution to the character and local distinctiveness of an area and its sense of place. (…)

The assessment should also consider, where appropriate, the likelihood of alterations to drainage patterns that might lead to in situ decomposition or destruction of below ground archaeological remains and deposits, and can also lead to subsidence of buildings and monuments."

11.13. MEAS responded as follows:

"Princes Dock, built 1816-21, is a non-designated heritage asset, recorded on the Merseyside Historic Environment Record, MME 9551.

Previous archaeological investigations of the site have demonstrated that below-ground structural remains of the dock do survive.

The National Planning Policy Framework, paragraph 128, is clear that:

'Where a site on which development is proposed includes or has the potential to include heritage assets with archaeological interest, local planning authorities should require developers to submit an appropriate desk-based assessment and, where necessary, a field evaluation.'

The Environmental Impact Assessment Scoping Report, Section 4.9, pp.13-14, has therefore correctly identified archaeology as one the issues to be addressed in the EIA.

MEAS is therefore in agreement with the proposed approach and methodology, as outlined in section 4.9.3 of the Environmental Impact Assessment Scoping Report, and would be happy to advise further on the nature of any archaeological mitigation, pre- or post-determination, that might be considered necessary."

11.14. Based on these two responses, the EIA Scoping Opinion, dated 8th September 2017, enclosed copies of both the above responses (refer to **Appendix 2.1**).

Significance Criteria

11.15. Annex 2 of the National Planning Policy Framework[2] (NPPF) defines Heritage Significance as "*The value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting*".

11.16. The intrinsic significance unique to each heritage asset can be defined as the sum of tangible and intangible values which make it important to society. This may consider age, aesthetic and the fabric of an asset as well as intangible qualities such as associations with historic people or events.

11.17. To assess the significance of below ground elements within the Site, this report has drawn guidance from Historic England[3], which recommends making assessments under the categories of: evidential, historical, aesthetic and communal value. The combined evidential, historical, aesthetic and communal values assessed for each heritage asset, or category of assets, results in an overall heritage significance rating.

11.18. The significance of below ground heritage assets within the Site is assessed using a range of significance ratings:

- **High**: A feature, space or theme which is significant at national or international level. These will tend to have a high cultural value and form an important element of a building or site.
- **Medium**: A feature, space or theme which is significant at a regional or national level. These will tend to have some cultural merit and form a significant part of the building or site.
- **Low**: A feature, space or theme which is of local or regional significance.
- **Neutral**: A feature, space or theme which has no cultural significance and is also not considered intrusive to heritage value.

11.19. A feature, space or theme which detracts from heritage value will be identified as 'intrusive'.

11.20. In order to assess the effect of the proposed Development on the significance of known and potential heritage assets, the following assessment provides a comparable analysis of the heritage significance against the magnitude of change.

11.21. This assessment is based on the criteria set out by the Design Manual for Roads and Bridges[4] (DRMB) and ICOMOS[5], and is a clear way of understanding the magnitude of change, and how levels of effect vary according to the significance of the heritage asset.

11.22. The magnitude of change is assessed based on the criteria set out in **Table 11.1**.

Table 11.1: Magnitude of Change

Magnitude of Change	Description
Substantial Beneficial	The proposed changes would significantly improve the overall setting and character of heritage assets, revealing and/or enhancing important characteristics which were previously unknown or inaccessible. There would be a substantial improvement to important elements of the asset.
Moderate Beneficial	The proposed changes would considerably improve the setting or overall character of the heritage asset. There may be an improvement in key uses and beneficial change (e.g. the creation of coherency) to the characteristics of the asset.
Slight Beneficial	The proposed changes may cause a minor improvement to the setting or overall character of a heritage asset.
Neutral	The proposed changes would have no impact on the heritage asset.
Slight Adverse	The proposed changes would have minor impact on the setting or overall character of a heritage asset. Change of this magnitude may be acceptable if suitable mitigation is carried out.
Moderate Adverse	The proposed changes would negatively alter the setting or overall character of the heritage asset. It would likely disturb key features and detract from the overall heritage significance. Change of this magnitude should be avoided where possible, but can be minimised or neutralised through positive mitigation.

Magnitude of Change	Description
Substantial Adverse	The proposed changes would significantly damage the overall setting and/or character of heritage assets. They would cause a notable disruption to, or in some cases, complete destruction of, important features. Change of this magnitude should be avoided.

11.23. The significance of the effect of the Development on the heritage significance of any given asset, is a function of the significance of that asset and the magnitude of change that would be caused by the Development. This is summarised in **Table 11.2**.

Table 11.2: Significance of Effect

Criteria		Heritage Significance			
		Neutral	Low	Medium	High
Magnitude of Change	Substantial Beneficial	Negligible effect	Beneficial effect of minor significance	Beneficial effect of moderate significance	Beneficial effect of major significance
	Moderate Beneficial	Negligible effect	Beneficial effect of minor significance	Beneficial effect of minor to moderate significance	Beneficial effect of moderate to major significance
	Slight Beneficial	Negligible effect	Beneficial effect of negligible to minor significance	Beneficial effect of minor significance	Beneficial effect of minor to moderate significance
	Neutral	Negligible effect	Negligible effect	Negligible effect	Negligible effect
	Slight Adverse	Negligible effect	Adverse effect of negligible to minor significance	Adverse effect of minor significance	Adverse effect of minor to moderate significance
	Moderate Adverse	Negligible effect	Adverse effect of minor significance	Adverse effect of minor to moderate significance	Adverse effect of moderate to major significance
	Substantial Adverse	Negligible effect	Adverse effect of minor significance	Adverse effect of moderate significance	Adverse effect of major significance

Limitations and Assumptions

11.24. There were no known restrictions on reporting or access to relevant records during the research or compilation of this desk-based assessment.

Baseline Conditions

Existing Baseline Conditions

11.25. An assessment of the below ground historic environment likely to be affected by the proposals is presented in **Appendix 11.1**, and summarised below.

11.26. As shown on **Figure 9.1**, all but a small portion of the Site falls within the buffer zone of the adjacent World Heritage Site (WHS). The very southern-most part of the Site falls within the WHS but no development is proposed in this area. The rest of the Site has been specifically excluded from the

WHS itself. It is likely that this is due to the early twenty-first century redevelopment in and around the Princes Dock. This development would have likely truncated original features which would have made a significant contribution to the understanding of the WHS.

11.27. The Site has the potential to contain palaeo-environmental and riverine deposits from Prehistoric to the present day. These would be of value in a regional context and would be of **medium** significance.

11.28. The extant structure of the Princes Jetty is the only surviving element of the original Liverpool Landing Stage, where many people embarked and disembarked for emigration to North America. It also demonstrates very early use of innovative construction techniques using reinforced concrete. These features link to criterion (ii) of the criteria for inscription for the WHS[6]. Although the jetty is not within the WHS itself, it is associated with features within the WHS. This therefore gives the Princes Jetty value, on at least regional context, through being associated with the WHS and would therefore be of at least **medium** significance.

11.29. Princes Dock has undergone many phases of alterations since its construction, and it is likely that evidence of these alterations survives below water level. The dock has been excluded from the WHS, which demonstrates that it is not of outstanding universal value; however, it is still a contributory feature towards Liverpool's marine mercantile history and therefore is important in a regional context and is of **medium** significance.

11.30. During the Site visit, several sets of railway tracks were observed, along with the footprints of previous buildings and stone block surfaces, both within and outside the Site. Both tracks and buildings are marked on historic OS maps. The tracks are part of the early twentieth century Riverside Railway, first shown on mapping in 1905. The railway and the buildings were part of the infrastructure of the Liverpool Docks, and therefore part of a major international port. Further survey would be required to fully assess the nature and extent of these surviving features. Features which survive within the Site, and which relate to the port, have value of at least regional context and would therefore be of **medium** significance.

11.31. Princes Jetty, Princes Dock and the associated infrastructure (i.e. railway lines, building footprints etc) form a coherent group of regional heritage value of **medium** significance. The assessment of potential effects in this chapter therefore considers these heritage assets as a single group.

11.32. The two mooring dolphins located to the west of Princes Jetty are of modern construction and not considered to be of heritage value. Therefore, they are not considered further as part of this assessment.

11.33. The northern end of Princes Dock is the site of a former eighteenth century fort. **Figure B** in **Appendix 11.1** indicates the location of the fort as being outside the Site boundary. However, cartographic evidence provided in **Appendix 11.1** shows that the limits of the former fort may extend within the northern part of the Site. Evidence suggests that the fort was dismantled to make way for the Princes Dock. It is unlikely that any footings or foundations of the fort remain, due the extensive nature of the works relating to the construction of the docks. If any features of the fort do remain, they would have value in a local context and would therefore be of **low** significance.

11.34. Previous archaeological investigations within the immediate vicinity of the Site have shown that there is often good preservation of elements of the historic dock infrastructure below the current ground surface, many of which were covered over by resurfacing. It is likely that further features are present below modern surfacing within the Site.

Likely Effects

Demolition and Construction

11.35. The likely impact from the Development would result from activities such as: demolition of Princes Jetty; piling; new services and utilities, or diversion of existing ones; and hard and soft landscaping. The demolition and construction works are described in **Chapter 6: Development Programme and Construction**.

Princes Dock, Princes Jetty and Associated Infrastructure

11.36. Princes Dock, Princes Jetty and associated infrastructure are assets of medium significance. The Development would entail the demolition of Princes Jetty, giving rise to a substantial magnitude of change. Also, the proposed resurfacing of the Dock to create the proposed passenger pick-up / drop-off area on Plot 11 and the direct physical impact to the structure of the Dock to form a connection with the new jetty would represent a substantial magnitude of change. As a consequence, in the absence of any mitigation measures, the demolition of Princes Jetty and disturbance to Princes Dock and associated infrastructure would result in **permanent, regional, adverse effects of moderate significance**.

Possible Paleo-Environmental Deposits

11.37. Paleo-environmental deposits, should they survive within the Site, would be assets of medium significance. Activities associated with demolition and construction could potentially truncate (or further truncate) these deposits locally, causing a slight magnitude of change. The construction of the proposed Development would therefore have the potential to give rise to **permanent, local, adverse effects of minor significance** in the absence of any mitigation measures.

Former Eighteenth Century Fort

11.38. Remains of the former eighteenth century fort which was dismantled to make way for the Princes Dock, should they survive within the Site, would be of low significance. Activities associated with demolition and construction could potentially truncate (or further truncate) these deposits locally, causing a slight magnitude of change. Given the low likelihood that these remains survive in situ within the Site, the construction of the proposed Development would not be likely to give rise to effects of more than **negligible** significance.

Completed Development

11.39. There would be no direct or indirect effects on below-ground archaeological resources once the Development is completed and operational. All effects on sub-surface archaeological heritage assets would have been mitigated ahead of the construction phase. As a result, **no significant effects** have been identified once the Development is completed.

Mitigation Measures and Likely Residual Effects

Demolition and Construction

Princes Dock, Princes Jetty and Associated Infrastructure

11.40. A programme of archaeological investigation, including building (structure) recording prior to demolition, and a watching brief over ground intrusive works associated with demolition of Princes

Jetty and the creation of the proposed passenger pick-up / drop-off area on Plot 11 would be an appropriate means of mitigating the likely effects of this phase of the Development on this group of assets.

11.41. The recording of Industrial period docks and facilities is an acknowledged research objective for the region[7], and therefore the residual effect from the Development on this group of assets would be reduced to **permanent, regional, adverse effects of minor significance**.

Possible Paleo-Environmental Deposits

11.42. An archaeological watching brief over future geotechnical site investigations would be appropriate to establish the paleo-environmental potential of the Site. Based on the results from this watching brief, the requirement for paleo-environmental sampling could then be agreed in consultation with MEAS.

11.43. Given that paleo-environmental sampling, particularly targeting areas of high potential such as coastal, alluvial and colluvial deposits, is an agreed research objective for the region[8], the residual effect from the construction of the proposed Development on this category of asset would be reduced to **negligible**.

Former Eighteenth Century Fort

11.44. The Development would not be likely to give rise to effects of more than **negligible** significance, and therefore no mitigation is proposed for potential effects of the construction on the Development on this asset.

Completed Development

11.45. There would be no direct or indirect effects on below-ground archaeological resources once the Development is completed and operational. All effects on sub-surface archaeological heritage assets would have been mitigated ahead of the construction phase. As a result, **no significant effects** have been identified once the Development is completed.

Summary

11.46. In the absence of mitigation, the Development was assessed to have likely effects as follows:

- During site preparations and construction, activities such as: demolition of Princes Jetty; piling; new services and utilities, or diversion of existing ones; and hard and soft landscaping would have a permanent regional adverse effect of moderate significance on Princes Jetty, Princes Dock and associated infrastructure;
- Similarly, during the same site preparations and construction activities as listed above, the Development would potentially have permanent local adverse effects of minor significance on paleo-environmental deposits, should these survive within the Site;
- Given the low likelihood that remains of the eighteenth-century fort survive within the Site, the Development would not be likely to give rise to effects of more than negligible significance; and
- Once completed there would be no direct or indirect effects on archaeological resources.

11.47. Following the mitigation recommended in this chapter the following residual effects are expected:

- The recording of Industrial period docks and facilities is an acknowledged research objective for the region. Therefore, the residual effect from the Development on Princes Jetty, Princes Dock and associated infrastructure would be reduced to permanent, regional adverse effects of minor significance during the demolition and construction phases;

- Given that paleo-environmental sampling, particularly targeting areas of high potential such as coastal, alluvial and colluvial deposits, is an agreed research objective for the region, the residual effect from the Development on this category of asset would be reduced to negligible during the demolition and construction phases.

References

1 ALGAO, English Heritage, 2007: North West Archaeological Research Framework

2 Department for Communities and Local Government, March 2012. *National Planning Policy Framework*

3 English Heritage, April 2008. Conservation Principles, Policies and Guidance for the sustainable management of the historic environment

4 The Highways Agency, August 2007. Design Manual for Roads and Bridges, Volume 11, Section 3, Part 2 HA 208/ 07 Cultural Heritage

5 International Council on Monuments and Sites (ICOMOS), 2011. Guidance on Heritage Impact Assessments for Cultural World Heritage Properties

6 LCC, October 2009: Liverpool Maritime Mercantile City World Heritage Site Supplementary Planning Document, Appendix 1: "*Criterion (ii): Liverpool was a major centre generating innovative technologies and methods in dock construction and port management in the 18th, 19th and early 20th centuries. It thus contributed to the building up of the international mercantile systems throughout the British Commonwealth*."

7 ALGAO, English Heritage, 2007: North West Archaeological Research Framework

8 ALGAO, English Heritage, 2007: North West Archaeological Research Framework

12. Ground Conditions and Contamination

Introduction

12.1. This chapter presents an assessment of the likely significant effects of the Development on soil and ground conditions. In particular, it considers the likely significant effects of ground contamination on human health and the quality of Controlled Waters.

12.2. This chapter provides a description of the methods used in the assessment. This is followed by a description of the relevant baseline conditions of the Site and surrounding area, together with an assessment of the likely potential effects of the Development during the Site preparation and construction works and once the Development is completed and operational. Mitigation measures are identified where appropriate to avoid, reduce or offset any adverse effects identified and / or enhance likely beneficial effects. Taking account of the mitigation measures, the nature and significance of the likely residual effects are described.

12.3. This chapter draws primarily on information collated from a Preliminary Environmental Risk Assessment (PERA) prepared by Waterman in October 2017, which is included as **Appendix 12.1**.

Assessment Methodology and Significance Criteria

Assessment Methodology

Baseline Conditions

12.4. A desk-based qualitative PERA was undertaken to establish the potential for ground contamination to exist at the Site and the likely contamination risk posed to a range of sensitive receptors, including human health and Controlled Waters. The PERA is presented in **Appendix 12.1**.

12.5. Establishing the baseline conditions and the potential for ground contamination to exist on the Site was informed by:

- A walkover and inspection of the Site by Waterman;
- A review of Landmark Envirocheck data;
- British Geological Survey (BGS) Geology Map Sheet 96 'Liverpool' Solid and Drift Edition, 1: 50,000 scale;
- BGS borehole logs located within the surrounding area;
- A review of the history of the Site and the surrounding using historic OS map extracts; and
- Consultation with Liverpool City Council (LCC) and the Environment Agency (EA).

Development of Conceptual Site Model

12.6. The PERA was carried out in accordance with current UK guidance on the assessment of contaminated land, including Model Procedures for the Management of Land Contamination (CLR 11) (Defra/Environment Agency, 2004)[1]. As such, the PERA includes a Site-specific conceptual model which identifies the likely potential pollutant linkages. Consideration is given in the conceptual model to the potential sources of contamination, migration pathways and sensitive receptors. The likely risks and therefore impacts of ground contamination upon human health, Controlled Waters, ecological receptors, property and landscaped areas have been assessed as part of the PERA using this source-pathway-receptor approach.

Assumptions and Limitations

12.7. The assessment presented in this chapter is based on desk-based qualitative information presented in the PERA. It is assumed that a comprehensive intrusive ground investigation would be undertaken prior to the construction of the Development to further develop the conceptual Site model and better understand existing ground conditions, and the extent of potential contamination within the soils and groundwater. The results of the investigation should be used in the preparation of human health, phytotoxicity, potable water pipe, groundwater and surface water risk assessments to determine potential risks from contamination. The investigation should outline recommendations for mitigation and/ or remedial measures if required.

Consultations

12.8. An EIA Scoping Opinion received from the Merseyside Environmental Advisory Service, acting on behalf of LCC, dated 6th September 2017 includes advice in relation to the preparation of a Construction Environmental Management Plan (CEMP) in order to minimise the main construction effects of the proposed Development. A summary of that advice is provided below:

'The CEMP should address and propose measures to minimise the main construction effects of the development and, amongst other things, should include details of ecological mitigation, construction and demolition waste management, pollution prevention and soil resource management. The CEMP would normally be expected to include the agreed method statements to mitigate or avoid adverse environmental impacts including:

- *Ecological mitigation measures;*
- *Biosecurity measure that will be undertaken during the works to prevent the spread of invasive non-native marine species;*
- *Waste Audit or similar mechanism;*
- *Demolition of existing structures;*
- *Measures to Prevent Pollution of Control Waters*

The CEMP should be compiled in a coherent and integrated document and should be accessible to site managers, all contractors and sub-contractors working on site as a simple point of reference for site environmental management systems and procedures. I advise that the CEMP should be secured though planning condition or other legal agreement for e.g. S106. The details of the draft CEMP should be submitted to the Council, agreed and implemented prior to the discharge of the planning condition.'

12.9. In their EIA Scoping Opinion, dated 4th September 2017 the Environment Agency (EA) state that 'the proposed development will be acceptable if the following planning conditions are included within any planning permission granted for the site to ensure that any unacceptable risks from contamination are adequately addressed and mitigated during the re-development of the site. Without these conditions, the proposed development on this site poses an unacceptable risk to the environment and we would object to the application'. The conditions required by the EA are summarised below:

- Preparation of a preliminary risk assessment and site investigation scheme (including detailed risk assessment) followed by an options appraisal and remediation strategy as necessary. A verification plan would then be required, providing details of the data that will be collected in order to demonstrate that the works set out in the remediation strategy are complete;
- Prior to any part of the Development being bought into use, a verification report would be required demonstrating completion of the works set out in the approved remediation strategy

and the effectiveness of the remediation submitted to and approved, in writing, by the local planning authority;

- If contamination not previously identified is found to be present at the Site, then no further development (unless otherwise agreed in writing with the Local Planning Authority) shall be carried out until a remediation strategy detailing how this contamination will be dealt with has been submitted to and approved in writing by the local planning authority. The remediation strategy shall be implemented as approved; and
- Piling or any other foundation designs using penetrative methods shall not be permitted other than with the express written consent of the local planning authority, which may be given for those parts of the Site where it has been demonstrated that there is no resultant unacceptable risk to groundwater. The Development shall be carried out in accordance with the approved details.

12.10. With regards to waste to be taken off-Site, the EA states the following:

'Contaminated soil that is, or must be disposed of, is waste. Therefore, its handling, transport, treatment and disposal is subject to waste management legislation, which includes:

- *Duty of Care Regulations 1991;*
- *Hazardous Waste (England and Wales) Regulations 2005;*
- *Environmental Permitting (England and Wales) Regulations 2017;*
- *The Waste (England and Wales) Regulations 2011.*

Developers should ensure that all contaminated materials are adequately characterised both chemically and physically in line with relevant guidance and that the permitting status of any proposed treatment or disposal activity is clear.'

12.11. In their scoping opinion dated 1st September 2017, Natural England (NE) state that 'the ES should thoroughly assess the potential for the proposal to affect designated sites'.

12.12. They further state that 'The development site is within the extension to Liverpool Bay / Bae Lerpwl potential SPA and could also have a potential impact on the following designated nature conservation sites:

- *Mersey Narrows SSSI*
- *North Wirral Foreshore SSSI*
- *Mersey Narrows & North Wirral Foreshore SPA*
- *Mersey Narrows and North Wirral Foreshore Ramsar*
- *Mersey Estuary SPA*
- *Mersey Estuary Ramsar*
- *Ribble & Alt Estuaries SPA*
- *Ribble & Alt Estuaries Ramsar*
- *Dee Estuary SAC*
- *Sefton Coast SAC*

The Environmental Statement should include a full assessment of the direct and indirect effects of the development on the features of special interest within these sites and should identify such mitigation measures as may be required in order to avoid, minimise or reduce any adverse significant effects.'

Significance Criteria

12.13. There is no specific methodology or guidance for the assessment of potential effects in relation to ground conditions and contamination for the purposes of EIA. Significance criteria have therefore been developed on the basis of accepted methodologies for the definition of EIA criteria, together with professional judgement. The significance criteria used in this assessment is detailed in **Table 12.1.**

Table 12.1: Significance Criteria for Ground Conditions and Contamination Assessment

Criterion	Description
Adverse Effect of Major Significance	High risk site classification – acute or severe chronic effects to human health and/or animal/ plant populations predicted. Effect on a potable groundwater or surface water resource of regional importance e.g. major aquifer, public water reservoir or inner source protection zone (SPZ) of a public supply borehole.
Adverse Effect of Moderate Significance	Medium risk site classification and proven (or likely significant) pollutant linkages with human health and/or animal/plant populations, with harm from long-term exposure. Effect on a potable groundwater or surface water resource at a local level e.g. effect on an outer groundwater SPZ. Temporary alteration to the regional hydrological or hydrogeological regime or permanent alteration to the local regime.
Adverse Effect of Minor Significance	Medium risk site classification and potential pollutant linkages with human health and / or animal / plant populations identified. Reversible, localised reduction in the quality of groundwater or surface water resources used for commercial or industrial abstractions, minor aquifer, etc.
Negligible effect	No appreciable impact on human, animal or plant health, potable groundwater or surface water resources.
Beneficial Effect of Minor Significance	Risks to human, animal or plant health are reduced to acceptable levels. Local scale improvement to the quality of groundwater or surface water resources used for commercial or industrial abstraction.
Beneficial Effect of Moderate Significance	Significant reduction in risks to human, animal or plant health, to acceptable levels. Significant local improvement to the quality of potable groundwater or surface water resources. Significant improvement to the quality of groundwater or surface water resources used for public water supply.
Beneficial Effect of Major Significance	Major reduction in risks to human, animal or plant health. Significant regional scale improvement to the quality of potable groundwater or surface water resources.

12.14. In addition, the terminology to establish the temporal and spatial scale of the effects is as follows:

- **'temporary'** effects are those associated with the Site preparation and construction works;
- **'permanent'** effects are those associated with the completed and operational Development;
- **'Site-wide'** effects are those affecting receptors within the Site only;
- **'local'** effects are those affecting neighbouring receptors;
- **'district'** effects are those which are likely to occur to receptors beyond the immediate neighbouring receptors, i.e. within central Liverpool;
- **'regional'** effects are those affecting receptors within the wider Liverpool area.

Baseline Conditions

Current Uses of the Site and Surrounding Area

12.15. The layout of the Site and its surrounds is described within **Chapter 3: Existing Land Uses and Activities** which should be consulted for full details. However, a summary is provided below.

12.16. The north-east of the Site comprises a hardstanding car-park (Plot 11). Surface conditions are noted to consist of tarmac and cobbles, with some gravel areas. A disused railway line is also visible in this area.

12.17. A disused jetty known as the Princes Jetty, the existing Liverpool Landing Stage and open waters of the Mersey Estuary occupy the western sections of the site. The Princes Jetty is currently dilapidated and not publicly accessible and is surrounded by security fencing. Within the open waters of the Mersey Estuary in the north of the Site two isolated concrete anchoring points were observed that were likely to have used with a historical floating landing stage. Open waters sit between the Liverpool Landing Stage and the river wall.

12.18. A marshalling yard and kiosk for the existing temporary ferry terminal is located in the south-east of the Site. The hard standing in this area was noted to be in good condition comprising tarmacked and paved surfaces. An area of soft landscaping and a memorial are located to the west of the marshalling yard but do not fall within the Site boundary. A section of the Liverpool Canal Link also runs under the southern car-park.

12.19. The carparks are linked by the Princes Parade road which runs north to south and connects to St Nicholas Place in the southern part of the Site. Access ramps to the existing floating landing stage connect to Princes Parade.

12.20. The Site is bounded by the Mersey Estuary and the Liverpool Landing Stage to the west, a residential apartment block (Alexandra Tower) and the Princes Half Tide Dock to the north, Numbers 8, 10 and 12 Princes Dock to the east and the Royal Liver Building to the south.

Historical Land Uses

12.21. The historical development of the Site has been assessed in the PERA through a review of available historical Ordnance Survey maps dating from the 1850s to the present day. A summary of the findings is provided in **Table 12.2**. Potentially contaminative uses are shown in ***bold italics***.

Table 12.2: Site History

Source	Site [a]	Surroundings [a]
OS Map Published by Lancashire and Furness, 1851, 1: 10,560	The Site is extensively developed on the dates of the first maps, and comprises the Princes ***Dock*** with the quay wall of the dock present in the northern section of the Site. The southern extent of the Site contains a dock referred to as the **George's *Dock* Basin.** A smaller dock denoted as the ***Seacombe Ferry Basin*** is situated approximately 30m to the north on the George's Dock Basin and cross the Site east west. A lock in the northern section of the Site connects the Princes Dock to the Princes Dock Basin to the north of the Site. Princes Parade Road is denoted running north south through the Site. No buildings are	A ***depot*** is situated 200m to the north, the ***dock buildings*** surrounding Waterloo Dock are 230m to the north. To the north east are a ***timber yard***, ***boat builders yard***, and ***pig market*** is located 200m, 220m and 270m to the north east. The Princes Dock bounds the Site to the east, with a number of **coal yards** located further to the east, the closest 180m from the Site Boundary. A ***boat building yard*** is located 200m to the east. Also to the east is a ***graveyard*** 100m from the Site boundary. The ***Prince's Graving Dock*** bounds the south eastern boundary, with ***Georges***

Source	Site [a]	Surroundings [a]
	located within the Site boundary at this time. The Princes ***Landing Stage*** is denoted in the western section of the Site.	***Dock*** and ***George's Ferry Basin*** located immediately to the south and west. Further ***smaller docks and dock buildings*** are located adjacent to the Site.
OS Map Published by Cheshire, 1881 - 1882, 1: 10,560	A long thin section of the Princess Dock at the northwest of the Site has been ***infilled*** and is now denoted as Mooring Points. A building (likely to be a ***warehouse***) occupies the north east section of the Site.	A ***railway*** is denoted 10m to the east and the
OS Map Published by Lancashire and Furness, 1893, 1: 2,500 & Lancashire and Furness, 1891 - 1895, 1894 & 1899, 1:500 & 1: 10,560	A line of small rectangular buildings are denoted along north south through the Site labelled as No11, No10, No9 and No8. A Swing bridge office is denoted at the north-eastern corner of the Site. Both the George's Dock Basin and Seacombe Ferry Basin appear to have been ***infilled*** and are denoted with ***Customs Store***, ***a Floating Bridge***, ***Princess Floating Landing Stage***.	A ***tobacco works, lead works and sawmill*** are denoted approximately 130m, 190m and 200m to the north east.
OS Map Published by Lancashire and Furness, 1908, 1: 2,500	The single warehouses have been replaced by a long ***warehouse*** structures. A series of mooring points are denoted along the north-western boundary. Centrally within the northern section of the Site, ***Cattle Pens*** are denoted together with a series of square structures A railway runs north south through the north-eastern section of the Site and off-site to the north-east. The southern section of the Site is now denoted as St Nicholas Place.	Clarks Basin has been ***infilled*** approx 80m to the east. The Port Riverside Station is denoted immediately to the east of the Site, with a Mortuary and the Port Sanitary Office also denoted.
OS Map Published by Lancashire and Furness & Cheshire, 1910, & 1913 1: 10,560	Prince's ***Jetty*** is denoted in north west of the Site. The ***Railway Station*** is denoted to extend onto the Site from the east.	Georges Dock has been ***infilled*** approximately 80m to the south.
OS Map Published by Lancashire and Furness & Cheshire, 1927 & 1928, 1: 2,500 & 1: 10,560	There are no significant changes denoted.	An ***engineering works*** is denoted 140m to the north east of the Site.
OS Map Published by Lancashire and Furness & Cheshire, 1938, 1: 10,560	There are no significant changes denoted.	There are no significant changes denoted.

Source	Site [a]	Surroundings [a]
Ordnance Survey Plan & Additional SIM, Publish 1954, 1955, 1954-1957 1: 1,250 & 1: 10,000	More buildings (Likely to be ***dock buildings/warehouses***) denoted in northern section of the Site.	Numerous ***warehouses*** now denoted within the area surrounding the Site. An ***engine shed*** 40m to the east. A ***bus station*** 50m to the south.
OS Plan Published, 1974, 1975-1989 & 1982-1987, 1: 2,500 & 1: 10,000	A number of the structures, to the south of the former Cattle Pens within the northern land parcel have been removed denoting open water. The dock buildings are no longer denoted in the northern section of the Site.	There are no significant changes denoted.
OS Plan Published, 1990-1991 & 1993, 1: 10,000	Railway Station no longer denoted.	Dock buildings around Princess Dock have been demolished.
Landmark Information Group, 10k Raster mapping Published, 1999 1: 10,000 & Historical Aerial Photography, Published 2000	Cleared areas in north of the Site is in use as a surface carpark.	Dock building around Waterloo Dock has been redeveloped into residential use.
Landmark Information Group, VecorMap Local, Published, 2017. 1:10,000	There are no significant changes denoted.	There are no significant changes denoted.

Envirocheck Database Search

12.22. A Landmark Envirocheck report was procured in preparation of the PERA.

12.23. There is one licence/consent registered to the Site, a Discharge Consent for discharge of Surface Water to the Mersey Estuary.

12.24. There are 2 No. recorded landfills within 1km of the Site, which may be a source of both off-site contamination and ground gas, as summarised in **Table 12.3**.

Table 12.3: Summary of Landfills in the Vicinity of the Site

Site Name (Reference)	Distance and Direction from Site	Status	Details of Content	Regulator / Information Source
Waterloo Dock River Entrance (Ref. LO28/ EAHLD16779)	Approx. 200m NW	Local Authority Recorded Landfill Site/ Historical Landfill Site	First input, 31st December 1985 Last input, 31st December 1985 Waste Accepted: Unknown	Merseyside Waste Disposal Authority

Site Name (Reference)	Distance and Direction from Site	Status	Details of Content	Regulator / Information Source
Trafalgar & Waterloo Docks, (Ref. 509/02)	Approx. 580m North	Registered Landfill Site/ Historical Landfill Site	First input, 1st January 1970 Last input, 31st December 1971 Waste Accepted: Clays S, Sand Incl. Excav. Road Mat'L (< 5% Wt/Load), Glass, Pottery, China, Enamels, Hardcore, Brickwork, Stone, Concrete, Inert Industrial Waste Consisting Of Max.Waste Permitted By Licence, Sub/Topsoil Prohibited Waste: Clinical - As In Control.Waste Regs'92, Commercial Waste, Contaminated Soil, Foundry/Moulding Sand, Household Waste, Industrial Wastes, Liquid Wastes, Malodorous Waste, Putrescible Waste, Sludge Wastes, Special Wastes, Timber/Products, Waste N.O.S. Max Input Rate: Medium (Equal to or greater than 25,000 and less than 75,000 tonnes per year)	Environment Agency - North West Region, South Area

12.25. The following licences and consents are registered within 1km of the Site:

- 47 No. Environmental Permits for discharges to surface water, the closest of which is located approximately 5m to the south of the Site for Emergency Sewage Effluent to the Mersey Estuary at the Princess Dock Mersey Pumping Station;
- 9 No. Environmental permits for Part B Activities. The nearest permit is registered to Costco Petrol Filling Station, located 247m north of the Site;
- 2 No. Licensed Waste Management Facilities, the nearest relates to an end of life vehicles facility located 680m north of the Site;
- 1 No. Registered Waste Treatment or Disposal Site relating to a scrapyard with transfer station located 620m to the north of the Site.

12.26. In addition to the above, there is 1 No. Planning Hazardous Substance Consents registered to Henty Oil Limited (Permit Ref. 14HZ/0300) relating to a combination of dangerous substances located 999m north of the Site.

Geology

12.27. The geology beneath the Site has been established in the PERA through review of the BGS 1:50,000 scale Geological Map included within the Landmark Envirocheck Report, the BGS website (accessed online 06/02/2017) and publicly available BGS borehole records. A summary is provided in Table 12.4.

Table 12.4: Site Geology

Stratum	Area Covered	Estimated Thickness	Typical Description
Made Ground	All areas with the exception of the west extent of the Site.	13m	Made Ground is likely to be present to at least a thickness of 13m as a result of construction of the docks.
Tidal Flat Deposits	Whole Site.	6m	Clay, Silty, Sandy.
Glacial Till	Whole Site	3-5m	Stiff brown Clay with lenses of sand.
Chester Pebble Beds Formation	Whole Site	unknown	Sandstone, Pebbly (gravelly).

12.28. Significant areas of Made Ground are anticipated due to the construction of the docks on Site. The land parcel at the south of the Site is denoted as a Dock Basin in the 1851 historical map, which by the 1894 maps is denoted as part of the dock landing area indicating this part of the Site has been reclaimed and the thickness of Made Ground is likely to be significant.

12.29. BGS mapping does not reveal any structural, geomorphological or geochemical features on or near to the Site.

12.30. The Site is not in an area that could be affected by coal mining activity and the Landmark dataset does not provide any evidence for metalliferous or non-coal mining activities on the Site.

Hydrology

12.31. There is one surface water located within the Site boundary: the Mersey Estuary. According to the EA Catchment Data Explorer (accessed online on 27/09/17), the Mersey Estuary is a heavily modified transitional water with an overall classification of 'moderate' with 'moderate' ecological quality and a 'fail' for chemical quality. The Princes Dock and the Princes Half Tide Dock, which form part of the Mersey Estuary, are located adjacent to the east and the north of the Site respectively.

12.32. The Liverpool Canal Link runs beneath the southern carpark linking the Princes Dock with the Canning Dock which is approximately 550m to the south of the Site.

12.33. According to the Landmark Envirocheck report there is 1 No. discharge consent registered to the Site for discharge of Other Matter-Surface Water to the Mersey Estuary. There are 47 No. discharge consents within 1km of the Site, the closest of which is located approximately 5m to the south of the Site for Emergency Sewage Effluent to the Mersey Estuary at the Princess Dock Mersey Pumping Station.

12.34. The Landmark dataset gives details of 24 No. pollution incidents to controlled waters in within 1km of the Site. The closest was located approximately 15m to the south of the Site relating to unknown pollutants. The receptor has not been identified.

Hydrogeology

12.35. According to the EA online dataset, the geological deposits underlying the Site are classified as per **Table 12.5**.

Table 12.5: Summary of Hydrogeological Properties of the Main Geological Strata

Stratum	Area Covered	Typical Description
Made Ground	Not Classified	Contains insignificant quantities of vertically or laterally extensive groundwater
Tidal Flat Deposits	Unproductive Strata	Contains insignificant quantities of vertically or laterally extensive groundwater
Glacial Till	Unproductive Strata	Contains insignificant quantities of vertically or laterally extensive groundwater
Chester Pebble Beds Formation	Principal Aquifer	Regionally important aquifer, likely to be used to support potable abstractions

12.36. The Site is not located within a groundwater Source Protection Zone.

12.37. Based on available information, it is anticipated that groundwater flow will be in a westerly direction and is likely to be in hydraulic continuity with the Mersey Estuary.

12.38. There are nine recorded groundwater abstractions within a 1km radius of the Site, the closest of which is located 220m east of the Site at George's Dock Pumping Station for a groundwater heat pump (other industrial/commercial/public services). No drinking water abstractions have been identified in the surrounding area.

12.39. There are no pollution incidents to groundwater within a 1km radius of the Site.

Ecological Systems

12.40. The Mersey Narrows & North Wirral Foreshore approximately 820m to the west of the Site on the opposite bank of the Mersey Estuary is designated as a Site of Special Scientific Interest (SSSI), a Ramsar site and Special Protection Area (SPA). Other designated ecological sites in the surrounding area include the Ribble and Alt Estuaries SPA and Ramsar site located approximately 6.7km to the north and the Mersey Estuary SPA and Ramsar site located 4.9km to the south of the Site.

Previous Reports

Liverpool Waters Masterplan Baseline Geo-Environmental Assessment Report (January 2008)

12.41. White Young Green Environmental Limited (WYGE) produced a Baseline Geo-Environmental Assessment Report in January 2008 (Ref: E013699/DTS/CEC/JAN08/V1) for the Liverpool Waters Masterplan. The "Proposed Liverpool Urban Area (Western Portion of the Site)" of the Masterplan includes the Site. The report concludes:

"…. It is considered that there is a potential for contamination sources at the site and in the surrounding areas, predominantly based on historical land uses identified. There is the potential for numerous hazard sources to be present at the site these would be described as a medium risk. The historical development of the site indicates that there have been several land uses that could be described as significant/high risk.

Overall, the risk assessment highlights that the contaminative land uses considered to pose a low to high risk."

12.42. One of the of the main recommendations from the report is that early consultation should be undertaken with both the Environment Agency (EA) and Liverpool City Council Contaminated Land

Team with respect to the design of any site investigations. In addition, the report recommends that Site investigations should be undertaken within all areas earmarked for development and should be undertaken in a phased manner.

12.43. The report also makes recommendations with regards to unexploded ordnance.

12.44. A full summary is provided in the PERA presented in **Appendix 12.1**.

Liverpool Waters Environmental Statement November 2011

12.45. WYGE also produced a Ground Conditions and Hydrology chapter for the Liverpool Waters Masterplan Environmental Statement. The chapter concluded that with the implementation of appropriate mitigation measures, the magnitude of residual impacts would range from *"Negligible"* to *"Slight"* with the significance of residual effects ranging from *"Neutral"* to *"Intermediate – Minor"*.

12.46. A full summary is provided in the PERA presented in **Appendix 12.1**.

Conceptual Site Model

Potential Contamination Sources

12.47. Whilst existing on-site potentially contaminative land uses are restricted to the use of the southern section of the Site as a car park, potentially contaminative historical on-site land uses include significant infilling / reclamation and various dockyard activities, including railways and associated infrastructure and warehousing. There is a potential that these land uses could have impacted upon the surrounding soils and Controlled Waters receptors. The recorded infilling also represents a potentially significant source of ground gas.

12.48. Potentially contaminative off-site land uses include former landfill sites, significant areas of infilling / reclamation, warehouses, railways and associated infrastructure, sawmills, tobacco works, lead works, coal yard, bus station and a grave yard. The potential for on-site migration of contamination and ground gas from these sources cannot be discounted.

Potential Pathways

12.49. The following potential pathways have been identified whereby potential receptors could be exposed to, or affected by, potential contamination:

- Dermal contact and ingestion of contaminated soils in areas of soft landscaping/ planting;
- Inhalation of contaminated dust and asbestos fibres;
- Migration and accumulation of soil-borne gases, landfill gases and vapours in future buildings, structures and confined spaces;
- Leaching of contaminants and migration through soils (including Made Ground);
- Migration of contaminants via groundwater;
- Surface run-off of contaminants;
- Direct contact between contaminated soils and groundwater and buried services and structures; and
- Root uptake of contaminants

Potential Receptors

12.50. The following receptors are considered at the Site under the Development proposals:

- Future Site users (customers, visitors and staff);
- Future construction and maintenance workers;
- Off-site current and future land users (including nearby residents, visitors to the docks and customers / employees of surrounding businesses);
- Surface Waters (i.e. the Mersey Estuary);
- Groundwater aquifers underlying the Site and in the vicinity;
- Buildings and services on-site and in the vicinity;
- Sensitive ecological systems (e.g. Mersey Narrows & North Wirral Foreshore); and
- Future plants and landscaped areas.

Likely Effects

Demolition and Construction

Disposal of Excavated Material

12.51. Due to the potential for contamination within the underlying soils, a proportion of any land excavated material may be classified as hazardous waste for the purposes of disposal to landfill. This would, however be confirmed by Waste Acceptance Criteria (WAC) testing to determine waste classification and allow identification of an appropriate disposal facility.

12.52. All wastes would then be transported to, and disposed of, at a licensed landfill site in accordance with the Duty of Care Regulations 1991[2] and, as applicable, in accordance with the Environmental Permitting (England and Wales) Regulations 2016[3] and the Hazardous Waste (England and Wales) Regulations 2005[4].

12.53. Once the aforementioned legislative requirements have been complied with, the disposal of contaminated material would result in **negligible** environmental effects.

Effects on Human Health from Ground Contamination and Ground Gas

12.54. Construction and demolition activities, particularly the breaking up of existing hardstanding surfacing, piling, earthworks associated with the construction of new structures, roads and parking facilities and the excavation of drainage routes has the potential to disturb and expose future construction workers and Site visitors to any contamination (including asbestos) present within the underlying soils and groundwater which would have been previously contained and effectively isolated by hardstanding, building footprint and other structures. There is also a potential that construction workers could be exposed to asbestos containing materials (ACMs) (if present) within the existing Lower Cruise Terminal building which is proposed for modification and reconfiguration.

12.55. In addition, there is considered to be a high risk of ground gas at the Site associated with the significant thicknesses of made ground assumed to underlie the Site, the presence of organic natural soils and potentially gassing off-site features, including former landfills. Ground gas associated with these features could potentially migrate via granular deposits into poorly ventilated spaces (such as excavations), thereby posing a potential risk to future construction workers.

12.56. However, worker safety throughout the demolition and construction period would be subject to mandatory requirements including the COSHH regulations 2002[5], the CDM Regulations 2015[6] and the Control of Asbestos Regulations 2012[7]. Demolition and construction workers would be made aware of the possibility of encountering contaminated soils and asbestos in made ground through

toolbox talks and would be required to use appropriate personal protective equipment (PPE) commensurate with the contaminants present and the activities being undertaken, thereby minimising the risk of exposure to potentially contaminated soils, dust, and perched groundwater.

12.57. The potential for exposure of construction workers to ground gas would be monitored where demolition and construction workers enter confined spaces such as excavations. Safe procedures for entry into excavations would be developed in line with HSE and CIRIA guidance and, where necessary, adequate respiratory protective equipment (RPE) and ventilation would be provided.

12.58. A refurbishment asbestos survey would be carried out prior to the proposed modification of the Lower Cruise Terminal building to identify the presence, extent and type of ACMs. Following on from the surveys, appropriate Health and Safety Plans would be developed as required under the CDM Regulations 2015 to remove and dispose of asbestos in an appropriate and safe manner.

12.59. Adherence to these legislative requirements would significantly reduce the health and safety risk posed to demolition and construction workers to a low level. Therefore, the likely effect of contamination and ground gas on human health would be **negligible**.

12.60. In the event of exposing soils and stockpiling construction waste (including excavated materials), dust could be generated during dry and windy conditions. Under these conditions, users of neighbouring businesses, nearby residents and the general public could temporarily be exposed to contamination via the inhalation of potentially contaminated soils or dust. In the absence of mitigation, the potential effect is considered to be **temporary, local, and of minor adverse significance**.

Effects on Human Health from Unexploded Ordnance

12.61. Liverpool was subject to significant bomb damage during World War 2 and Unexploded Ordnance (UXO) is considered to be a high risk at the Site. As such, any intrusive works, including ground investigation, demolition, excavation, construction and piling have the potential to cause severe harm to construction workers and the general public surrounding the Site. An assessment of UXO has been prepared previously by BAE Systems for the Liverpool Waters Masterplan area (within which the Site is located) with the assessment stating that *"the probability of encountering UXO during the project is relatively high…however…the probability of initiating the device and causing an explosion is substantially lower"*. In light of the available information, it is therefore considered that in the event of encountering UXO at the Site, and in the absence of mitigation, the effect of UXO on human health is considered to be **temporary, local and of major adverse significance**.

Effects on Soils and Controlled Waters

12.62. During demolition and construction, areas of existing hardstanding would be broken out to accommodate the Development, allowing increased rainwater and surface run-off to infiltrate the subsurface. This could potentially mobilise previously contained residual contamination which could feasibly migrate into the underlying aquifers or the Mersey Estuary giving rise to **temporary, local effects of minor adverse significance**.

12.63. To facilitate demolition and construction, it is anticipated that potentially polluting substances and activities would be introduced to the Site. These may include concrete pouring, storage of fuels and chemicals and leaks/ spills of fuel and oil from demolition and construction vehicles. In the event of an accidental pollution incident, and in the absence of mitigation, the potential effect on Controlled Waters is considered to be **temporary, local and of moderate adverse significance**.

12.64. An indicative piling layout prepared by Ramboll estimates that piles for the suspended deck structure would extend to bedrock at depths of between 15m and 25mbgl, although the exact depths

would be determined via ground investigation prior to the commencement of the construction works. It is therefore considered that piling would have the potential to create new pathways for contamination into the underlying Principal bedrock aquifer. However, the precise piling methodology would be subject to a foundation works risk assessment, prepared in consultation with the EA to ensure that potential risks to the underlying aquifer associated with contamination would be minimised. In view of this, the potential contamination risk to underlying groundwater aquifers would be **negligible**.

Effects on Sensitive Ecological Receptors

12.65. As discussed above, the demolition and construction of the proposed development would introduce potentially polluting substances and activities to the Site. Whilst unlikely, there is a potential that accidental released, leaks or spills could occur, leading to migration via surface water beyond the boundary of the demolition and construction area resulting in effects on animal and ecological receptors of the Mersey Narrows & North Wirral Foreshore which is a designated SSSI, SPA and Ramsar site. Consequently, in the absence of mitigation, the potential effect on sensitive land uses in the surrounding area as a result of demolition and construction works is considered to be **temporary, local and of minor adverse significance**.

12.66. The distance of the Site from the Ribble and Alt Estuaries SPA and Ramsar site and the likely effects of dilution and attenuation are such that the likely effect of any contamination events associated with the demolition and construction phase of the proposed development would be **negligible**.

12.67. The large distance and upstream location of the Mersey Estuary SPA and Ramsar site in relation to the Site suggests that the potential effect of the demolition and construction phase of the proposed development would be **negligible** due to dilution and attenuation effects.

Completed Development

Effects on Human Health from Ground Contamination and Ground Gas

12.68. As described in **Chapter 5: Proposed Development**, the completed Development would comprise the construction of a new landing stage and suspended deck structure, construction of a new cruise terminal building with parking, pick-up and drop-off facilities, modification and reconfiguration of the existing Lower Cruise Terminal building and erection of a vehicular and pedestrian linkspan bridge and boarding bridges. Areas of open space and public realm would also be provided. The potential risk posed to future Site users from exposure to potentially contaminated soils, groundwater and ground gas is considered to be low for the following reasons:

- The majority of the Site would be hard-surfaced, which would form a barrier between people and direct contact with any potentially contaminated soil that remains following demolition, excavation and groundworks, thus breaking the linkage between potential sources and receptors;
- Public realm and pedestrian routes would be predominantly hard landscaped and augmented with only limited areas of soft landscaping. Any material used within soft landscaped areas would comprise clean and inert imported topsoil;
- The proposed new terminal building is to be built on a suspended deck structure constructed over the River Mersey, piled directly into the underlying bedrock. As such, the proposed terminal building would not be in direct contact with either made ground or organic natural soils and consequently, no risk is considered in relation to gas ingress and potential accumulation.

12.69. In light of the above it is considered that future occupants and users of the Site would be unlikely to come into contact with contaminated soil, groundwater or ground gas. The risk to future Site users is therefore considered to be **negligible**.

Effects on Soils and Controlled Waters

12.70. The Development proposals are not expected to introduce new potentially contaminative land uses to the Site as it is already in use for the berthing of cruise ships. All shipping activities would be undertaken in accordance with activity-specific environmental risk assessments that outline the potential hazards and impacts of an activity (such as leaks or spills from docked ships) as well as the risk control measures that would be put in place in order to reduce potential impacts as far as practicable.

12.71. Any potentially contaminative or hazardous materials used or stored on-Site during the operation of the Development would be stored and handled appropriately and any leaks/ spills cleaned up in accordance with EA and DEFRA Regulations.

12.72. New parking provision would be provided in the north of the Site and whilst there is a potential for leaks and spills from parked vehicles, all highways and parking areas would be installed with appropriate interceptors and pollution abatement controls to prevent contaminated surface run-off or spills from entering the underlying soils or the Mersey Estuary.

12.73. In light of this, whilst the potential for accidental pollution incidents, spillages, leaks or releases cannot be completely discounted, the potential impacts would be significantly reduced and therefore potential effects are considered to be **permanent, local and of minor adverse significance**.

Effects on Sensitive Ecological Receptors

12.74. As described above, whilst the potential for accidental releases, spills and leaks associated with the day to day activities of the cruise terminal and associated infrastructure cannot be completely discounted, all activities would be carried out in accordance with activity-specific environmental risk assessments and risk control measures would be put in place to reduce the potential for pollution incidents as far as practicable.

12.75. All potentially contaminative or hazardous materials used on-site during the operation of the Development would be stored and handled appropriately and any spills / leaks cleaned up in accordance with appropriate regulations. Surface run-off would be discharged into the Mersey Estuary via appropriate interceptors and pollution abatement controls. Consequently, the potential for accidental pollution incidents to enter the Mersey Estuary and migrate beyond the Site boundaries to sensitive receptors within the Mersey Narrows & North Wirral Foreshore is considered to be reduced as far as practicable.

12.76. It is however recognised that risks cannot be completely eliminated and therefore potential effects are considered to be, at worst, **permanent, local and of minor adverse significance**.

12.77. The distance and location of other sensitive ecological receptors from the Site are such that the day to day activities of the cruise terminal and associated infrastructure are expected to give rise to **negligible** effects.

Effects on Plants and Landscaped Areas

12.78. As described previously, all proposed soft landscaped areas would be effectively capped from any underlying contamination via the importation of clean, inert topsoil as a growing medium. As such the potential effect on plants and landscaped areas would be **negligible**.

Effects on Buried Structures and Services

12.79. Buried structures and services within the completed Development would be suitably designed for the prevailing ground conditions and contaminant concentrations present in the soils and groundwater at the Site to ensure that the integrity of the materials is maintained at all times. This may include a requirement for sulphate-resistant concrete and / or barrier water supply pipes. Consequently, the likely effect on buried structures and services is considered to be **negligible**.

Mitigation Measures and Likely Residual Effects

12.80. This assessment has highlighted the potential for contamination to be present within the soils and groundwater underlying the Site associated with historical land uses. An intrusive environmental and geotechnical ground investigation would be carried out prior to the commencement of demolition and construction works, the scope of which would be agreed in advance with the relevant regulatory bodies. The investigation would be designed to determine if the Site is suitable for its intended use and will identify any potentially unacceptable risks to human health, Controlled Waters, ecological receptors and the built environment from soil/ groundwater contamination and ground gas/ vapours. Should the investigation identify potentially unacceptable risks at the Site, an appropriate remediation strategy would be prepared and agreed in consultation with LCC and the EA. Implementation of any remediation strategy would be followed by a process of validation.

12.81. A refurbishment asbestos survey would be carried out prior to the proposed modification of the Lower Cruise Terminal building to identify the presence, extent and type of ACMs. Following on from the surveys, appropriate Health and Safety Plans would be developed as required under the CDM Regulations 2015 to remove and dispose of asbestos in an appropriate and safe manner.

Demolition and Construction

Disposal of Excavated Material

12.82. All material to be removed off-site would be subject to waste classification sampling and analysis in accordance with the UK legislative requirements.

12.83. In the event that future ground investigation reveals elevated levels of contamination within material scheduled for excavation and disposal, such material may require on-site treatment to reduce contaminant concentrations prior to disposal to landfill or re-use within construction.

12.84. Material identified as containing leachable contaminants would be suitably contained by bunding or other containment measures to prevent the potential release of contaminated run-off and thus protect underlying soils, groundwater and surface water receptors.

12.85. Once the aforementioned legislative requirements have been complied with, the disposal of contaminated material would result in **negligible** residual environmental effects.

Effects on Human Health from Ground Contamination and Ground Gas

12.86. As previously stated worker safety throughout the demolition and construction period would be subject to mandatory requirements including the COSHH regulations 2002, the CDM Regulations 2015 and the Control of Asbestos Regulations 2012. These regulations set out extensive requirements for the protection of construction workers and stress the importance of appropriate procedures in the event of the workforce encountering unexpected contamination.

12.87. The potential for elevated concentrations of ground gases and vapours to be present within the soils at the Site would be determined via intrusive investigation. The potential for exposure of

construction workers to ground gas would be monitored where construction workers enter confined spaces such as excavations. Safe procedures for entry into excavations would be developed in line with HSE and CIRIA guidance and, where necessary, adequate respiratory protective equipment (RPE) and ventilation would be provided

12.88. A Construction Environmental Management Plan (CEMP) would be prepared for implementation during future and demolition and construction works and would include precautions to minimise the exposure of workers and the general public to potentially harmful substances. The contents of the CEMP would be agreed in advance with regulatory bodies but is likely to include, in line with the framework CEMP provided in **Chapter 6: Development Programme and Construction**:

- Personal hygiene, washing and changing procedures;
- The requirement for all Site personnel and visitors to use PPE and, where appropriate, RPE commensurate with the activities being undertaken and the contaminants present and for all personnel to be provided with asbestos awareness training;
- Adoption of dust suppression methods as required, such as water spraying, wheel washing facilities for vehicles leaving the Site and covering of stockpiled materials and materials being transported to and from the Site;
- Requirement for Site boundaries to be hoarded and secured at all stages of the demolition and construction works;
- Regular cleaning of all Site roads, access roads and the public highway; and
- Measures to avoid surface water ponding and collection of disposal of all on-site run-off.

12.89. The above measures would be carried out in accordance with the HSE publication 'Protection of Workers and the General Public during the Development of Contaminated Land'[8] and CIRIA Report 132 'A Guide for Safe Working on Contaminated Sites' (1996)[9].

12.90. Following the implementation of the above mitigation measures, the residual risk to human health during the demolition and construction phase is considered to be **negligible**.

Effects on Human Health from Unexploded Ordnance

12.91. In addition to the mandatory health and safety requirements that all demolition and construction works would be subject to, a specialist Site-specific UXO desk-based risk assessment would be procured in advance of any intrusive works to examine the possibility of encountering UXO at the Site. In the event that the assessment identifies a potential risk, the recommendations and mitigation measures outlined in the report would be deployed in full. The scope of mitigation measures, if required, is unknown but may include Site-specific explosive ordnance safety and awareness briefings, the provision of unexploded ordnance Site safety instructions, the presence of any explosive ordnance engineer on-site to support shallow intrusive works or intrusive magnetometer surveys for borehole and pile clearance. Following adherence to mandatory health and safety requirements and implementation of Site-specific mitigation measures, the likely residual effect of unexploded ordnance on human health would be **negligible**.

Effects on Soils and Controlled Waters

12.92. As discussed above, a programme of intrusive investigation would be undertaken prior to construction which would seek to identify potentially leachable residual contamination within the soils at the Site. Where leachable contaminants are identified and there is assessed to be a risk to the underlying groundwater aquifers or the Mersey Estuary, appropriate remediation / mitigation

would be provided. This may include encapsulation of the soils below hardstanding surfaces or building footprint, or the excavation of impacted soils with subsequent disposal off-Site.

12.93. As stated above, a CEMP would be prepared and implemented during future demolition and construction works. Whilst the contents of the CEMP are to be agreed, anticipated measures for the minimisation of potential contamination of underlying soils and Controlled Water receptors are as follows:

- Implementation of procedures for the management of fuels and other potentially hazardous materials, spillage clean-up, use of best practice construction methods and monitoring;
- The use of appropriate tanked and bunded areas for fuels, oils and other chemicals;
- Locating stockpiles of materials found to be contaminated on hardstanding surfaces to prevent mobile contaminants infiltrating into the underlying soils;
- Dust suppression measures; and
- Measures to avoid surface water ponding and collection and disposal of all on-Site run-off.

12.94. It is currently expected that piling depths would extend into the bedrock which is designated by the EA as a Principal Aquifer. The Environment Agency's 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention'[10] describes various methods and scenarios for piling through contaminated land. This guidance recommends that a Foundation Works Risk Assessment be prepared. It is considered that with the application of an appropriate piling methodology, risks to underlying Aquifers from piling works penetrating through potentially contaminated land would be **negligible**. The piling method to be used on the Site would be confirmed following implementation of an intrusive ground investigation and through consultation with the EA.

12.95. Following the implementation of the above mitigation measures, including a Foundation Works Risk Assessment, risks would be largely managed. However, as the potential for accidental spillages or released cannot be completely discounted, the residual risk to Controlled Waters during the demolitions and construction phase would be **temporary, local and of minor adverse significance**.

Effects on Sensitive Ecological Receptors

12.96. As above, whilst the possibility of accidental pollution incidents during future demolition and construction works cannot be completely discounted, measures implemented as part of a CEMP would reduce the likelihood of such an incident entering the Mersey Estuary and indirectly impacting the off-site Mersey Narrows & North Wirral Foreshore. Consequently, the potential residual effect of future demolition and construction works on sensitive ecological receptors is considered to be, at worst, **temporary, local and of minor adverse significance**.

12.97. As stated, the likely effects of the demolition and construction phase on other sensitive ecological receptors would be **negligible** and no specific mitigation measures beyond those specified above are considered to be required.

Completed Development

Effects on Human Health from Ground Contamination and Ground Gas

12.98. As previously described, an intrusive ground investigation would be undertaken at the Site to confirm the extent of mitigation and remedial measures required to ensure that the Site is suitable

for its intended use and that there would be no unacceptable risks posed to future human health receptors.

12.99. As described above, the proposed terminal building would be constructed on a new suspended deck structure situated above the River Mersey. As such there would be no contact between the proposed building and potentially gassing soils and therefore the risks associated with gas ingress and accumulation in confined spaces is negligible and no mitigation other than inherent in the design of the structure would be required. Taking the above remedial and mitigation measures into account, the likely residual effect of ground contamination on future human health would be **negligible**.

Effects on Soils and Controlled Waters

12.100. As stated above, all future Site activities would be risk assessed with appropriate control measures put in place to ensure that potential impacts on soils and Controlled Water receptors are minimised as far as practicable. In addition, all potentially contaminative or hazardous materials used on-site as part of the day-to-day operations of the Site would be stored and handled appropriately and any spills/ leaks cleaned up in accordance with EA and DEFRA Regulations, whilst surface water run-off would be discharged to the Mersey Estuary via appropriate interceptors and pollution abatement controls.

12.101. Whilst the control measures detailed above are considered to reduce the likelihood and severity of any accidental pollution incidents, risks cannot be completely eliminated. As such, residual effects are considered to be, at worst, **permanent, local and of minor adverse significance**.

Effects on Sensitive Ecological Receptors

12.102. As above, whilst all future Site activities would be risk assessed with appropriate control measures in place in order to reduce the likelihood and severity of accidental pollution incidents, the potential for an incident to occur cannot be entirely eliminated. Consequently, the residual effect of the completed Development on the Mersey Narrows & North Wirral Foreshore is considered to be, at worst, **permanent, local and of minor adverse significance**.

12.103. As stated previously, future Site activities are expected to have **negligible** effects on other sensitive ecological receptors in the surrounding area and consequently, no specific mitigation measures beyond those outlined above in relation to the Mersey Narrows & North Wirral Foreshore are considered to be required.

Effects on Plants and Landscaped Areas

12.104. Where ground investigation identifies phytotoxic contamination within proposed areas of soft landscaping, a clean capping layer comprising imported subsoil and topsoil would be provided as a growing medium. The thickness of the capping required would be informed through consultation with LCC and the landscape architect. Following mitigation, the residual effect of contamination on future plants and landscaped areas is considered to be **negligible**.

Effects on Buried Structures and Services

12.105. Specifications for future buried concrete and potable water supply pipes would take into account contaminant concentrations within the underlying soils and groundwater to ensure that their integrity would be unaffected. Potable water supply pipes would be specified in accordance with the UK Water Industry Research Ltd guidance[11] and in consultation with service providers. Buried concrete would be specified in accordance with BRE Special Digest SD1[12]. As such, the likely residual effect is considered to be **negligible**.

Summary

12.106. In the absence of mitigation, the Development was assessed to have likely effects as follows:

- During demolition and construction works, the disposal of potentially contaminated material from the Site would have a **negligible** effect;
- Adherence to legislative requirements would result in **negligible** effects on future demolition and construction workers from contamination and ground gas;
- During demolition and construction, contaminated soils and dust generated during dry and windy conditions could result in **temporary, local effects of minor adverse significance** on surrounding Site users and the general public;
- During demolition and construction, the potential effects on human health of encountering UXO would be **temporary, local and of major adverse significance**;
- During demolition and construction, piling activities and the introduction of potentially polluting substances and activities to the Site could lead to **temporary, local effects of minor adverse significance** on soils and Controlled Waters;
- During demolition and construction, the introduction of potentially polluting substances and activities to the Site could lead to **temporary, local effects of minor adverse significance** on sensitive ecological receptors;
- Remedial measures would be implemented as standard and therefore potential effects on human health under the completed Development would be **negligible**;
- The introduction of potentially contaminative activities to the Site as part of the completed Development could result in **permanent, local effects of minor adverse.**
- The potential for accidental releases, spills and leaks associated with the day to day activities of the cruise terminal and associated infrastructure could result in **permanent, local effects of minor adverse significance** on sensitive ecological receptors.
- The capping of plants and landscaped areas as part of the completed Development would results in **negligible** effects;
- The completed Development would utilise sulphate-resistant concrete and/ or barrier water supply pipes as required, resulting in **negligible** effects;

12.107. Following the mitigation recommended in this chapter the following residual effects are expected:

- Adherence to the legislative requirements would result in a **negligible** environmental effect in relation to the disposal of excavated material;
- The legislative and regulatory framework set out to protect Site workers and the public would be implemented through a CEMP, resulting in **negligible** residual effects from ground contamination and ground gas during the demolition and construction stage;
- Mandatory health and safety requirements, in addition to mitigation measures specified in a Site-specific UXO desk-based risk assessment would be deployed in full resulting in residual **negligible** effects on demolition and construction workers from UXO;
- The introduction of potentially contaminative materials and activities to the Site would be managed through a CEMP and the piling methodology would be selected following the completion of a Foundation Works Risk Assessment. However, the potential for accidental spillages and releases cannot be completely eradicated and consequently the residual effects on soils, Controlled Waters and sensitive ecological receptors would be **temporary, local and of minor adverse significance**;

- Implementation of mitigation and remedial measures as required within the completed Development would result in **negligible** residual effects;
- Whilst all future Site activities would be risk assessed with appropriate control measures in place, risks to soils, Controlled Waters and sensitive ecological receptors cannot be completely eliminated, although the likelihood and severity of any accidental pollution incidents would be reduced resulting in residual **permanent, local effects of minor adverse significance**.
- All plants and landscaped areas within the completed Development would be capped with clean, imported soils as necessary resulting in **negligible** residual effects;
- The completed Development would utilise sulphate resistant concrete and barrier water supply pipes as necessary, resulting in **negligible** residual effects.

References

1 DEFRA/ Environment Agency (2004): Model Procedures for the Management of Contaminated Land, Environment Agency Report 11.

2 Secretary of State for the Environment (1991): The Environmental Protection (Duty of Care) Regulations 1991 (as amended). HMSO, London.

3 Secretary of State and the Welsh Ministers (2016): The Environmental Permitting (England and Wales) Regulations 2016. HMSO, London.

4 Secretary of State (2005): The Hazardous Waste (England and Wales) Regulations 2005. HSMO, London

5 HSE (2002): Control of Substances Hazardous to Health Regulations 2002 (as amended). Health and Safety Executive.

6 HSE (2015). Construction (Design and Management) Regulations 2015. Health and Safety Executive.

7 HSE (2012). Control of Asbestos Regulations 2012. Health and Safety Executive.

8 HSE (1991): Protection of Workers and the General Public During Development of Contaminated Land. Health and Safety Executive.

9 CIRIA (1996): Report 132: A Guide for Safe Working on Contaminated Sites. CIRIA, London.

10 The Environment Agency, Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention, 2001.

11 UKWIR (2010): Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites (10/WM/03/21). UKWIR.

12 BRE Construction Division (2005): Concrete in Aggressive Ground (Special Digest 1). BRE, Watford.

13. Marine Ecology, Ornithology and Terrestrial Ecology

Introduction

13.1. This chapter, which was prepared by APEM Ltd (marine ecology and ornithology) and Waterman (terrestrial ecology), presents an assessment of the likely effects of the Development on marine ecology, ornithology and terrestrial receptors. In particular, consideration is given in the assessment to potential habitat loss and disturbance, changes to water quality and sediment transport regime, above water and underwater noise, collision risk and the potential for spread or introduction of non-native species.

13.2. This chapter provides a description of the methods used in the assessment. This is followed by a description of the relevant baseline conditions of the Site and surrounding area, together with an assessment of the likely potential effects of the Development during the Site preparation and construction works and once the Development is completed and operational. Embedded mitigation (referred to here as inherent mitigation design) that is included as part of the project design/methods is considered as part of the initial assessment. For any significant effects identified after consideration of any inherent mitigation design, additional mitigation measures are identified where appropriate to avoid, reduce or offset any adverse effects identified and/or enhance likely beneficial effects. Taking account of the additional mitigation measures, the nature and significance of the likely residual effects are described.

13.3. The chapter is accompanied by the following appendices, provided in ES Volume 3:

- **Appendix 13.1:** Marine Ecology Benthic Survey Report;
- **Appendix 13.2:** Ornithology Desk Study & EIA Screening;
- **Appendix 13.3:** Mersey Estuary Fish Species List;
- **Appendix 13.4**: Preliminary Ecological Appraisal; and
- **Appendix 13.5**: Summary of Relevant Legislation, Planning Policy and Guidelines.

Assessment Methodology and Significance Criteria

Data Collation and Acquisition

Desk-Based Review

13.4. To enable an assessment of potential effects of the Development on marine ecology, ornithology and terrestrial ecology it was necessary to first establish the baseline (or existing) environment by conducting a desk-based review of grey and published literature, and examining available data including previous surveys conducted in the vicinity of the Development.

13.5. Key information obtained from the data reviews for marine ecology, ornithology, terrestrial ecology and the site-specific benthic ecology survey is summarised in the Existing Baseline Conditions Section below.

Desk-Based Review: Marine Ecology

13.6. For the marine ecology assessment, the receptors identified as being potentially affected by the Development were:

- Plankton (phyto- and zoo-);
- Benthic infauna and epibiota (i.e. epifauna/flora) and associated habitats (intertidal and subtidal);

- Fish; and
- Marine mammals.

13.7. For plankton, fish and marine mammals, desk-based review of available data was considered sufficient to effectively inform the assessment of potential ecological effects and available data are summarised below in the Existing Baseline Conditions section.

13.8. For benthic fauna and habitats, it was concluded that insufficient up-to-date data were available for the Development area. Consequently, project-specific benthic grab and wall scrape surveys were conducted at the Site. Full details of the survey are provided in **Appendix 12.1** with survey results summarised below in the Existing Baseline Conditions Section.

Desk-Based Review: Ornithology

13.9. A detailed review of available data for ornithology features was conducted to collate bird data for species of conservation interest and the habitats and protected sites on which they depend. Data were obtained from a wide range of organisations/individuals as indicated in **Appendix 12.2**. The desk study within the ornithology data review identified that there were recent and comprehensive surveys carried out of waterbirds using the Mersey Estuary and the docks within Liverpool and that there was little terrestrial bird interest of conservation value in the area other than certain rare nesting birds that were already monitored.

Desk-Based Review: Terrestrial Ecology

13.10. As set out in **Appendix 12.4**, an ecological desk study was undertaken during which all records of protected terrestrial species, and/or other notable fauna and flora within 1km of the Site were requested from Local Biodiversity Records Centre for North Merseyside (LBRCNM). Records also included those species listed on the North Merseyside Biodiversity Action Plan (LBAP).

13.11. Records of important statutory and non-statutory sites designated for their nature conservation value within 1km of the Site were searched for on the Multi-Agency Geographic Information for the Countryside website[1]. For European sites, the area of search was increased to 10km.

13.12. In addition, Habitats of Principal Importance (HoPI) and Species of Principal Importance (SoPI) listed under Section 41 of the NERC Act, as well as Habitat Action Plans (HAPs) and Species Action Plans (SAPs) listed under the LBAP, were consulted to assign an ecological context to the Site.

Acquisition by Field Survey: Benthic Ecology Data

13.13. A benthic grab and wall scrape survey was conducted in the vicinity of Princes Jetty on 27th June 2017. A 0.1m^2 Day grab was deployed to collect one macrobiota sample, a sediment sample for particle size analysis (PSA) and further samples for chemical analysis at nine stations encompassing areas within and outside the Site. Grab samples were collected in accordance with Ware & Kenny (2011)[2].

13.14. In addition, at four stations on hard structures within the survey area a 0.01m^2 wall scrape sample was taken of the epifaunal community. The sample was taken in accordance with the methodologies described by Worsfold (1998)[3].

13.15. Benthic grab and wall scrape samples were sieved over a 0.5 mm mesh in accordance with Water Framework Directive (WFD) guidance for benthic sampling in transitional waters[4]. Taxa were identified to the lowest possible practicable taxonomic level using appropriate taxonomic literature. PSA was performed in accordance with North East Atlantic Marine Biological Analytical Quality Control Scheme (NMBAQCS) Best Practice Guidance[5] and the particle size data was entered into GRADISTAT[6] to produce sediment classifications, following Folk (1954)[7].

13.16. Biotopes were assigned according to JNCC guidance v.04.05[8] and EUNIS[9] based on consideration of the species present, their relative abundances and sediment type.

13.17. In addition, a range of chemicals were analysed within the sediment samples based on a comprehensive suite which was agreed via consultation with the statutory authorities and their advisors.

13.18. Full details on the survey approach and results are provided in **Appendix 12.1**.

Acquisition by Field Survey: Ornithology

13.19. It was agreed through consultation with Merseyside Environmental Advisory Service (MEAS), acting on behalf of Liverpool City Council (LCC) as the local planning authority, that a programme of wintering bird surveys would be carried out in late 2017 to confirm the desk-based ornithological findings summarised above. It has been agreed with all relevant parties that these surveys will be undertaken during the determination period of the planning application.

Acquisition by Field Survey: Terrestrial Ecology

13.20. An 'Extended' Phase 1 Habitat Survey of the Site was undertaken on the 10th of April 2017. Due to Site boundary changes, an update survey was undertaken on the 18th September 2017 using the Joint Nature Conservancy Council[10] standard 'Phase 1' survey technique. The Phase 1 Habitat Survey methodology was 'Extended' by undertaking an assessment of the Site to support protected and notable faunal species.

13.21. Where access allowed, adjacent habitats were also considered to assess the Site within the wider area, and to provide information with which to assess possible impacts of the proposed Development.

Consultation

13.22. For the purposes of the marine ecology assessment, written consultation was conducted with the Environment Agency, Natural England and the Marine Management Organisation in relation to the design of project-specific benthic survey work.

13.23. In addition, on 31st July 2017 an EIA Scoping Report was submitted and Scoping Opinion sought from LCC, as the Local Planning Authority, and its advisors. Comments were received from the MEAS, Environment Agency, Historic England, LCC and Natural England. All relevant responses are summarised in **Chapter 2: EIA Methodology** and have been addressed appropriately within this chapter.

Assessment of Terrestrial Ecology

13.24. The desk-based review of terrestrial ecology and the subsequent 'Extended' Phase 1 Habitat Survey of the Site are reported in the Preliminary Ecological Assessment (PEA) report presented in **Appendix 12.4**. The PEA confirmed that the on-site terrestrial habitats are commonly found locally and nationally, are not of geographical or legal importance and are unlikely to be significantly impacted.

13.25. All terrestrial ecological features identified through the PEA have been scoped out of further assessment because the population or area likely to be affected by the Development is of insufficient size or diversity to be of ecological value, no potential effect pathway between the Development and these features has been identified; and/or contravention of the legislation relating to the feature is unlikely to occur. Therefore, terrestrial ecology is not considered further within this chapter.

Assessment Methodology and Significance Criteria for Marine Ecology and Ornithology

Introduction

13.26. The identification and assessment of the potential ecological effects associated with the development was conducted in accordance with the Chartered Institute of Ecology and Environmental Management (IEEM) guidelines for Environmental Impact Assessment (EIA)[11,12].

13.27. The assessment approach was based on the conceptual 'source-pathway-receptor' model. This model identified likely environmental effects resulting from the proposed construction, operation and decommissioning of the Development. This process provided an easy to follow assessment route between effect sources and potentially sensitive receptors ensuring a transparent impact assessment. The parameters of this model are defined as follows:

- **Source**: the origin of a potential effect (noting that one source may have several pathways and receptors) i.e. an activity such as jetty foundation installation and a resultant effect e.g. resuspension of sediments, seabed abrasion and removal of substrata, underwater noise, etc.
- **Pathway**: the means by which the effect of the activity could influence a receptor e.g. for the example above, resuspended sediment could settle across the seabed (i.e. smothering), or seabed disturbance could cause temporal or permanent habitat loss.
- **Receptor**: the element of the receiving environment that is affected e.g. for the above example, benthic invertebrate species living on or in the seabed could be smothered by the deposited sediments which could affect movement, feeding or respiration.

13.28. The assessment was quantitative where suitable data, evaluation and assessment methods were available and, if not, were qualitative and based on a combination of empirical data, anecdotal information and professional judgement.

13.29. Iterative steps involved in the assessment approach included:

- Determination of potential interactions between the Development and ecological receptors;
- Definition of baseline environment within the influence of the Development;
- Assessment of the value and sensitivity of ecological receptors;
- Consideration of inherent mitigation design (i.e. measures that are already included in the project design/methods to mitigate effects) as part of the initial assessment;
- Assessment of the magnitude of effects;
- Assessment of the significance of effects;
- Proposal of additional mitigation measures to reduce, prevent or where possible offset any adverse significant effects; identified after consideration of inherent mitigation design;
- Assessment of the residual effects after any additional mitigation measures have been considered; and
- Assessment of cumulative effects (provided in **Chapter 15: Cumulative Effects**).

Identification of Effect Pathways

13.30. An initial stage of the assessment was to identify potential interactions between the Development proposals and marine ecology and ornithology receptors. Potential environmental interactions are shown in **Table 13.1** andTable 13.2 respectively. Interactions considered to result in a potential significant effect were taken forward to the effects assessment stage.

Table 13.1: Interactions Matrix for Potential Effects on marine ecology receptors. ✓ = potential interaction

Receptor	Phytoplankton	Zooplankton	Intertidal species & habitats	Subtidal species & habitats	Fish	Marine mammals
Demolition and Construction						
Loss of habitat			✓	✓		
Physical disturbance and displacement (disturbance of bottom sediments)				✓	✓	
Physical disturbance and displacement (visual)					✓	✓
Underwater noise and vibration					✓	✓
Changes to water quality (suspended solids and release of chemicals from sediments)	✓	✓		✓		
Pollution (direct e.g. oil)	✓	✓	✓	✓	✓	✓
Collision risk due to vessel movements						✓
Spread of invasive non-native species	✓	✓	✓	✓		
Physical disturbance and displacement (indirect i.e. through the food chain)					✓	
Completed Development						
Physical disturbance and displacement (sediment accretion)			✓	✓	✓	
Physical disturbance and displacement (visual)						✓
Underwater noise and vibration					✓	✓
Pollution (direct e.g. oil)	✓	✓	✓	✓	✓	✓
Collision risk due to vessel movements						✓
Spread of invasive non-native species	✓	✓	✓	✓		

Table 13.2: Interactions Matrix for Potential Effects on Birds. ✓ = potential interaction

Receptor	Wintering waterbirds	Breeding birds
Demolition and Construction		
Loss of habitat	✓	✓
Physical disturbance and displacement (visual)	✓	✓
Airborne noise and vibration	✓	✓
Changes to water quality (suspended solids and release of chemicals from sediments)	✓	
Pollution (direct e.g. oil)	✓	
Physical disturbance and displacement (indirect – food chain)	✓	
Completed Development		
Physical disturbance and displacement (visual)	✓	✓
Airborne noise and vibration	✓	✓
Changes to water quality	✓	
Pollution (direct e.g. oil)	✓	

Assessment Criteria

13.31. Generic assessment criteria for this EIA are set out in Chapter 2: EIA Methodology. However, some deviation from these generic criteria have been developed for the assessment of ecological effects. Criteria therefore include:

- Nature of effect i.e. beneficial or adverse; direct or indirect;
- Extent of the effect (geographical area e.g. site-wide, local, district, regional, and the size of the population affected);
- Likelihood of effect occurring (refer to **Table 13.3**);
- Persistence of the effect e.g. short term (1 year), medium term (2-10 years), long term (>10 years) or permanent; and
- Timing and frequency of effects in relation to key potential periods of increased sensitivity e.g. migration periods for diadromous fish species; food resources during coastal bird breeding periods etc.

13.32. The value/sensitivity of each receptor was determined based on consideration of factors outlined in **Table 13.4** and **Table 13.5** (the highest category allocated to value or sensitivity was taken forward to assessment), and the magnitude of the potential effect was based on the criteria set out in **Table 13.6**. Based on the value/sensitivity of the receptor and the predicted magnitude of the potential effect, the significance of effect was then determined as indicated in **Table 12.11**.

Table 13.3: Likelihood of effect occurring and confidence in assessment

Likelihood	Guideline	Evidence base to evaluate likelihood of effects
Certain	Probability estimated at 95% chance or higher	Based on consideration of same pressures arising from similar activities, acting on the same type of receptor in comparable areas (i.e. UK). Previous studies indicate consistent magnitude of effect. Scientific evidence and/or construction information is detailed/ extensive.
Probable	Probability estimated above 50% but below 95%	Based on consideration of same pressures arising from similar activities, acting on the same type of receptor in comparable areas (i.e. UK) or similar pressures on receptor/similar receptor in other areas (i.e. outside UK). Previous studies indicate a possible range of magnitude of effect. There may be some limitations to scientific evidence base and/or construction information partially reducing certainty of assessment.
Unlikely	Probability estimated above 5% but less than 50%	Based on consideration of same pressures arising from similar activities, acting on the same type of receptor in comparable areas (i.e. UK) or similar pressures on the receptor /similar receptor in other areas (i.e. outside UK). Previous studies do not indicate consistent effect or range of magnitude. There may be considerable limitations to scientific evidence base and/or construction information considerably reducing certainty of assessment.
Extremely unlikely	Probability estimated at less than 5%	Based on consideration of same pressures arising from similar activities, acting on the same type of receptor in comparable areas (i.e. UK) or based on similar pressures on the receptor /similar receptor in other areas (i.e. outside UK). Few if any previous studies to indicate any effect on the sensitive receptor.

Value and Sensitivity

13.33. Guidelines used to assign the value and sensitivity of the receptor are provided in **Table 13.4** and **Table 13.5**. It should be noted that high value and high sensitivity are not necessarily linked within a particular effect. A receptor could be of high value (e.g. an interest feature of a Special Area of Conservation (SAC) or Special Protection Area (SPA)) but have a low or negligible physical/ecological sensitivity to an effect and vice versa. The value of a receptor can be used where relevant as a modifier for the sensitivity (to the effect) already assigned to the receptor and the logic applied for the assessment will be clearly indicated in the assessment narrative.

Table 13.4: Value Criteria for Terrestrial and Marine Ecology Assessment

Value	Definition
Very High	• An internationally designated site or candidate site (SPA, pSPA, SAC, cSAC, pSAC, Ramsar site etc.) or an area which the country agency has determined meets the published selection criteria for such designation, irrespective of whether or not it has yet been notified. • Internationally significant and viable areas of a habitat type listed in Annex 1 of the Habitats Directive. • Globally threatened species (i.e. Critically endangered or endangered on IUCN Red list) or species listed on Annex 1 of the Berne Convention. • Regularly occurring populations of internationally important species that are rare or threatened in the UK or of uncertain conservation status. • A regularly occurring, nationally significant population/number of any internationally important species. • Habitat/species are highly regarded for their important biodiversity, social/community value and / or economic value.
High	• A nationally designated site (SSSI, NNR, MNR, MCZ) or a discrete area, which the country conservation agency has determined meets the published selection criteria for national designation (e.g. SSSI selection guidelines) irrespective of whether or not it has yet been notified. • Regularly occurring, globally threatened species (i.e. Vulnerable or lower on IUCN Red list) or species listed on Annex 1 of the Berne Convention. • Previously UKBAP habitats and species; S41 species of NERC Act • Habitat/species possess important biodiversity, social/community value and / or economic value.
Medium	• Viable areas of key habitat identified in the Regional/County BAP or smaller areas of such habitat which are essential to maintain the viability of a larger whole. • Viable areas of key habitat identified as being of Regional value in the appropriate Natural Area profile. • Water Framework Directive biological element. • Any regularly occurring significant population that is listed in a Local Red Data Book. • Significant populations of a regionally/county important species. • Habitat/species possess moderate biodiversity, social / community value and / or economic value.
Low	• Areas of habitat identified in a sub-County (District/Borough) BAP or in the relevant Natural Area profile. • District sites that the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves selected on District/Borough ecological criteria (District sites, where they exist, will often have been identified in local plans). • Sites/features that are scarce within the District/Borough or which appreciably enrich the District/Borough habitat resource. • Species are abundant, common or widely distributed. • Habitat/species possess low biodiversity, social/community value and / or economic value.
Negligible	• There is no site designation for areas of habitat. • Species present are common and widespread. • Habitat/species are not considered particularly important for their biodiversity, social/community or economic value.

Table 13.5: Sensitivity Criteria for Terrestrial and Marine Ecology Assessment

Sensitivity	Definition
Very High	• Species are under significant pressure and/or are highly sensitive to changing environments. • Species are intolerant of the effect with little or only slow recovery.
High	• Species may be under significant pressure and/or highly sensitive to changing environments. • Species may have a very low capacity to tolerate the effect with little or only slow recovery.
Medium	• Species may be currently under pressure or are slow to adapt to changing environments. • Species may have a low capacity to tolerate or recover from the effect.
Low	• Species are generally adaptable to changing environments. • Species may show some tolerance of the effect or recover quickly from the effect.
Negligible	• Species are highly tolerant of the effect.

Magnitude

13.34. Magnitude was assessed taking into account the application of any inherent mitigation design measures to be incorporated at the demolition and construction or operation phase. Where inherent mitigation design has been considered this has been clearly indicated in the likely effects below. Guidelines used to assign magnitude of the effect are provided in **Table 13.6**.

Table 13.6: Magnitude Criteria for Marine Ecology Assessment

Magnitude	Definition
Major	• Effect causes extensive changes to all or a significant proportion of the habitat resulting in loss of function of the habitat. Effects expected to extend beyond the Development Site. • Effect causes a change to all or a significant proportion of the population resulting in a decline in the abundance of the population, or other trophic levels, that will not be reversed through natural recruitment for several generations.
Moderate	• Effect causes a change to part of the habitat but does not result in long term effects on the function of the habitat. • Effect causes a substantial change in abundance, affecting a portion of a population that may last for more than two years but does not result in long term impacts to the population itself or other trophic levels.
Minor	• Effect causes a change to a small area of habitat, resulting in no loss of function of the habitat. • Effect causes a change to a small group of localised individuals of a population for a short period of time (up to two years) but does not affect the viability of the population or other trophic levels.
Negligible	• Effects on the habitat/population are undetectable or within the range of natural variation.
No Change	• The activity will have no interaction with the receptor.

Impact Significance

13.35. Following the identification of the receptor value and sensitivity and the determination of the magnitude of the effect, the significance of the effect was determined guided by the matrix presented in **Table 12.11**. In line with CIEEM guidance[11], and therefore unlike the other technical chapters in this ES, only effects that are of moderate or major significance represent those with the potential to be 'significant' in EIA terms.

Table 13.7: Matrix to Guide Determination of Effect Significance

Sensitivity/ Value	Magnitude of Effect				
	Major	Moderate	Minor	Negligible	No Change
Very High	Major	Major	Moderate or Major	Minor	Neutral
High	Major	Moderate or Major	Minor or Moderate	Minor	Neutral
Medium	Moderate or Major	Minor or Moderate	Minor	Negligible or Minor	Neutral
Low	Minor or Moderate	Minor	Negligible or Minor	Negligible	Neutral
Negligible	Minor	Negligible or Minor	Negligible	Negligible	Neutral

13.36. It is important that the matrix (and indeed the definitions of value/sensitivity and magnitude) is seen as a framework to aid understanding of how a judgement has been reached from the narrative of each effect assessment and it is not a prescriptive formulaic method. Professional judgement has been applied to the assessment of likelihood and ecological significance of a predicted effect and where required modifications have been made to the outputs of **Table 13.7** with reasoning clearly indicated. For the purpose of this assessment CIEEM guidance[9] has been followed which states that an ecologically-significant effect is:

'an impact that has a negative, or positive, effect on the integrity of a site or ecosystem and/or the conservation objectives for habitats or species populations within a given geographical area. In this way significant impacts are distinguished from other, lesser (and, in the context of EIA, unimportant) effects'.

Mitigation Measures

13.37. The assessment assessed the likely significance of effects after consideration of inherent mitigation design. For any effects considered be of moderate or higher significance after the implementation of inherent mitigation design, further mitigation/enhancement measures have been proposed to reduce the significance of effect to minor or lower. In line with CIEEM guidance[9], and therefore unlike the other technical chapters in this ES, effects of minor adverse significance do not require mitigation measures to be applied.

Likely Residual Effects

13.38. Residual effects on marine ecological and ornithology receptors (i.e. effects following implementation of specific mitigation measures) were then identified and their significance determined.

Limitations and Assumptions

13.39. The assessment is based on the information that has been provided to date in relation to methods for demolition and construction and operation detail. In many cases the information provided has been high level and various details (including for example the number of piles for the new suspended platform structure and expected months of work) have not yet been finalised. Where this is the case a precautionary worst-case scenario approach to the assessment has been adopted where appropriate, and it has been assumed that the Works (as set out in **Chapter 6: Development Programme and Construction**) could be conducted at any time of year.

13.40. Specific values for expected noise levels of piling at the Site are not available and the assessment has been based on noise level data reported from other comparable developments.

13.41. Conditions at or near to the Site can be subject to change over time with species movement moving both into or out of the study area. Therefore, this report and its recommendations reflect the conditions recorded at the time of the project-specific surveys and most recent desk study data available. For highly mobile species such as fish or marine mammals it has been assumed that individuals of any of the species that have been recorded previously in the lower Mersey Estuary could be present at the Site, although in terms of actual fish assemblages or marine mammals present this is not likely to not be the case and therefore this represents a precautionary approach to the assessment.

Existing Baseline Conditions

Designated Sites

European Sites and Ramsar Sites

13.42. European Sites are SACs and SPAs which form part of the European-wide Natura 2000 network of nature protection areas. A map of designated sites in the vicinity of the Site is provided in **Figure 13.1** and due to the scale of the Development it has been considered appropriate to screen in European Sites and Ramsar sites within 5km of the Site for consideration in the assessment.

13.43. The protected sites within 5km of the Site are indicated in **Table 13.8**. With the exception of the Dee Estuary SAC, the only protected features of these sites are birds, with no protected marine or terrestrial ecology features.

Sites of Special Scientific Interest

13.44. The location of Sites of Special Scientific Interest (SSSIs) within 5km of the Site is provided in **Figure 13.1**.

13.45. The Mersey Estuary SSSI encompasses the Mersey Estuary Ramsar and SPA sites. The Mersey Narrows and North Wirral Foreshore SSSIs are component parts of the Liverpool Bay SPA and the Dee Estuary SAC.

13.46. Features of the Mersey Estuary, New Ferry, North Wirral Foreshore and Sefton Coast SSSIs of relevance to the marine ecology assessment are primarily the intertidal sand and mudflats which support large numbers of birds. Salt marsh is also an important habitat for birds which is a feature of the Mersey Estuary, Mersey Narrows and North Wirral Foreshore SSSI.

Table 13.8: Protected sites, interest features and distance to the Site

Site	Nature Conservation Value	Interest features	Distance to Site (km)
Dee Estuary/Aber Dyfrdwy SAC	International	Annex I habitats that are a primary reason for selection of this site: • *Mudflats and sandflats not covered by seawater at low tide* • *Salicornia and other annuals colonizing mud and sand* • *Atlantic salt meadows (Glauco-Puccinellietalia maritimae)* Annex I habitats present as a qualifying feature, but	4.2

Site	Nature Conservation Value	Interest features	Distance to Site (km)
		not a primary reason for site selection: • *Seven habitats listed in SAC citation* No Annex II species are listed as a qualifying feature. Annex II species present as a qualifying feature, but not a primary reason for site selection: • *River lamprey, sea lamprey, petalwort*	
Mersey Narrows & North Wirral Foreshore Ramsar site	International	Little gull, common tern, knot and bar-tailed godwit. Waterbird assemblage: cormorant, oystercatcher, grey plover, sanderling, dunlin and redshank.	0.8
Mersey Estuary Ramsar site	International	Shelduck, redshank, teal, pintail and dunlin. Waterbird assemblage: ringed plover, curlew, spotted redshank, greenshank and wigeon.	3.3
Liverpool Bay SPA	European	Red-throated diver and common scoter.	4.6
Liverpool Bay proposed SPA extension	European	Little gull, common tern and little tern. Waterbird assemblage: red-breasted merganser and cormorant.	0
Mersey Narrows & North Wirral Foreshore SPA.	European	Redshank and turnstone. Waterbird assemblage: dunlin, knot, grey plover, oystercatcher and cormorant.	0.8
Mersey Estuary SPA	European	Golden plover, dunlin, pintail, redshank, shelduck and ringed plover. Waterbird assemblage: curlew, black-tailed godwit, lapwing, grey plover, wigeon, great crested grebe and teal.	3.3
Mersey Estuary SSSI	National	Pintail, shelduck, wigeon, teal, dunlin, curlew, redshank and golden plover. Citation mentions intertidal sand and mudflats, marshland, salt marshes, brackish marshes and boulder clay cliffs with freshwater seepages.	4.3
Mersey Narrows SSSI	National	Turnstone, redshank and cormorant. Citation mentions intertidal sand and mudflats.	0.8
New Ferry SSSI	National	Pintail and black-tailed godwit. Citation mentions intertidal sand, mudflats and other habitats (shingle and cobbles, pioneer salt marsh).	3.3
North Wirral Foreshore SSSI	National	Knot, bar-tailed godwit, turnstone and dunlin. Citation mentions intertidal sand and mudflats, embryonic salt marsh.	4.2

Marine Ecology

Plankton

Phytoplankton

13.47. Phytoplankton are microscopic single-cell algae within the marine water column which utilise inorganic carbon and nitrogen sources and light energy for metabolic synthesis of organic molecules and growth[13]. Phytoplankton form the basis of marine food webs and are actively consumed by a wide range of herbivorous marine species[14]. Phytoplankton productivity is

primarily influenced by variations in depth, temperature, light, water column mixing and availability of nutrients[15,16]. When productivity is particularly high, blooms can form, mainly within the shallower and more heavily mixed waters nearer the coastline where deep-water upwelling and runoff brings nutrient-rich waters to the well-illuminated surface layers of the water column[17].

13.48. Phytoplankton is one of the biological quality elements used to assess status of water bodies under the Water Framework Directive (WFD). The Development is within the Mersey WFD transitional water body and in the 2016 Cycle 2 round of WFD monitoring Phytoplankton was classed to be at Moderate potential, with a target of Good potential by 2027.

13.49. The Mersey Estuary is an extremely turbid environment due to the strong tidal currents which erode and rework bottom channels. The phytoplankton taxa present here are consequently likely to be well adapted to the considerable fluctuations in levels of suspended solids and associated high levels of turbidity.

13.50. The phytoplankton assemblages within the Mersey Estuary are influenced by tidal movements and vary over the tidal cycle. In addition, assemblage composition and biomass of these algae change considerably on a seasonal basis which is typical of dynamic environments such as the Estuary. Although site-specific data for phytoplankton are not available for the Prince's Jetty site, phytoplankton sampling at other locations indicates the range of phytoplankton and potential abundances of phytoplankton that could be present in the vicinity of the proposed Development.

13.51. Phytoplankton was sampled at 15 stations approximately 5 km upstream of the Site in summer 2007[18] as part of survey work for a proposed saline discharge to the Mersey Estuary. Altogether, 58 phytoplankton taxa were recorded in the samples and the dominant taxa were diatoms. The number of taxa present at each station ranged from 12 to 21 with a mean of 17 taxa per station. The total density of phytoplankton cells per site ranged from 893 cells ml^{-1} to 2123 cells ml^{-1}. The mean phytoplankton concentration across all sites was 1524 cells ml^{-1}.

13.52. Phytoplankton sampling was also conducted at fourteen stations throughout the Mersey Estuary for the proposed Mersey Tidal Power Scheme including stations upstream and downstream of the Site in autumn 2009[19] and spring 2010[20]. A total of 18 phytoplankton taxa were recorded across all stations in autumn 2009 and 25 taxa in spring 2010 and during both seasons samples were dominated by diatoms. At the station closest to the Site (coordinates: SJ 33400 91100) a total of four taxa were recorded in autumn 2009 and five taxa in spring 2010. Overall, across the survey between two and six taxa were recorded at each site in autumn 2009 and between two and 12 taxa were recorded at each site in spring 2010. Phytoplankton density in the spring 2010 survey was an order of magnitude greater (mean density of 1,740 cells ml^{-1}) than the autumn 2009 survey (mean density of 136 cells ml^{-1}) which is consistent with the increase in ambient light level and temperature that occurs during the spring months which triggers rapid growth of many phytoplankton taxa.

Zooplankton

13.53. Zooplankton are vital to the ecological function of marine ecosystems. Zooplankton consists of both permanent (holoplankton e.g. copepods) and temporary (meroplankton e.g. crustacean and fish larvae) members of the heterotrophic plankton community. Zooplankton feed on phytoplankton and smaller zooplankton, and in turn, provide an important food source for higher trophic levels. For example, copepods are important prey items for many fish larvae, including commercial gadoids such as cod *Gadus morhua*, haddock *Melanogrammus aeglefinus* and whiting *Merlangius merlangus*.

13.54. Site specific zooplankton data are not available; however, it is considered assemblages within the outer Mersey Estuary will be consistent with assemblages recorded within the eastern Irish Sea. Different zooplankton taxa peak in abundance at different times of year. Copepods (Subclass

Copepoda) within the zooplankton of the Irish Sea are almost entirely calanoids (Order Calanoida), although a significant population of *Oithima* sp. (Order Cyclopoida) has also been recorded[21]. Copepod abundance is typically lower on the eastern side of the Irish Sea than on the western side (Kennington & Rowlands 2006).

13.55. Remaining zooplankton taxonomic groups recorded for the area, such as molluscs (larvae of sea snails, bivalves, squids and octopuses; Phylum Mollusca), cladocerans (water fleas; Order Cladocera) and echinoderm larvae (larvae of sea stars, sea urchins, sea cucumbers, and relatives; Phylum Echinodermata) are only present in very low abundances in the eastern areas of the Irish Sea[19].

13.56. Ichthyoplankton surveys conducted in the eastern Irish Sea between 2001 and 2003 identified fish eggs from 19 species and fish larvae from 30 species, a number of which were commercially important fish species including herring *Clupea harengus*, cod *G. morhua*, haddock *M. aeglefinus*, whiting *M. merlangus*, and dab *Limanda limanda*[22]. Peak numbers of fish eggs were recorded in March-April[20].

Benthic Macroinvertebrates

13.57. Benthic invertebrates is one of the biological quality elements used to asses status of water bodies under the WFD. The Development is within the Mersey WFD transitional water body and in the 2016 Cycle 2 round of WFD monitoring Benthic Invertebrates was classed to be at Good potential, with a target of Good potential by 2027.

Intertidal Invertebrates

13.58. The intertidal zone within the study area is primarily composed of manmade structures including the existing jetty, dock walls and other manmade structures. There is also a small area of intertidal sediment at the mouth Prince's Half Tide Dock immediately to the north of the Site (approx. 3000m^2). This area was difficult to access and it is anticipated that the benthic assemblages in this section would be impoverished (in common with the subtidal assemblages) and that species present would be widespread throughout the estuary.

13.59. The project-specific benthic survey collected wall scrape samples at four locations comprising locations within, and in the vicinity of, the existing jetty structure within the north section of the Site (refer to **Appendix 12.1**). A total of seven taxa were recorded, with just one and two invertebrate individuals recorded from two of the scrapes and the non-native invasive barnacle *Austrominius modestus* was the most abundant taxon at the other two wall scrapes. The density of individuals varied from 1 to 570 individuals per 0.01m^2. It was not possible to sample the legs of the existing dilapidated wooden jetty structure due to Health and Safety considerations; however, the legs of the wooden jetty were noted to be encrusted with barnacles expected to be predominantly *A. modestus* and no macroalgae was observed. *A. modestus* was also noted to have a high density along the dock walls.

Subtidal Invertebrates

13.60. The Mersey is predominantly a sandy estuary, with fine sediment occurring in places along its inner margins[23]. Extensive background data for subtidal invertebrates in the wider Mersey Estuary have been collected for a number of projects in the Mersey Estuary including the Mersey Gateway Project. These surveys indicate an impoverished benthic fauna characteristic of dynamic estuarine environments.

13.61. As an example, subtidal invertebrate surveying was conducted throughout the Mersey Estuary for the proposed Mersey Tidal Power Scheme in autumn 2009[17] and spring 2010[18] at fourteen stations from the mouth of the Estuary to the Silver Jubilee Bridge. At the two stations nearest the

Site (approx. 1 km from the Site with one upstream and the other downstream on the other side of the Mersey Estuary) the mean number of taxa per station was 9 to 13 taxa in autumn 2009 and 12 to 15 taxa in spring 2010. Mean density at these sites ranged from just 27 to 37 individuals m^{-2} in autumn 2009 and 287 to 967 individuals m^{-2} in spring 2010. In autumn 2009 the most abundant taxa at these two stations were juveniles of the blue mussel *Mytilus edulis* and nematoda, and in spring 2010 the most abundant taxa were *M. edulis* juveniles and *Nephtys* spp. Across the survey as a whole oligochaete worms comprised five of the ten most abundant taxa (enchytraeidae, *Heterochaeta costata*, *Tubificoides benedii*, *Paranais litoralis* and *T. pseudogaster* agg.) in autumn 2009 while the most abundant macrofaunal taxon in spring 2010 was juvenile *M. edulis* followed by *Tubificoides benedii*.

13.62. The Environment Agency (EA) was contacted to obtain monitoring data from the Mersey Estuary, however, no data were available beyond 2008.

13.63. To obtain more localised data to inform the ecological assessment for the Development a project-specific survey was conducted in June 2017 within the north section of the Site in the vicinity of the current jetty (refer to **Appendix 12.1**). Across the nine stations sampled the survey found that the subtidal sediments were quite heterogeneous with three stations classified as Sand, another three stations classified as Sandy Mud, and one station each was classified as Muddy Sandy Gravel, Gravelly Muddy Sand and Slightly Gravelly Sand.

13.64. A total of 69 taxa were recorded during the benthic grab site characterisation survey. Species richness at stations varied from five to 30 taxa and the density of individuals varied from 600 per m^2 to 68,100 per m^2 (with the greatest density value due to a very high density of *M. edulis* juveniles at one of the stations). Across the survey the most abundant taxon was the blue mussel *M. edulis* followed by the acorn barnacle *Amphibalanus improvisus*. *A.improvisus* is considered by some sources to be a non-native species in Europe, introduced from east U.S.A. but conclusive evidence for this is lacking and historical records from Europe suggest that it could be native to Europe. We therefore currently consider it to be cryptogenic (i.e. a species that is neither demonstrably native, nor introduced)[24]. Despite variations in sediment type there was no significant difference in benthic assemblages across stations and all grab stations were assigned the biotope A5.43 'Sublittoral mixed sediment in variable salinity' (estuaries) (SS.SMx.SMxVS).

13.65. A single *Sabellaria alveolata* worm was found at one of the grab stations. This species can form dense reefs consisting of large numbers of worms. The reef habitat is an Annex I habitat under the EC Habitats Directive and this habitat is not present at the Development site.

13.66. Some non-native species were recorded within the subtidal grabs as follows:

- The Australian barnacle *A. modestus* which was found in three of the sediment grab samples. This species was first reported in Britain in 1946.
- The American piddock *Petricolaria pholadiformis* which was unintentionally introduced with the American oyster *Crassostrea virginica* by 1890. A single juvenile was recorded in one of the grab samples.
- Three specimens from this survey have been tentatively identified as the starlet sea anemone *Nematostella vectensis*. Identification of anemones from preserved benthic samples is very difficult, since they contract, hiding most of the useful identification features, and lose colour patterns. The specimens from these samples, however, resembled in overall appearance confirmed specimens from our reference collection and they have been assumed to be this species for the purposes of assessment. The starlet sea anemone is a non-native species that was introduced to the UK from the eastern U.S.A[25,26]. However, this species also remains classified as Vulnerable on the IUCN Red List, is protected under the Wildlife and Countryside Act, and is a Species of Principal Importance in England under Section 41 list of the NERC Act. The protected status of the species, was based on the then known distribution of the

species being limited to a small number of lagoons in the south-east of England, a potentially vulnerable habitat itself. This protected status and its occurrence on the IUCN Red List both pre-date the recognition of the species as a widespread and widely introduced species. Furthermore, the Red List assessment was conducted in 1996 and bares a caveat that the species requires reassessment. Due to the potentially conflicting non-native and protected classifications, there has been discussion about whether the protected status for the species in England should be reconsidered[23,24]. Should the protection remain, it is understood that the primary aim of this protected status, in English populations at least, should be more to protect potentially vulnerable habitats (e.g. saline lagoons) in which it is a specialist rather than the species *per se*[23,24]. *N. vectensis* has been previously recorded from the south-east of England and, to our knowledge, the records in this survey are the first from the north-west of England. The records were made at two grab stations, both of which lie outside the red line boundary a short distance to the north of the Site but were not neighbouring grab stations (Appendix 12.1). The findings indicate that this species it is likely more widespread in the estuary with a potentially patchy distribution.

13.67. For some taxa it was not possible to identify individuals to species level but they could potentially include non-native species e.g. *Streblospio*, *Sessilia*, *Jassa*, *Ensis* and *Amathia*.

Fish

13.68. Fish is one of the biological quality elements used to assess status of water bodies under the WFD. The Development is within the Mersey WFD transitional water body and in the 2009 Cycle 1 round of WFD monitoring Fish was classed to be at Good potential, with no classification for the 2016 round of monitoring.

13.69. Estuaries are characterised by relatively few fish species which are well adapted to the estuarine environment[27]. The Mersey Estuary is a highly dynamic environment and fish species inhabiting the area must endure large fluctuations in salinity, temperature, turbidity, nutrient levels and water movement. A relatively small number of species dominate the assemblage and most species migrate into the Estuary from coastal waters and can utilise the Estuary a nursery area, as opposed to being resident within the Estuary. Diadromous species, such as eel, lamprey and salmon, migrate through the Mersey Estuary to reach habitats in the Mersey Estuary and further upstream.

13.70. At least 46 fish species have been recorded within the Mersey Estuary (data collated from ERL[28], Hering[29], and APEM[30,31] and EA monitoring data). Of particular note are eleven species of conservation importance:

- Atlantic salmon *Salmo salar*, river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* are Annex II species protected under the European Habitat and Species Directive (92/43/EEC). These species are not qualifying species for protection within the Mersey Estuary but they are qualifying features of the Dee Estuary/Aber Dyfrdwy SAC and there is potential for movement of these species from the Dee Estuary/Aber Dyfrdwy SAC into the Mersey Estuary. River and sea lamprey are also protected under Appendix III of the Convention on the Conservation of European Wildlife and Natural Habitats 1979 (the 'Bern Convention'; 82/72/EEC).
- European eel *Anguilla anguilla* are protected under European eel management plan legislation (Eel Recovery Plan, Council Regulation No 110/2007 implemented under The Eels (Wales and England) Regulations 2009. The North West River Basin District Eel Management Plan affords Eel protection within the Mersey Estuary.

- The following seven species were previously protected at a national level under the UK Biodiversity Action Plan (UKBAP) which has since been superseded and these species are now listed as Species of Principal Importance under Section 41 of the NERC Act:
  - sea trout *Salmo trutta*;
  - European smelt *Osmerus eperlanus*;
  - Atlantic cod *Gadus morhua*;
  - herring *Clupea harengus*;
  - plaice *Pleuronectes platessa*;
  - common sole *Solea solea*; and
  - whiting *Merlangius merlangus*.

13.71. The likely seasonal presence of some of the key species of conservation interest within the Mersey Estuary is provided below in **Table 13.9**.

13.72. Beam trawl surveys were conducted in the Mersey Estuary for the proposed Mersey Tidal Power project. No fish were recorded at the two sampling stations closest to the Site (approx. 1 km from the Site) in autumn 2009[17] and eight taxa were recorded in spring 2010[18] (common sole, dab, flounder, plaice, poor cod, sand goby, sprat, whiting) which included juvenile and adult plaice, and all of the flounder were juveniles. Sampling was conducted by beam trawl from the mouth of the estuary up to Runcorn and across the entire survey area (14 stations) only three taxa were recorded in autumn 2009; with 13 taxa recorded in spring 2010. All fish recorded were typical of estuarine demersal fish assemblages[27].

13.73. Environment Agency (EA) monitoring data (including WDF TraC data) were obtained for stations within the Mersey Estuary (this was comprised of beam and otter trawl data available from 1981 to 2009). A total of 44 fish species were recorded over that period. Data were also available up to 2015 for the Mersey Mouth but these sites were north of the North Wirral Foreshore and further offshore and were considered less relevant for the assessment.

Table 13.9: Summary of the seasonal time of passage or residency of selected fish species in the Mersey Estuary.

Receptor	Residence and/or Transit	Life Stage	Residence and/or Transit Times J F M A M J J A S O N D
Atlantic salmon	Transit	Smolt d/s	
		Adult u/s	
River lamprey	Transit/ resides	Newly metamorphosed adults d/s	
		Adults u/s	
Sea lamprey	Transit	Newly metamorphosed adults d/s	
		Adults u/s	
European eel	Transit/ resides	Glass eel u/s	
		Silver eel d/s	
Sea trout	Transit/ resides	Smolt d/s	
		Adult u/s	
European smelt	Transit	Adult	
		Juvenile	
Cod	Resides/ nursery		

Receptor	Residence and/or Transit	Life Stage	Residence and/or Transit Times											
			J	F	M	A	M	J	J	A	S	O	N	D
Herring	Resides/ nursery													
Plaice	Resides/ nursery													
Sole	Resides/ nursery													
Whiting	Resides/ nursery													

Note: Green cells indicate periods of fish passage and blue cells indicate periods of potential residency within the Mersey Estuary. Direction of travel is indicated for some life stages as either upstream (u/s) or downstream (d/s)

Marine Mammals

13.74. A relatively small number of cetacean species have been recorded in the waters of Liverpool Bay and nearshore waters of the northern Irish Sea (i.e. within 60km of the coast) compared the UK as a whole[32] with a total 15 species of cetaceans recorded since 1975[33,34]. (including species that are present at any time of the year, those recorded annually as seasonal visitors, and species that are recorded only casually in the region).

13.75. Few cetaceans have been observed within the Mersey Estuary with numbers of individuals sighted decreasing with increasing distance upstream along the estuary. The species most likely to be encountered within the study area are expected to be harbour porpoise and bottlenose dolphin[32, 35].

13.76. The Seawatch Foundation has a cetacean observer network and collates cetacean sightings submitted by members of the public around the UK. There were a hundred sightings of cetaceans recorded in the northwest of England between 2014 and 2017, only 16 sightings occurred within the Mersey with a total of 40 individuals[32]. Harbour porpoise was the most commonly sighted cetacean species (34 individuals from 12 separate sightings). The other sightings were of bottlenose dolphin (2 individuals from one sighting), unknown cetacean species (2 individuals from one sighting), one common dolphin and an unknown species.

13.77. There are also two species of pinniped that are regularly observed in small numbers in the eastern Irish Sea which are the grey seal *Halichoerus grypus* and the harbour seal *Phoca vitulina*. Grey seals are regularly observed in the summer months hauled out at Hilbre Island in Liverpool Bay but there are low numbers of sightings of seals within the Mersey Estuary[36].

13.78. Marine mammals found within the study area are afforded both national and international protection under a range of legislation and plans including the Bonn and Bern Conventions (including ASCOBANS), EC Habitats Directive, The Wildlife and Countryside Act, NERC Act and Conservation of Seals Act.

Ornithology

13.79. A full ornithology desk-based data review and screening exercise is provided in **Appendix 12.2** with the main findings summarised here. The results of the proposed wintering bird surveys to be undertaken in late 2017 will be provided to LCC and MEAS during the determination period of the planning application.

13.80. The Site is located in and adjacent to the Mersey Estuary, which is one of the UK's most important sites for non-breeding (wintering) birds, especially waders and wildfowl. The Study Area for this assessment focuses mainly on the species that reside within 750m of the Site, the species that are features of designated sites (SPAs and Ramsar sites) within up to 5km and other designated sites (SSSIs) within up to 1km, as listed within **Table 13.8**.

13.81. The desk study for this assessment examined site-specific survey data, national survey databases and grey literature within County bird reports and County avifauna. The desk study considered a number of non-breeding and breeding waterbird species and described the occurrence of them within or in close proximity to the Site (refer to **Appendix 12.2**), including; shelduck, cormorant, great crested grebe, oystercatcher, lapwing, curlew, turnstone, knot, dunlin, redshank, little tern, common tern, black-headed gull, little gull, lesser black-backed gull, herring gull, great black-backed gull and black-legged kittiwake. These birds feed and roost mostly on the saltmarshes and mudflats surrounding the Estuary. The desk study also confirmed that the Mersey Estuary also hosts a large colony of breeding terns during the breeding season (summer) and a small colony of black-legged kittiwakes, though not within close proximity to the Site. The majority of the birds associated with the Mersey Estuary are located outside the city of Liverpool's boundaries.

13.82. The key finding from the desk study was that the land within close proximity to the Site and in the surrounding docks on the urbanised eastern side of the Mersey Estuary within the City of Liverpool supports very few of the waterbirds during any season across the calendar year. The Site was found to not be of importance for any particular bird species as a breeding location or as a non-breeding location used to nest, forage, loaf or roost. The Site is largely void of waterbirds, though some relatively common species do reside within it on occasion.

Terrestrial Ecology

13.83. As noted above, terrestrial ecology is not assessed within this chapter. Refer to **Appendix 12.4: Preliminary Ecological Appraisal** for further information.

Summary of the Baseline

Marine Ecology

13.84. The phytoplankton and zooplankton assemblages within the Site are expected to be typical of the Mersey Estuary and Liverpool Bay area. Assemblages will change and be redistributed across each tidal cycle. It is anticipated that taxa present at the Site would be well adapted to the extremely turbid environment and fluctuating tide levels of the Mersey Estuary.

13.85. There is a very small section of intertidal sediment (approx. 3000m^2) at the mouth of Prince's Half Tide Dock immediately the north of the Site red line boundary. There are also intertidal habitats within the Site on man-made structures including the existing jetty and dock walls. These structures were colonised by species including the non-native barnacle *Austrominius modestus*, macroalgae and small numbers of periwinkle.

13.86. The subtidal sampling within the Site indicated that the sediments were quite heterogenous. However, the subtidal assemblage was relatively impoverished. The subtidal macroinvertebrate assemblage was dominated by juvenile blue mussel *M. edulis* and the cryptogenic acorn barnacle *A. improvisus*. Several non-native species were recorded. Three individuals of the starlet sea anemone *N. vectensis* were recorded at stations north of the Site red line boundary. As far as we are aware, this is the first record of this species in North West England. The species is non-native but is also currently a protected species although it is understood this is primarily associated with the protection of vulnerable habitats within which it is a specialist (e.g. saline lagoons).

13.87. There are at least 46 fish species within the Mersey Estuary of which eleven are species of conservation importance. These include the migratory (diadromous) species: Atlantic salmon; river lamprey; sea lamprey; and European eel which are protected under Annex II of the Habitats Directive as well as seven species that are protected under Section 41 of the NERC Act: sea trout

(also a migratory species); sea trout, European smelt; Atlantic cod; herring; plaice; common sole; and whiting.

13.88. The number of marine mammals recorded within the Estuary is low; however, there are occasional sightings of harbour porpoise and bottlenose dolphin, and the pinnipeds grey and harbour seal.

Ornithology

13.89. The Site offers very few opportunities for terrestrial bird species with regards to nesting sites or suitable food resources for foraging and doesn't have opportunities for any of the bird species associated with the protected sites listed in **Table 13.8**. A small number of common bird species, such as blackbirds and robins, may occur on the Site but not in any significant numbers. This is to be expected, as the Site has very few plants or shrubs and no old warehouses or sheds. In addition to common species, two protected bird species are known to have bred close to the Site; peregrine falcon and black redstart, which were included within the desk study to inform the baseline; however, there are no records for either species on the Site. This may be explained by the lack of tall structures for peregrines within the Site, which would mean that they are highly unlikely to select this location for nesting. Similarly, a lack of old warehouses and nesting ledges mean that the habitat is not preferable for black redstart for breeding, but as it is a species that is notoriously difficult to locate unless singing, it could be frequenting the Site to forage.

Evaluation to Identify Receptors to be Assessed

Marine Ecology

13.90. The range of potential key receptors present at the Site was considered with relevant receptors screened into the assessment. Value categories for receptors screened into the assessment (following criteria in **Table 12.8**) are summarised in **Table 13.10**.

Table 13.10: Value of receptors expected to be potentially present within the Site.

Value	Receptor	Reasoning
Very High	Fish (Diadromous species)	There is potential for several migratory species to pass through the Development area that are protected under Annex II of the Habitats Directive (river and sea lamprey and Atlantic salmon) and European eel is protected under Council Regulation No 1100/2007/EC.
	Marine mammals	A number of marine mammal species are protected by a range of international policy / legislation including the Habitats Directive.
High	Fish (Section 41 species)	There are several species protected within the UK including former UK BAP species, and priority species listed in Section 41 of the NERC Act (2006).
	Starlet sea anemone *Nematostella vectensis*	Protected under the Wildlife and Countryside Act, is a Species of principal importance in England under the NERC Section 41 list. Listed as Vulnerable on the IUCN Red list.
Medium	Phytoplankton	Phytoplankton is a WFD biological element
	Intertidal species and habitats	Benthic invertebrates is a WFD biological element
	Subtidal species and habitats	Benthic invertebrates is a WFD biological element
	Fish (species not protected by specific conservation policy/legislation)	Fish is a WFD biological element

Value	Receptor	Reasoning
Low	Zooplankton	Zooplankton within the Development area are not protected and are expected to be typical of the Mersey Estuary and Liverpool Bay area. Zooplankton can provide a food resource for other species of conservation and commercial importance, and the larvae of species of conservation and commercial importance form a component of zooplankton.
Negligible	No receptors allocated to this category.	N/A

Ornithology

13.91. The full ornithology receptor screening process is provided in **Appendix 12.2**.

13.92. Of the bird species accounted for in the desk study (refer to **Appendix 12.2**) four were valued at the level of regional importance (oystercatcher, turnstone, redshank and common tern). Although none of these four species are known to reside within the Site in significant numbers the three wader species are known to reside within the Mersey Narrows on the opposite side of the Mersey Estuary and common tern is known to utilise coastal waters all along the Estuary. These four species are also interest features of designated sites in the vicinity of the Site.

13.93. The screening, carried out on all relevant bird species, is based on the source-pathway-receptor method (refer to **Appendix 12.2**). This considers the Site and any proposed development activities associated with it as a potential source of adverse effects on birds, the route by which that potential adverse effect might reach those birds (the 'pathway', which in many cases is dependent on distance) and the presence of a designated site or the presence of the species in significant numbers.

13.94. The outcome of the screening is summarised in **Table 13.11** with five species screened in for consideration within this assessment; oystercatcher, turnstone, redshank, common tern and black redstart. The following passages describe, in summary, their occurrence within the Site or in close proximity to the Site.

Oystercatcher

13.95. Oystercatchers residing within the Mersey Narrows and North Wirral Foreshore are mostly confined to the north Wirral coastline, with only relatively low numbers within the Mersey Narrows[37]. WeBS count data collected over five wintering periods between 2011/12 to 2015/16 also provide evidence that only low numbers of birds utilise the Mersey Narrows, with a maximum count of 400 birds recorded in this count sector in April 2015 (and it should be noted that this site is on the opposite side of the Mersey Estuary to that of the Development). Few birds were recorded in the wintering bird surveys[38] with birds recorded in three count sectors in the winter surveys with a maximum count of 14 in West Waterloo Dock immediately to the north of the Site. Records of one to two birds were recorded at three different count sectors in the spring, whilst none were recorded in the autumn close to the Site. Due to this species being cited as an assemblage species of nearby designated sites, but only being found in low numbers close to the Site it is considered to be of regional importance, with an associated receptor value of **medium**.

Turnstone

13.96. Turnstone residing within the Mersey Narrows and North Wirral Foreshore are mostly confined to the north Wirral coastline, particularly at Leasowe, with only relatively low numbers within the

Mersey Narrows[35]. However, the last five years of WeBS count data collected over the wintering periods between 2011/12 to 2015/16 provide maximum winter counts of between 12 and 164 birds in the Mersey Narrows count sector. Turnstone were recorded in two count sectors within, or close to, the Site during the wintering bird surveys[36], with a maximum of 11 birds in West Waterloo Dock and 20 at Canning Hall Tide Dock. No birds were recorded within close to the Site during the spring and autumn surveys. Due to this species being a cited interest feature of the nearest designated site and as it is only found in numbers of regional significance within close proximity to the Site it is considered to be of regional importance, with an associated receptor value of **medium**.

Redshank

13.97. The number of redshank residing within the Mersey Narrows and North Wirral Foreshore has increased in importance in a regional context over the last 10-15 years[35]. The last five years of WeBS count data collected over the wintering periods between 2011/12 to 2015/16 also provides evidence that this area has become more important for this species, with maximum winter counts increasing from 22 birds in the Mersey Narrows count sector in November 2011 to 400 in April 2015. Redshank were not recorded in any of the count sectors within, or close to the Site during the winter, spring or autumn bird surveys[36]. Due to this species being a cited interest feature of nearby designated sites and being found in reasonable numbers close to the Site it is considered to be of regional importance, with an associated receptor value of **medium**.

Common Tern

13.98. Common tern residing within the Mersey Narrows and North Wirral Foreshore are mostly confined to coastline with sandy beaches, with very few birds recorded within the Mersey Narrows[35]. WeBS count data collected over the years between 2011 and 2016 also provides evidence that only low numbers of birds utilise the Mersey Narrows (though the focus is predominantly during the non-breeding period), with a maximum count of four birds in September 2015. No common terns were recorded in the bird surveys close to the Site[36]. However, this species is a cited interest feature of a nearby designated site and despite only being found in low numbers close to the Site it is considered to be of regional importance, with an associated receptor value of **medium**.

Black Redstart

13.99. Black redstarts are not known to breed on any of the structures within the Site (*pers. comm.* County Bird Recorder). A male was recorded in song at Clarence Dock in 2014[39], which is approximately 750 m to the north of the Site. However, due to the secretive nature of this species, its preference to spend time on roof tops and its ability to forage over wide areas that are often private with no right of access for people, it is possible that this species may be present in some capacity. Although this is a Schedule 1 species it is not known to be nesting or foraging in the Site, so is considered to be of local importance, with an associated receptor value of **low**.

Table 13.11: Value of receptors (bird species) and summary of screening for impact assessment

Receptor	Value	Occurs in or adjacent to Site	Feature of designated site within 1 km	Screened in / out
Shelduck	Low	No	No	Out
Cormorant	Low	Yes	Yes	Out
Gt crested grebe	Low	No	No	Out
Peregrine falcon	Low	No	No	Out
Oystercatcher	Medium	No	Yes	In
Lapwing	Low	No	No	Out

Receptor	Value	Occurs in or adjacent to Site	Feature of designated site within 1 km	Screened in / out
Curlew	Low	No	No	Out
Turnstone	Medium	No	Yes	In
Knot	Low	No	Yes	Out
Dunlin	Low	No	Yes	Out
Redshank	Medium	No	Yes	In
Little tern	Low	No	Yes	Out
Common tern	Medium	No	Yes	In
Black-hdd gull	Low	Yes	No	Out
Little gull	Low	No	Yes	Out
Lssr black-bd gull	Low	Yes	No	Out
Herring gull	Low	Yes	No	Out
Gt black-bd gull	Low	No	No	Out
Black-lg kittiwake	Low	No	No	Out
Black redstart	Medium	Yes	No	In

Likely Effects

Demolition and Construction

13.100. A summary of the proposed demolition of the existing jetty and construction of the proposed Development is provided in **Chapter 6: Development Programme and Construction**. In addition, the following assumptions have been made for the purposes of this assessment:

- It has been assumed that the existing jetty has in the region of 140 wooden posts, each 0.6m in diameter[39], giving an overall footprint on the estuary bed of 39.6m^2. The feasibility of removing the existing piles from the estuary bed once the jetty structure has been demolished is being considered; however, at this stage as a worst-case scenario it is assumed that they would all be cut off approximately 1m below current silt level ;
- One or more jack-up barges are expected to be used to remove the wooden jetty piles. These barges place spud legs on the estuary bed to anchor the vessel. It is anticipated that the barges would have four spud legs each; however, the footprint of such spud legs is considered to be minimal in relation to the subtidal area of the Site; and
- The overall design for the new suspended deck structure has not been finalised. However, for the purposes of assessment it is considered that there would be 155 piles (which includes 15 piles for an abeyance region), each 914mm in diameter, giving an overall footprint on the estuary bed for the new jetty of approximately 102m^2. It should be noted that the number of piles and their locations could be subject to change once the design is finalised.

13.101. The main pathways by which the Development is considered to potentially have an effect on marine ecology and ornithology during demolition and construction phases have been outlined in **Table 13.1** andTable 13.2**Table** 13.2 and are listed below. Each is considered in more detail within the text below where appropriate:

- Loss of habitat;
- Physical disturbance and displacement (disturbance of bottom sediments);
- Physical disturbance and displacement (visual);

- Airborne noise and vibration;
- Underwater noise and vibration;
- Changes to water quality (suspended solids and release of contaminants from sediments);
- Pollution (direct e.g. oil);
- Collision risk due to vessel movements;
- Spread of non-native species; and
- Physical disturbance and displacement (indirect i.e. through the food chain).

Loss of Habitat

13.102. Receptors potentially affected by this effect are intertidal habitats and species, subtidal habitats and species, and birds.

Intertidal Habitats and Species

13.103. During demolition and removal of the existing jetty, species encrusting the existing wooden jetty structure and the supporting habitat would be permanently removed. The wooden pile habitat would be replaced via the installation of metal piles for the new Cruise Liner Terminal, so the replacement structures would not be like for like. However, wall scrapes and observations from project-specific survey indicate that over time metal piles would be expected to be colonised by barnacles and other organisms currently on the wooden jetty (refer to **Appendix 12.1**). It should be noted, however, that the dominant encrusting organisms on the current structures which would be expected to colonise the new structures would include the non-native barnacle *Austrominius modestus*.

13.104. The effect has been assessed to be local and permanent due to the loss of individuals on the current structure. However, the new structures to be installed would be expected to be colonised by the same main taxa that are currently present. Overall, the magnitude of the effect is considered to be minor. The value and sensitivity of the intertidal species/habitats is assessed to be medium and any effect is assessed likely to be **permanent, local and of minor adverse significance**.

Subtidal Habitats and Species

13.105. Removal of the jetty structures would result in the loss of subtidal invertebrates and algae that have colonised them but these species are widespread on other structures in the vicinity of the Works including the walls at the waterfront and these taxa would be expected to colonise new jetty structures introduced for the Development.

13.106. During construction of the new suspended deck structure for the Cruise Liner Terminal there would also be loss of habitat due to installation of piles which are currently planned to avoid the locations of the current pile footings. The area of the estuary bed due to the installation of new piles is small (footprint of approximately 102m^2) which also represents a small proportion of the available subtidal habitat within the Site. For the purposes of assessment, it is assumed that current piles would remain in place as a worst-case scenario, consequently this would be a net habitat loss with no subtidal sediment habitat gained from pile removal.

13.107. Any effect on subtidal invertebrates on the jetty structures due to demolition/removal, and in the subtidal sediments due to construction works would be local and loss of the existing sediment habitat due to introduction of new piles would be permanent**.** New structures would provide new artificial subtidal habitat to be colonised by organisms that currently colonise subtidal sections of the existing jetty structure. With the very small area of subtidal sediment habitat that could be lost due to the Development there is not expected to be any effect on the integrity of the populations

of subtidal invertebrates within the Site and within the wider Mersey Estuary, and invertebrates are likely to be able to recolonise any disturbed areas from the wider population. Consequently, the magnitude of the effect is considered to be minor**.** The value of the subtidal species/habitats is assessed to be high (due to the potential presence of the Section 41 list species *N. vectensis*) and sensitivity is considered to be medium**.**

13.108. Based on the above considerations it is considered likely that any effects would be **permanent, local and of minor adverse significance**.

Birds

13.109. The species of waders screened in for assessment (oystercatcher, turnstone and redshank) are not known to reside on the Site as they are found on the opposite side of the Mersey Estuary to the Site, so would not be subject to any habitat loss as a consequence of this Development. Common tern also do not reside on the Site, so the Development would not cause any loss of habitat to this species, as it nests at Seaforth to the north and is not known to forage significantly in waters adjacent to the Site. Despite the loss of habitat being permanent the construction works would only be local, so consequently regardless of the level of sensitivity of all three waders and common tern the magnitude of effect is deemed to be 'no change', therefore the significance of effect would be **neutral** for all four bird species.

13.110. Black redstarts have a medium sensitivity to habitat loss, based on their preference to specific urban habitats in the UK[40]. However, they are not known to forage on the Site and the demolition plans do not involve the destruction or removal of any known nesting locations. Despite the loss of habitat being permanent the construction works would only be local, as the footprint of the Site is limited in size and would not constitute a significant loss of foraging space for this species, should it be present during the breeding season. Consequently, the magnitude of effect is deemed to be negligible and the significance of effect is considered to be of **negligible**.

Physical Disturbance and Displacement (Disturbance of Bottom Sediments)

13.111. Receptors potentially affected by this effect are subtidal habitats/species and fish.

13.112. In addition to the potential mortality of individuals within the footprint of new piles there could be displacement of subtidal invertebrates or fish within areas immediately outside the pile footprints due to physical disturbance of sediment in the area. This could include the smothering of individuals by sediment settling out of solution.

13.113. Once the jetty is removed sediment transport modelling has indicated the overall effect would be to reduce the potential for fine sediment accretion particularly in the area north of the structure, around the Prince's Half Tide Dock approaches[41].

13.114. Predicted effects would be limited to approximately 1km from the existing jetty. The reduction in accretion in these areas would result in other areas experiencing a small increase in the potential for fine sediment accumulation as material which would have settled further towards the channel would now be able to settle nearer the bank line[39].

Subtidal Habitats and Species

13.115. The area of subtidal sediment potentially affected by this disturbance would be larger than the area within the pile footprints but would still be very small in relation to the availability of similar habitats within the Site boundary and wider Estuary. Any disturbed/displaced benthic invertebrates would only be displaced a short distance and would be expected to survive such disturbance. The effects of changes in sediment transport regime would be gradual and

sediments would likely be recolonised with recruitment from the wider populations following disturbance.

13.116. Any effects would be local and temporary and the magnitude of the effect is considered to be negligible**.** The value of the subtidal species/habitats is assessed to be high (due to the potential presence of *N. vectensis*) and sensitivity is considered to be low**.** Therefore any effects would be **temporary, local and of minor adverse significance**.

Fish

13.117. Fish are highly mobile and any fish physically disturbed by the work due to sediment movement/changes in habitat would be able to avoid the area during periods of disturbance and return to the area if required once disturbance has ceased. The type of habitat potentially disturbed is widespread within the Site boundary and wider Estuary so fish would not have to move far to find similar habitat.

13.118. Any effects would be local and temporary and the magnitude of the effect is considered to be negligible. The value of fish potentially present at the Site is assessed to be very high for diadromous fish, high for other protected fish species, and medium for other fish species and sensitivity to the effect is considered to be low. Overall any effects are considered likely to be **temporary, local and of minor adverse significance**.

Physical Disturbance and Displacement (Visual)

13.119. Receptors potentially affected by this effect are fish, marine mammals and birds.

13.120. Visual disturbance could occur as a result of movements of vehicles such as excavators, piling rigs, dump trucks, cranes, tractors and trailers at or within close proximity to the Site and workmen walking on or close to the Site. Within the aquatic environment visual disturbance could be associated with the presence of barges during construction. There is also potential for visual disturbance due to any artificial light used during the demolition and construction works.

Fish

13.121. Fish are highly mobile and are also well habituated to the presence of vessels in the Mersey Estuary. They could avoid the area due to any visual disturbance if required. Any effects would be local and temporary and the magnitude of the effect is considered to be negligible. The value of fish at the Development site is assessed to be very high for diadromous fish, high for other protected fish species, and medium for other fish species and sensitivity to the effect is considered to be negligible. Overall any effects are considered likely to be of **negligible** significance.

Marine Mammals

13.122. Marine mammals in the area would be expected to be well habituated to the presence of vessels. In particular, seals would be able to detect sources of light during construction if works were conducted at night. However, the Mersey Narrows is a built-up area and marine mammals present would be habituated to the presence of light from a wide range of sources. In addition, the numbers of marine mammals frequenting the Mersey Estuary is very low. Any effects would be local and temporary and the magnitude of the effect is considered to be negligible. The value of marine mammals is assessed to be very high and sensitivity to the effect is considered to be negligible. Overall any effects are considered likely to be of **negligible** significance.

Birds

13.123. Physical disturbance as a consequence of machinery, vehicles / vessels and workmen at the Site or travelling to and from it could potentially cause temporary or permanent displacement of bird species feeding and / or roosting within a preferred area. At the lowest degree, a species may be too far from the activities to be influenced by any associated machinery or people or they may become habituated to these or other disturbance stimuli, thereby not reacting to or moving away from activities associated with disturbance. At the highest degree, a species may react to the presence of machinery, vehicles / vessels or workmen by vacating a preferred area for feeding or roosting and not return until such disturbances are no longer present.

13.124. The species of waders screened in for assessment (oystercatcher, turnstone and redshank) are not known to reside on the Site as they are found on the opposite side of the Mersey Estuary to the Development. The distance between the Site and the closest area of suitable sand/mudflats on the Wirral side is approximately 850m. Demolition and construction works carried out by machinery, vehicles and workmen on the Site are too far from these three species to pose a potential disturbance stimuli. In addition, the presence of one or more jack-up barges which would be adjacent to the Site in the Mersey Estuary would also be too far from any birds on the opposite side of the estuary to be subject to disturbance. Any effects would be local and temporary, and regardless of the level of sensitivity of all three wader species to visual disturbance stimuli the magnitude of effect is considered to be 'no change', therefore the significance of effect would be **neutral** for these species.

13.125. Common tern do not reside on the Site and do not regularly forage in waters close to it, so would not be subject to disturbance visually. The main nesting location for this species is at Seaforth Dock, which is approximately 7km to the north, meaning that none of the machinery, vehicles, vessels or workmen would be visible to them when they may be at their most sensitive. Any effects would be local and temporary, and regardless of the level of sensitivity of common tern to visual disturbance stimuli the magnitude of effect is considered to be 'no change', therefore the significance of effect would be **neutral** for this species.

13.126. Black redstarts have a negligible sensitivity to physical disturbance, as in the UK they predominantly reside within urban areas that are subjected to the potential sources of disturbance in the form of machinery, vehicles, vessels and workmen[38]. As they are not known to forage on the Site the physical presence of machinery, vehicles, vessels and workmen would be unlikely to cause significant disturbance to this species. However, if they do reside at the Site then they would already be subject to current levels of traffic from cars moving along the road on to the Princes Dock and from regular cruise vessels docking nearby so any effects would be local and temporary and the magnitude of the effect is considered to be negligible. Overall, the significance of effect is considered to be **negligible**.

Airborne Noise and Vibration

13.127. The receptor potentially affected by this effect is birds.

13.128. The sources of above water noise and vibration from the demolition and construction activities associated with this Development include the movement and operation of plant vehicles, machinery and workmen on the Site, and vessels with machinery on the water adjacent to the Site. In addition, there is the requirement to drive piles into the estuary bed for the new suspended platform structure. Many of these activities are localised within the Site or close to the Site (e.g. vessels or terrestrial vehicles approaching or leaving the Site).

13.129. Modern demolition methods would be used to minimise noise and ensure demolition materials are recovered and separated for recycling (refer to **Chapter 6: Development Programme and Construction** and **Chapter 8: Noise and Vibration**).

13.130. To minimise potential noise and vibration, Site-specific best practice measures would be implemented and adhered to by Contractors. A summary of such measures includes:

- Careful selection of Works methods and plant to be used to minimise noise at source as far as reasonably practicable;
- Switching off plant and vehicle engines when not in use;
- Regular maintenance and servicing of vehicles, equipment and plant;
- Adhering to operational hours (to be agreed with the Applicant);
- The use of hoarding around the perimeter of the Site and temporary acoustic barriers, where appropriate; and
- Breaking out of concrete structures would be undertaken using low noise and vibration techniques where possible.

Birds

13.131. The sources of noise and vibration from the mobilisation activities associated with this Development include the movement and operation of plant vehicles, vessels and machinery on the Site and adjacent to it on the water. The biggest potential source of noise is from piling of the steel tubular piles for the new Cruise Liner Terminal. It has not been finalised at this stage whether vibro- or percussion piling would be used and the method would be selected based on the potential to affect the structural integrity of the dock walls. As a precautionary worst-case scenario, it has been assumed that percussion pilling would be used for the purposes of assessment. The assessment is based on the assumption of use of tubular steel piles of 914mm in diameter.

13.132. Percussive piling involves the downward impact of hammers on piles and is estimated to produce maximum noise levels of 89dB at 10m from the source[42]. For the purposes of assessment, it has been assumed that a total of 155 piles would be driven into the estuary bed. It is estimated that there would be a maximum five months of piling and the worst case for birds is to consider this coinciding with the more sensitive non-breeding season (winter) months between November and March.

13.133. Piling is a source of noise that has the potential, should it be of a nature and loud enough when it reaches the location where a receptor of concern occurs, to disturb bird species that are interest features of designated sites. There are a number of factors that affect the level of noise that reaches the receptors of concern. The principal factors are the level at source, the distance, the presence of any barrier and the nature of the ground between source and receptor. With regard to distance, for a point source of sound (i.e. a machine) a doubling of the distance results in a 6dB(A) fall in level. With regard to the nature of the ground, if it is a hard-reflecting surface (e.g. asphalt, paving, water) it can increase noise levels by up to 3dB(A) (this is because the noise that has travelled directly and the reflected noise is combined).

13.134. The sound pressure level (SPL) for piling being proposed for use in this Development has been sourced from Defra (2005)[40]. Attenuation with distance has been calculated using a proprietary noise attenuation calculator[43], with conversion to sound power level (SWL) at source and the results presented for 850m in **Table 13.12**, the distance to the closest point on the opposite side of the Mersey Estuary that accommodates species screened in for this assessment.

Table 13.12: Attenuation of noise with distance

Source	SPL at 10m (dB) (Defra, 2005)	SWL (dB)	SPL at distances relevant to this study		
			500m	750m	850m
Hammer piling rig	89	120	38.8	34.5	33.1

13.135. To assess the response levels of the waterbirds close to the proposed works from acoustic influence associated with those Works, the IECS Estuarine Bird Assessment Tool Kit (IECS Tool Kit)[44] has been used for guidance. For birds in the intertidal environment different types of disturbance stimuli can be characterised by the reactions that different bird species have to such stimuli (as listed in the IECS Tool Kit). This could be as a result of noise and vibrations from multiple vehicle movements and/or the installation and operation of heavy machinery. In such circumstances waterbirds feeding and/or roosting on the intertidal area may, at the highest degree, move to areas in excess of 300m from the source of disturbance (strong escape behaviour, at a large response distance). At the lowest degree, a species may become habituated to noise and vibration disturbance stimuli, thereby not reacting to or moving away from activities associated with disturbance (hardly any escape behaviour and very short flight distance when approached).

13.136. The noise from the percussion piling rig is anticipated to be 89 db(A) at 10 m from the source, and reducing to <40 db(A) within 500 metres (**Table 13.12**). Works undertaken during the non-breeding period, including the months of November through to March would coincide with waterbirds being present on the opposite side of the Mersey Estuary. Based on AQTAG09 noise thresholds and guidance[45], it is recommended that noise levels would be restricted to below 55 dB for periods of work extending over one hour and, where possible, noise above 80 dB would be avoided as that is a maximum disturbance factor. In addition to noise thresholds in Ormerod *et al* (2004)[42] this assessment has used disturbance distances from the IECS Tool Kit[41] to determine the potential effects of noise on different species of birds in the intertidal area.

13.137. The species of waders screened in for assessment have differing levels of sensitivity regarding noise disturbance, with oystercatcher having a low sensitivity, turnstone having a negligible sensitivity and redshank having a very high sensitivity. However, these three species of waders are not known to reside on the Site as they are found on the opposite side of the Mersey Estuary to that which the Development is located. The distance between the Site and the closest area of suitable sand / mud flats on the Wirral side is approximately 850 m away. Accounting for the maximum dB level from percussion piling on the Site of 89 dB at 10 m from the source and the combination of a noise decay rate over distance, noise levels would fall to 33.1 dB at 850 m. Any effects would be local and temporary and regardless of the level of sensitivity of all three wader species to noise disturbance stimuli the magnitude of effect is deemed to be 'no change'. Therefore, the significance of effect is considered to be **neutral** for these species.

13.138. Common tern have a low sensitivity regarding noise disturbance, but as they do not reside on the Site and do not regularly forage in waters near to the Site they would not be subject to noise disturbance. The main nesting location for this species is at Seaforth Dock, which is approximately 7 km to the north, meaning that noise emitted from percussion piling would not reach them when they may be at their most sensitive. In addition, any potential effects would be local and temporary and regardless of the level of sensitivity of common tern to noise disturbance stimuli the magnitude of effect is deemed to be 'no change'. Therefore, the significance of effect would be **neutral** for this species.

13.139. Black redstarts have a **negligible** sensitivity to noise disturbance and are known to prefer urban areas in the UK that may be subjected to regular and high levels of noise such as building sites,

power plants and busy city centres. As they are not known to forage on the Site any noise emitted from percussion piling would be unlikely to cause significant disturbance to this species. However, if they do reside at the Site then they would already be subject to current levels of noise from cars moving along the road on to the Princes Dock and from regular cruise vessels docking nearby so any effects from percussion piling would be local and temporary and the magnitude of the effect is considered to be minor at most. Consequently, if the magnitude of effect is deemed to be minor, then the significance of effect would be **negligible**.

13.140. If they do reside at the Site then they would already be subject to current levels of noise from cars and the current cruise ships docking alongside the Site. However, as they are not known to forage on the Site the proposed percussion piling would be unlikely to cause significant disturbance to this species. Consequently, regardless of the level of sensitivity of black redstart the magnitude of effect is deemed to be negligible, therefore the significance of effect would be **negligible**.

Underwater Noise and Vibration

13.141. The receptors potentially affected by this effect are fish and marine mammals.

13.142. The deconstruction and removal of the existing Princes Jetty would generate some underwater noise due to the breaking and removal of wooden piers and other structures.

13.143. Noise could be generated by the barges and other boats utilised to remove the Princes Jetty structure. The number of barges to be operating in the area has not yet been finalised; however, it is understood that barges would be used extensively during demolition. It is anticipated that tugs may be used to move the barges to Site and the barges would be stationary during demolition and removal operations and there may also be movements of crew boats in the area. Some indicative underwater noise levels for the operation of these vehicles (i.e. during transit) are indicated in **Table 13.13**.

Table 13.13: Typical Source Noise Levels for expected Construction Vessels

Vessel	Vessel Details	Frequency Range (kHz)	Extrapolated Source Noise Level (dB re 1 µ Pa, peak-peak)	Reference
Tug	Manoeuvring sealift barge in shallow water	0.01 to 20	170 (based on measurement of 144 dB rms re 1 µPa @ 60 m)	Richardson (2006) [46]; Patterson & Blackwell (2007)[47]
Crew Boat	8.5 m long underway at 13 knots	0.01 to 20	175 (based on measurement of 166 dB rms re 1 µPa @ 1 m)	Zykov & Hannay (2006)[48]

13.144. The biggest potential source of noise is from piling of the steel tubular piles for the new Cruise Liner Terminal.

13.145. It has not been finalised at this stage whether vibro- or percussion piling would be used and the method would be selected based on the potential to affect the structural integrity of the dock walls. As a precautionary worst-case scenario, it has been assumed that percussion pilling would be used for the purposes of assessment. The assessment is based on the assumption of use of piles of tubular steel of 914 mm in diameter.

13.146. Peak sound levels generated by percussion piling can vary in relation to numerous factors including pile type and diameter, hammer size and substrate type[49]. Underwater noise modelling data specific to the proposed Development are not available, consequently the assessment has been based on consideration of available data from previous studies.

13.147. Percussive piling involves the downward impact of hammers on piles and can generate impulses with sound pressure levels of 180-235 dB re: 1 µPa[50].

13.148. An assessment of noise levels using a hydraulic drop hammer (approximately 9 tonnes with 800 to 1600 mm diameter tubular piles) indicated peak estimated noise levels at source were 179 dB re 1 µPa, dropping to 162 dB re 1 µPa at 100 m from the source, and 157 dB re 1 µPa at 250 m from the source[51].

13.149. Studies of noise generated by percussive piling of 300 mm H-piles found peak sound pressure at source was 195 dB re 1 µPa and SEL 170 db re:1µPa^2-s for thick walled piles[52].

13.150. The SPL generated by vibro-piling has lower sound pressure emission levels than for percussive piling, with noise levels from vibro-piling generally in the region of 20-35 dB re: 1 µ Pa lower[45,46].

13.151. For the purposes of assessment, it has been assumed that a total of 155 piles would be driven into the estuary bed. It is estimated that there would be a maximum five months of piling and the specific months during which piling would occur are yet to be confirmed. General construction hours would likely be 08:00 - 18:00 hours Monday to Friday; 08:00 - 13:00 hours Saturday; with no working on Sundays or bank holidays.

Fish

13.152. Underwater noise may cause the following effects in fish:

- Behavioural effects (e.g. changes in swimming behaviour and orientation, communication between conspecifics and detection of predators/prey);
- Masking effects (i.e. the reduction in the detectability of a given sound as a result of the simultaneous occurrence of another sound);
- Temporary threshold shift in hearing (short or long term changes in hearing sensitivity that may or may not reduce fitness);
- Recoverable tissue injury (injuries, including hair cell damage, minor internal or external hematoma etc. None of these injuries are likely to result in mortality); and
- Mortality and potential mortal injury (immediate or delayed death).

13.153. Hearing abilities of fish can vary in relation to morphological adaptations of the acoustico-lateralis apparatus, in particular the distance of the swim bladder to the inner ear[53,54,55]. Species with no swim bladder (e.g. flatfish) have a lower hearing ability than many other fish species and rely on detection of particle motion (the oscillatory displacement of fluid particles in a sound field)[56]. Those with a swim bladder but no connection to the inner ear (e.g. salmon) have better hearing but can also only detect particle motion. Species with an extension of the swim bladder that terminates within the inner ear (e.g. herring) can hear sounds over a far greater range than other species[57,58], and can detect both particle motion and sound pressure (a form of stress measured in term of force/unit area).

13.154. Due to the different hearing abilities of marine species, numerous assessments of the potential impacts of underwater noise and vibration in the UK have used the dB_{ht} (*Species*) concept[59]. The dB_{ht} (*Species*) scale provides an equivalent to the dB(A) scale used for human noise exposure in air as it models the noise level that a specific species would experience. There are a number of limitations with this approach, however, including difficulties associated with deriving the required data for individual species and consideration of issues inherent with utilising audiogram data for the approach[60].

13.155. As an alternative approach Popper *et al*. (2014)[46] provides criteria that can be applied to assess the potential effects of noise on fish from different marine activities such as piling and vessel noise. The approach assesses the potential effects of underwater noise on fish based on grouping

species according to their hearing apparatus, specifically whether they have no swim bladder, they have a swim bladder but it is not involved in hearing, or they have a swim bladder which is involved in hearing[46].

13.156. The noise levels are based on consideration of peak noise (the maximum absolute value of the instantaneous sound pressure (or motion) during a specified time interval), and cumulative Sound Exposure Level (SEL_{cum}) which is the linear summation of the individual sound events over the time period of interest and can be calculated as[46]:

$$SEL_{ss} + 10\log 10 (N)$$

where SEL_{ss} is the Sound Exposure Level for a single strike and N is the number of impulsive events.

13.157. Insufficient data exist to make a recommendation for guidelines in relation to masking effects (i.e. the reduction in the detectability of a given sound as a result of the simultaneous occurrence of another sound) or behavioural effects of noise (e.g. changes in swimming behaviour and orientation, communication between conspecifics and detection of predators/prey). Consequently, a subjective approach has been adopted in which the relative risk of an effect is placed in order of rank at three distances from the source – near (e.g. tens of meters from the source), intermediate (e.g. hundreds of meters from the source), and far (e.g. thousands of meters from the source)[46] (refer to **Table 12.18**).

Table 13.14: Proposed mortality, potential injury, temporary threshold shift, masking and behaviour criteria for fish (from Popper *et al*. 2014)

Fish grouping	Mortality and potential mortal injury	Impairment			
		Recoverable injury	Temporary Threshold Shift	Masking	Behaviour
Pile Driving					
No swim bladder (particle motion detection)	>219 db SEL_{cum} or >213 dB peak	>216 db SEL_{cum} or >213 dB peak	>186 db SEL_{cum}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Swim bladder is not involved in hearing (particle motion detection)	210 db SEL_{cum} or >207 dB peak	203 db SEL_{cum} or >207 dB peak	>186 db SEL_{cum}	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Swim bladder is involved in hearing (primarily pressure detection)	207 db SEL_{cum} or >207 dB peak	203 db SEL_{cum} or >207 dB peak	186 db SEL_{cum}	(N) High (I) High (F) Moderate	(N) High (I) High (F) Moderate
Shipping and Continuous Sounds					
No swim bladder (particle motion detection)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Swim bladder is not involved in hearing (particle motion detection)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low

Fish grouping	Mortality and potential mortal injury	Impairment			
		Recoverable injury	Temporary Threshold Shift	Masking	Behaviour
Swim bladder is involved in hearing (primarily pressure detection)	(N) Low (I) Low (F) Low	170 dB rms for 48 hrs	158 dB rms for 12 hrs	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low

Notes: peak and rms sound pressure levels dB re 1 µPa; SEL dB re 1 µPa2·s. All criteria are presented as sound pressure even for fish without swim bladders since no data for particle motion exist. Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N; tens of metres from source), intermediate (I; hundreds of metres from source), and far (F; thousands of metres from source).

13.158. Cumulative Sound Exposure Level and Peak noise levels at source are unlikely to exceed the values indicated in **Table 12.18**
Table 13.14 for the proposed scale of piling; however, as specific underwater noise data for the proposed piling approach are not available this cannot be confirmed at this stage and as a precautionary approach it is assumed that these levels may be reached. Sound levels, however, would attenuate rapidly throughout the water column with increased distance from the source.

13.160. This assessment focusses on the key fish species of conservation importance indicated in **Table 13.9**.

Lamprey, Plaice, Sole

13.161. Lamprey lack a swim bladder and otolith organs but feature statoliths or labyrinth organs, which are anatomical structures thought to detect underwater noise (particle velocity). These species belong to the category 'No swim bladder (particle motion detection)'. In addition, flatfish such as plaice and sole do not have a swim bladder and are also considered within this category.

13.162. In terms of vessel noise it is considered individuals within hundreds of metres could experience masking effects with a moderate risk of masking effects beyond this distance, and behavioural effects may be evident at distances of hundreds of metres from the source, however, these effects are unlikely to affect survival of individuals. There would be a moderate risk of temporary threshold shift within tens of metres of vessels if vessel noise was continuous, but any vessel activity at the site would be expected to be intermittent.

13.163. When considering piling activity there is potential for temporary threshold shift for individuals very close to the source where sound pressures could potentially be >186 db SEL_{cum}, however, no injury or mortality would be expected as sound levels would be expected to be less than 213 dB peak or 216 db SEL_{cum} either at source, or very close to the source.

13.164. As the piling would occur along the north bank of the Mersey Estuary individuals would be able to easily move further out into the estuary away from the noise source and as piling hours would be restricted there would be extensive windows of no piling activity when fish could move past the area.

13.165. Magnitude of effect is considered to be negligible for these receptors. Basing the assessment on lamprey which has the highest value of these species, the value of the receptor is considered to be very high and sensitivity is negligible. Overall, any effects are considered likely to be of **negligible** significance.

Atlantic Salmon; Sea Trout, European Smelt

13.166. Although salmon have a swim bladder it has been found that fish only respond to low frequency tones (below 380 Hz) with particle motion being the stimulus[61,46]. This species is, therefore, primarily a kinetic detector and hearing is poor compared to other species that can detect sound pressure changes. In common with Atlantic salmon and other salmonids, sea trout have a swim bladder but do not possess specialised hearing structures and do not have a wide hearing bandwidth or sensitivity to sound pressure levels. It is considered that they rely on particle motion for hearing[62]. In addition, European smelt has a similar peak hearing threshold to these species. Consequently, it is considered that these three species belong to the category 'Swim bladder is not involved in hearing (particle motion detection)'.

13.167. In terms of vessel noise, the potential risks are the same as indicated above for fish in the category 'No swim bladder (particle motion detection)'. When considering pile driving there could be temporary threshold shift for fish exposed to sound levels >186 db $SEL_{cum,}$ and with percussion piling there is potential for sound levels of 203 db SEL_{cum} which could result in recoverable injury, although it would be expected that such noise levels would only be encountered close to the piling source.

13.168. As the piling would occur along the north bank of the Mersey Estuary individuals would be able to easily move further out into the estuary away from the noise source and as piling hours would be restricted there would be extensive windows of no piling activity when fish could move past the area. There would be times of year during which there could be increased sensitivity of different migratory species to the effects of noise as indicated in Table 13.9, however, as the timing of the works is not yet known, taking a precautionary approach, it has been assumed it could be conducted at any time of year which could correspond to sensitive periods for fish migration.

13.169. Overall, magnitude of effect is considered to be minor and basing the assessment on Atlantic salmon which has the highest value of these species, the value of the receptor is considered to be very high and sensitivity of these species to underwater noise is medium. Any effects are considered likely to be of **moderate adverse** significance. Consequently, further mitigation is required to reduce the significance of this effect.

European Eel; Herring; Atlantic Cod; Whiting

13.170. Herring (and in general other Clupeids) have a swim bladder with special anatomical adaptations which enables them to detect noise pressure and provides enhanced hearing capabilities increasing the sensitivity of this species to underwater noise[46]. In Atlantic cod the swim bladder plays an accessory role in hearing and cod are sound pressure-sensitive at higher frequencies[46] and whiting, which is also a gadoid fish is considered to have similar hearing capabilities. European eel are able to detect sound pressure as well as particle motion which increases their hearing sensitivity and hearing bandwidth[46]. It has been found that at low frequencies the relevant stimulus parameter is particle motion, with no involvement of the swim bladder, while at the higher frequencies the swim bladder can convey an auditory advantage enabling the detection of pressure[63], however, specialised anatomical adaptations are lacking[60]. Although the hearing sensitivity varies considerably across these species with herring being the most sensitive, they each belong to the category 'Swim bladder is involved in hearing (primarily pressure detection)'.

13.171. When considering vessel noise it is considered individuals within thousands of metres of the noise source could experience masking effects, and behavioural effects are likely within tens of metres of the source, there is a moderate risk of behavioural changes within hundreds of meters and a low chance of such changes beyond this distance, however, these effects are unlikely to affect survival of individuals. The noise levels at which there are risks of temporary threshold shift or recoverable injury (**Table 12.18**) could potentially be generated by vessels, however, these effects

are associated with continuous exposure for 12 to 48 hours and any vessel noise associated with demolition or construction works would be expected to be far more intermittent.

13.172. When considering pile driving there could be a temporary threshold shift for fish exposed to sound levels of 186 db $SEL_{cum,}$ and with percussion piling there is potential for sound levels of 203 db SEL_{cum} which could result in recoverable injury, although it would be expected that such noise levels would only be encountered close to the piling source.

13.173. As the piling would occur along the north bank of the Mersey Estuary individuals would be able to easily move further out into the estuary away from the noise source and as piling hours would be restricted there would be extensive windows of no piling activity when fish could move past the area. There would be times of year during which there could be increased sensitivity of European eel to the effects of noise as indicated in **Table 13.9**, however, as the timing of the works is not yet known, taking a precautionary approach, it has been assumed it could be conducted at any time of year which could correspond to sensitive periods for fish migration.

13.174. Magnitude of effect is considered to be minor and basing the assessment on European eel which has the highest value of these species, the value of the receptor is considered to be very high and sensitivity of these species to underwater noise is high. Any effects are considered likely to be of **moderate adverse** significance. Consequently, further mitigation is required to reduce the significance of this effect.

Marine Mammals

13.175. Underwater noise can have physical and behavioural effects on marine mammals. Physical injury can include permanent threshold shift (i.e. permanent hearing damage caused by very intensive noise or by prolonged exposure to noise) or a temporary threshold shift, and behavioural effects can include avoidance of an area subject to noise disturbance.

13.176. Southall *et al*. (2007)[64] provides a set of criteria to assess the noise levels at which there could be physical injury to marine mammals categorised into low-, mid- and high-frequency cetaceans (based on hearing ability), and pinnipeds (e.g. seals) in water or air. Southall *et al*. (2007)[61] indicates separate criteria for single pulse, multiple pulse or nonpulse noise sources. One source of underwater noise associated with the demolition and construction works is the noise from vessels and the continuous noise generated by vessels is consistent with a nonpulse sound. Piling activity is associated with single pulse and multiple pulse noise sources (Table 12.19).

13.177. The injury criteria used for this assessment are those criteria set out in Southall *et al*. (2007)[61] while the behavioural response criteria are based on a review of the relevant studies compiled by Southall *et al*. (2007)[61] and supplemented by information in Tougaard *et al*. (2015)[65] and are considered to be conservative estimates (Table 12.19).

13.178. Southall *et al*. (2007)[61] classed harbour porpoise as ‘high-frequency cetaceans’ and estimated an auditory bandwidth of 200 Hz to 180 kHz for this species. Common and bottlenose dolphin are classed as ‘mid-frequency’ cetaceans, however, the sound pressure levels at which there could be injury or behavioural effects are indicated to be the same for both ‘high’ and ‘mid-frequency’ cetaceans[61], (Table 12.19).

13.179. As indicated in the Existing Baseline section, the main marine mammals that could potentially be present in the vicinity of the Development site are considered to be harbour porpoise or grey seals, with common or bottlenose dolphins and harbour seals also potentially present although numbers of sightings in the Mersey Estuary are low. Consequently, the assessment has focussed on these species.

13.180. Marine mammal individuals could potentially be affected if the noise levels indicated in Table 12.19 are reached by the proposed piling works. It is considered that the noise levels indicated to

result in behavioural effects for pinnipeds (171 db re:1µPa^2-s (M_{pw})) would likely be evident at the source of pile driving while the noise level causing behavioural changes in harbour porpoise and dolphin species could also be reached (183 db re:1µPa^2-s (M_{hf})). It is considered that piling could result in noise levels that could cause injury of pinnipeds in water (186 db re:1µPa^2-s (M_{pw}) and noise levels that could cause injury to harbour porpoise and dolphins would be less likely to occur (198 db re:1µPa^2-s (M_{hf})). It is considered vessel noise levels would not be high enough to cause injury of marine mammals.

Table 13.15: Proposed injury criteria for high frequency cetaceans and pinnipeds in water (from Southall *et al*. 2007)

Marine mammal group	Sound type		
	Single pulses	**Multiple pulses**	**Nonpulses**
Proposed injury criteria			
High and mid frequency cetaceans			
Sound pressure level Sound exposure level	230 db re:1µPa (peak) 198 db re:1µPa^2-s (M_{hf})	230 db re:1µPa (peak) 198 db re:1µPa^2-s (M_{hf})	230 db re:1µPa (peak) 198 db re:1µPa^2-s (M_{hf})
Pinnipeds (in water)			
Sound pressure level Sound exposure level	218 db re:1µPa (peak) 186 db re:1µPa^2-s (M_{pw})	218 db re:1µPa (peak) 186 db re:1µPa^2-s (M_{pw})	218 db re:1µPa (peak) 203 db re:1µPa^2-s (M_{pw})
Proposed behavioural response criteria			
High and mid frequency cetaceans			
Sound pressure level Sound exposure level	224 db re:1µPa (peak) 183 db re:1µPa^2-s (M_{hf})	Not available	Not available
Pinnipeds (in water)			
Sound pressure level Sound exposure level	212 db re:1µPa (peak) 171 db re:1µPa^2-s (M_{pw})	Not available	Not available

13.181. Marine mammals are only occasionally recorded in the Mersey Estuary. However, as piling would be undertaken across a five month period (and when piling occurs it could be between 08:00 - 18:00 hours), for the purposes of assessment a precautionary approach has been undertaken and it is assumed that at some point during the piling programme they would potentially be in the vicinity of the works. An important consideration is that the although the noise levels discussed above could be evident at, or in the vicinity of, the piling source, noise levels would attenuate rapidly with increase distance from the piling activity.

13.182. Taking account of the points indicated above magnitude of effect is considered to be minor. The value of the receptor is considered to be very high and sensitivity to underwater noise is high. Overall, any effects are considered likely to be of **moderate adverse** significance. Consequently, further mitigation is required to reduce the significance of this effect.

Changes to Water Quality (Suspended Solids and Release of Sediment Chemicals)

13.183. Receptors potentially affected by this effect are plankton, subtidal habitats and species and birds.

13.184. Changes to water quality may occur as a result of activities disturbing the estuary bed which could lead to an increase in turbidity, and resuspension of bottom substrates could potentially result in the release of chemicals locked in the sediments to the water column (e.g. trace metals, hydrocarbons). Direct pollution of the water from other sources is considered separately below.

13.185. Site-specific survey indicated that there were exceedances of chemical standards primarily at stations within the sampled areas of the Site, with lower chemical concentrations at the stations a short distance north of the red line boundary. The station with greatest exceedances was located immediately next to the current jetty footprint with exceedances for a number of heavy metals and PAHs. The specific exceedances against different standards are covered in further detail in **Appendix 12.1**.

Phytoplankton and Zooplankton

13.186. Increases in suspended solids can inhibit photosynthesis of phytoplankton and can clog the feeding apparatus of zooplankton, however, the Site is naturally turbid and phytoplankton and zooplankton assemblages present at the Ste would be dispersed on each flood and ebb tide. For the reasons indicated above any changes to suspended solids levels or chemical concentrations that could affect phytoplankton would be local and temporary and the magnitude of the effect is considered to be negligible. The value is assessed to be medium (based on the higher value of phytoplankton) and sensitivity is assessed to be negligible and any effects would be of **negligible** significance.

Subtidal Habitats and Species

13.187. As indicated above the area of sediment expected to be resuspended due to demolition and construction works is expected to be small in relation to availability of similar habitat in the area. In terms of increases in suspended solids any resuspended solids are expected to quickly settle back out of the water column and organisms present in the area are expected to be well adapted to the naturally high levels of suspended solids within the estuarine waters at the Site. There is potential for concentrations of chemical to increase over the short term during the demolition and construction works, however, tidal movements would rapidly disperse any chemicals within the water column. Overall, any effects would be local and temporary and the magnitude of the effect is considered to be negligible. The value and sensitivity of subtidal species/habitats at the Development site is assessed to be high (due to the potential presence of the Section 41 list species *N. vectensis)*, however, sensitivity to the effect is low and any effects would be of **negligible** significance.

Birds

13.188. Changes to water quality may occur as a result of activities disturbing the estuary bed which could lead to a resuspension of bottom substrates that could potentially result in the release of chemicals locked in the sediments to the water column (e.g. trace metals, hydrocarbons). For four out of five species screened for assessment (oystercatcher, turnstone, redshank and black redstart) as they do not reside in the waters potentially effected then they would not be subjected to this. As common tern may be present in small numbers and forage within the water adjacent to the Site they may be subjected to this potential effect, however, any such changes in water quality would only be temporary and localised and the magnitude of effect would only be negligible. Consequently, regardless of the level of sensitivity for all five bird species as a result of any changes in water quality, the resulting significance of effect would be **negligible**.

Pollution Direct (e.g. Oil)

13.189. Receptors potentially affected by this effect are plankton, intertidal and subtidal habitats and species, fish, marine mammals and birds.

13.190. As part of the Works, a Construction Environmental Management Plan (CEMP) would be implemented and would provide inherent mitigation against potential pollution from activities at the Site (refer to **Chapter 6: Development Programme and Construction**).

13.191. The CEMP would include the following standard mitigation measures:

- Surface drainage would pass via settlement and oil interception facilities, where required, and discharge arrangements would be agreed with the utility provider;
- Stockpiling of contaminated materials would be avoided, wherever possible. Stockpiles would be located on areas of hard standing or on plastic sheeting to prevent mobile contaminants infiltrating into the underlying ground; and
- Potentially hazardous liquids on the Site such as fuels and chemicals would be managed and stored in accordance with best practice guidance, such as that published by the Environment Agency. Storage tank and container facilities would be appropriately bunded within designated areas and located away from surface water drains, docks and the Mersey Estuary.

13.192. An Emergency Incident Plan would be in place to deal with any spillages and/or pollution incidents. This would include the provision of on-site equipment for containing spillages, such as emergency booms and chemicals to soak up spillages. Any pollution incidents would be reported immediately to the appropriate regulatory bodies such as the Environment Agency.

Phytoplankton and Zooplankton

13.193. With the inherent mitigation design indicated above it is considered that introduction of pollutants to the water column from the works such as oils would largely be avoided, and with the Emergency Incident Plan in place any effects would be local and temporary and the magnitude of the effect is considered to be negligible. The value is assessed to be medium (based on the higher value of phytoplankton) and sensitivity is assessed to be negligible and any effects would be of **negligible** significance.

Intertidal and Subtidal Habitats and Species

13.194. With the inherent mitigation design indicated above it is considered that introduction of pollutants to the water column from the works such as oils would largely be avoided, and with the Emergency Incident Plan in place any effects would be local and temporary and the magnitude of the effect is considered to be negligible. The value and sensitivity of subtidal species/habitats at the Development site is assessed to be high (due to the potential presence of the Section 41 list species *N. vectensis)* and sensitivity to the effect is medium. Overall any effects would be of **minor adverse** significance.

Fish

13.195. In addition to the considerations above fish are mobile and individuals would be expected to be able to move away from any areas of pollution if required. Any effects would be local and temporary and the magnitude of the effect is considered to be negligible. The value and of fish at the Development site is assessed to be very high for diadromous fish, high for other protected fish species, and medium for other fish species and sensitivity to the effect is medium. Overall any effects are considered likely to be of **minor adverse** significance.

Marine Mammals

13.196. In addition to the considerations above marine mammals are mobile and individuals would be expected to be able to move away from any areas of pollution if required. Any effects would be local and temporary and the magnitude of the effect is considered to be negligible. The value and sensitivity of marine mammals is assessed to be very high and sensitivity to the effect is medium. Overall effects are considered likely to be of **minor adverse** significance.

Birds

13.197. Very few of the activities proposed to be undertaken for the construction of the Development involve the use of dangerous or polluting chemicals or substances. The main potential effect could derive from an oil spill on to the water. However, despite many bird species being **highly sensitive** to oil pollution incidents, if individuals come into direct contact with pollutants, the embedded mitigation provided in the CEMP reduces the potential for this to occur and any such incident would only be considered to be small scale, localised and temporary in nature. Consequently, regardless of the level of sensitivity for terrestrial and waterbird species it is deemed to be a negligible magnitude of effect as a result of any oil spills, with the resulting significance of effect being **negligible** or **minor adverse** in nature.

Collision Risk due to Vessel Movements

13.198. The receptor potentially affected by this effect is marine mammals.

13.199. Demolition and removal of the existing Princes Jetty would be conducted by barge. The number of barges to be operating in the area has not yet been finalised. however, it is understood that barges would be used extensively during demolition and construction. It is anticipated that tugs may be used to move the barges to Site and the barges would be stationary during demolition and removal operations and there may also be movements of crew boats in the area.

Marine Mammals

13.200. Collision of marine mammals with vessel propellers can lead to physical injury and in some cases fatalities. As indicated in the Existing Baseline section, the main marine mammal species potentially present within the vicinity of the Site are harbour porpoise, bottlenose dolphin and grey seal. These species and other marine mammals are agile and have fast swimming speeds which can help them evade collision with vessels.

13.201. Between 2005 and 2010, a total of 52 stranded bottlenose dolphins were reported to the UK Cetacean Strandings Investigation Programme (CSIP)[66]. A post mortem examination was conducted on 18 individuals and none of these were considered to have been a result of vessel strike[63]. Incidents of mortality or injury of harbour porpoise caused by vessels remain a very rare occurrence in UK waters, and out of 478 post mortem examinations carried out on harbour porpoises in the UK from 2005-2010 only four (0.8%) were attributed to probable effect from a ship or boat.

13.202. Despite being fast and agile, grey seals can collide with anthropogenic structures such as fishing gear and vessels[67]. Reduced perception levels of a collision threat through distraction, whilst undertaking other activities such as foraging and social interactions, are possible reasons for collisions[68] and seals can also be very curious of new foreign objects placed in their environment which could also increase the risk of collision. Seals are relatively robust to potential strikes, however, as they have a thick sub-dermal layer of blubber which would defend their vital organs from the worst of any blows[65]. In general, incidents of mortality or injury of grey seals caused by vessels remain a very rare occurrence in UK waters, although numerous instances are expected to remain unreported[69,63].

13.203. To evade a strike, marine mammals tend to require acoustic information to be able to determine in which direction and at what speed a vessel is moving. Where there is erratic movement of watercraft the risk of collision with personal water craft is considerably greater than that associated with other watercraft (e.g. a barge or ferry) travelling on a direct course. The vessels involved in the Development would be anticipated to transit relatively slowly and would travel in a direct course as far as possible.

13.204. The barges involved in the demolition of the existing jetty and construction of the new Cruise Liner Terminal would be small and once towed to Site are expected to remain relatively stationary just moving short distances as required, consequently the risk of a collision with marine mammals is considered to be extremely unlikely. Any effects would be local and temporary at the population level. Taking account of the points indicated above and the low numbers of marine mammals that are observed within the Mersey Estuary, the magnitude of effect is considered to be negligible. The value of the receptor is considered to be very high and sensitivity to the effect is considered to be low and any effects are considered likely to be of **negligible** significance.

Spread of Non-Native Species

13.205. The receptors potentially affected are plankton and intertidal and subtidal habitats and species.

13.206. Demolition and removal of the existing Princes Jetty would be conducted by barge. These barges are expected to remain within the Mersey Estuary for the entire demolition phase.

13.207. Within the UK, pathways of introduction involving vessel movements (fouling of hulls and ballast water) have been identified as the highest potential risk routes for the introduction of non-native species[70,71].This could either be from discharge of ballast water at site or via transportation on vessel hulls. During the construction phase the main vessels in operation would be barges, tugs and pilot vessels as indicated above for the 'Underwater Noise and Vibration' construction detail.

13.208. Once non-native species become established and disperse within a new habitat they can out-compete local species for space and resources, prey directly on local species, or introduce pathogens[72]. Consequently, the introduction of non-native species could potentially affect the ecological functioning of communities in the intertidal and subtidal zones.

13.209. The main non-native species recorded during the site-specific benthic survey were the invasive barnacle *A. modestus,* the starlet sea anemone *N. vectensis* and the American piddock *P. pholadiformis*.

13.210. A project-specific Biosecurity Risk Assessment would be produced which outlines numerous inherent mitigation design measures which would be incorporated into construction methods to limit the risk of introduction of invasive non-native species (INNS). Best practice guidelines would be followed and a standard INNS protocol would be implemented by the contractor. Biosecurity assessments would be undertaken for all vessels and further measures taken would include consideration of the following:

- Management of vehicles and vessels during demolition and construction including:
  - Biofouling
  - Ballast water
  - Movement of slow or stationary vehicles
  - Use of small vessels
- Ports and Harbour protocol:
  - Adherence to legislative guidance for specific port and harbour authorities
- Conforming to industry guidelines:
  - Follow best practice guidance, apply Best Available Technology (BAT)
- Conforming to guidelines on marine biosecurity planning as advised by Natural England:
  - Follow best practice guidance as set out in the Natural England and Natural Resources Wales Biosecurity Planning guidance[73].

Phytoplankton and Zooplankton

13.211. Site-specific survey has indicated that non-native species may be present in the area and larvae of individuals may be dispersed into the water column as a result of the Works and form part of the zooplankton present or consume phytoplankton present. Such changes, however, would not be expected to influence the plankton assemblage as a whole.

13.212. Any effects would be local and temporary at the population level and with the inherent mitigation design indicated above magnitude of effect is expected to be negligible. The value of the receptor is considered to be medium (based on the higher value of phytoplankton) and sensitivity is low, and any effects are considered likely to be of **negligible** significance.

Intertidal Habitats and Species

13.213. As determined by the site-specific survey *A. modestus* is already widespread on physical structures at the Development site including the walls and pile structures of the current jetty. Removing the current structures would result in removal of individuals from the Site, however, as this species is widespread in the Mersey Estuary and individuals would remain on the walls and would readily colonise the area and any new structures introduced.

13.214. Any effects would be local or national and permanent at the population level and with the inherent mitigation design indicated above magnitude of effect is expected to be minor. The value and sensitivity of the receptor is considered to be medium and any effects are considered likely to be of **minor adverse** significance.

Subtidal Habitats and Species

13.215. *A. modestus, N. vectensis* and *P. pholadiformis* were recorded within grab samples collected at the Development site. *A. modestus* was recorded within and outside the Site, *N. vectensis* was recorded at two stations outside the Site, while one juvenile *P. pholadiformis* was recorded within the Site. As indicated above, *A. modestus* is already widespread on physical structures at the Site and the Works could potentially lead to movement of any individuals of *P. pholadiformis* within the area.

13.216. *N. vectensis* is unusual in that it is a protected species which is usually characteristic of lagoon environments. The fact that it was recorded outside the Site indicates that its ability to colonise the area would not likely be affected by any aspect of the construction works.

13.217. If any effects did occur and new non-native species were introduced to the area it is considered effects would be local or national and permanent at the population level, however, with the inherent mitigation design indicated above magnitude of effect is expected to be minor. The value and sensitivity of the receptor is assessed to be medium (i.e. value of subtidal species and habitats without *N. vectensis*) and any effects are considered likely to be of **minor adverse** significance.

Physical Disturbance and Displacement (Indirect i.e. through the Food Chain)

13.218. Receptors potentially affected by this effect are fish and birds.

13.219. Where there are significant effects on invertebrates and fish, there is the potential for indirect effects on fish and birds via reduction in their food resources.

Fish

13.220. Fish are mobile and individuals would be able to move to different areas to forage as required. Effects identified for benthic plankton / benthic invertebrates have all been assessed to be of negligible or minor significance. Any effects would be local and temporary and the magnitude of

the effect is considered to be negligible. The value of fish at the Development site is assessed to be very high for diadromous fish, high for other protected fish species, and medium for other fish species and sensitivity to the effect is low. Overall any effects are considered likely to be of **negligible** significance.

Birds

13.221. Activities could lead to underwater noise sources disturbing underwater bird prey species such as fish. This in itself may indirectly affect bird species being able to find prey items due to the influence of noise on fish. Four out of five species screened for assessment (oystercatcher, turnstone, redshank and black redstart) do not rely on foraging for fish or in the waters potentially affected and would consequently not be subjected to this effect. Common tern are the only species of bird screened in for assessment that are reliant on fish species as prey items, and may be present in small numbers foraging within the water adjacent to the Site and may be subjected to this potential effect. The effect of underwater noise on local fish populations has been assessed to be of moderate significance before mitigation, however, any effect would be local and temporary and birds would be able to forage away from the Site if required and any potential effect would be of negligible magnitude for common terns. Consequently, regardless of sensitivity to any effect it is considered that the significance of effect would be **negligible** in nature.

Completed Development

13.222. A description of the operation of the proposed Development is provided in **Chapter 5: The Proposed Development**. The main pathways by which the Development is considered to potentially have an effect on marine ecology and ornithology during the operational phase have been outlined in **Table 13.1** and **Table** 13.2 and are listed below. Each is considered in more detail within the text below where appropriate:

- Physical disturbance and displacement (sediment accretion);
- Physical disturbance and displacement (visual);
- Airborne noise and vibration;
- Underwater noise and vibration;
- Pollution (direct e.g. oil);
- Collision Risk Due to Vessel Movements; and
- Spread of Invasive Non-Native Species.

Physical Disturbance and Displacement (Sediment Accretion)

13.223. Receptors potentially affected by this effect are intertidal and subtidal habitats and species and fish.

13.224. As indicated by flow modelling the introduction of the piled structure associated with the cruise terminal counters some of the effect of removing the existing structure in terms of sediment accretion[39]. The change in the extent of the piled structure would result in a small area with increased potential for accretion underneath the proposed piled structure[39]. All the predicted accretion effects would be limited to approximately 1 km from the existing jetty.

Intertidal and Subtidal Habitats and Species

13.225. The area of subtidal sediment potentially affected by this disturbance/change would occur upstream and downstream of the Site (but within a distance of 1 km)[39] and the area affected would still be very small in relation to the availability of similar habitats within the Site red line boundary and wider estuary. There could be a small change in the area of intertidal habitat due to

accretion. Changes would be gradual and any disturbed/displaced benthic invertebrates would be expected to survive such changes. Any effects would be local and temporary and the magnitude of the effect is considered to be negligible. The value and sensitivity of the subtidal species/habitats is assessed to be high (due to the potential presence of *N. vectensis*) and sensitivity is considered to be low. Overall, it is considered that any effects would be of **negligible** significance.

Fish

Fish are highly mobile and any fish physically disturbed due to sediment movement/changes in habitat would be able to avoid the area and return to the area if required once any disturbance has ceased. The type of habitat potentially disturbed is widespread within the Site boundary and wider Estuary so fish would not have to move far to find similar habitat. Changes would be gradual and any effects would be local and temporary and the magnitude of the effect is considered to be negligible. The value and sensitivity of fish at the Development site is assessed to be very high for diadromous fish, high for other protected fish species, and medium for other fish species, however, sensitivity to this effect is considered to be negligible. Overall, it is considered that any effects would be of **negligible** significance.

Physical Disturbance and Displacement (Visual)

13.226. Receptors potentially affected by this effect are marine mammals and birds.

13.227. During the operational phase the main source of direct visual disturbance would be any increase in vessel traffic as a result of the Development.

13.228. The existing Liverpool Cruise Terminal has been estimated to have been used by 62 cruise liners during the 2017 summer season (comprising 42 transit and 20 turnaround vessels). This is considered likely to equate to 12 or 13 cruise ships in the busiest months.

13.229. The predicted vessel usage for future years is indicated in **Table 13.16** with 2020 being the opening year. It is predicted that for the opening year there would be a 'worst case' of 14 cruise ships in the busiest month which is just two more cruise ships than currently use the existing terminal. In 2027, there is predicted to be a slight increase to 16 cruise ships in the busiest month. It should be noted that the new Cruise Terminal would replace the existing temporary Cruise Terminal, which would close when the new facility becomes operational.

Table 13.16: Predicted vessel usage of the new ferry terminal between 2018 and 2027. Medium vessel = 900 pax, large vessel = 1500 pax, extra large vessel = 2500 pax.

Year	Target Transit Vessels	Target Turnaround Vessels (Medium)	Target Turnaround Vessels (Large)	Target Turnaround Vessels (Extra Large)	Target Total
2018	36	23	1	1	**61**
2019	36	24	1	1	**62**
2020	37	10	19	1	**67**
2021	38	8	19	4	**69**
2022	39	8	20	4	**71**
2023	39	8	22	5	**74**
2024	40	8	24	6	**78**
2025	42	8	24	6	**80**

Year	Target Transit Vessels	Target Turnaround Vessels (Medium)	Target Turnaround Vessels (Large)	Target Turnaround Vessels (Extra Large)	Target Total
2026	42	8	24	6	**80**
2027	42	8	24	6	**80**

Note: Medium vessel = 900 passengers, large vessel = 1500 passengers, extra-large vessel = 2500 passengers.

Marine Mammals and Birds

13.230. It is considered that marine mammals and birds in the area are already habituated to regular movement of large vessels and associated visual disturbance within the Mersey Estuary. The predicted increase in vessel use of approximately an extra four cruise ships per month in the busiest months by 2027 would represent approximately a 33% increase during the busiest months in the number vessel using the existing terminal (which is currently approximately 12 per month).

13.231. Any effects would be local and temporary at the population level. Due to the relatively small increase in the numbers of cruise ships likely to be using the new cruise terminal per month the magnitude of effect is considered to be negligible. Considering the highest receptor value for these groupings the value of the receptor is considered to be very high, however, sensitivity to the effect is considered to be negligible. Overall, any effects are considered likely to be of **negligible** significance.

Airborne Noise and Vibration

13.232. Receptors potentially affected by this effect are birds.

13.233. The main potential increase in airborne noise and vibration during operation would be associated with an increased number of cruise ships transiting through the area and noise effects from operation of permanent sources associated with the Development in-particular fixed external plant;

13.234. As indicated above, however, the number of additional vessel movements per month would be relatively small and birds would be habituated to vessel movements in the area. Noise levels generated by fixed external plant at the Site are expected to be low.

Birds

13.235. The highest receptor value for any of the five bird species screened in for this assessment is considered to be medium. Any effects would be local and temporary and the magnitude of effect is considered to be negligible. Consequently, regardless of the sensitivity of any of the five receptors any effects are considered likely to be of **negligible** significance.

Underwater Noise and Vibration

13.236. Receptors potentially affected by this effect are fish and marine mammals.

13.237. The main potential increase in underwater noise and vibration during operation would be associated with an increased number of cruise ships transiting through the area and hoteling. As indicated above, however, the number of additional vessel movements per month would be relatively small and fish and marine mammals would be habituated to vessel movements in the area and associated underwater noise.

Fish and Marine Mammals

13.238. Any effects would be local and temporary at the population level and the magnitude of effect is considered to be negligible. Receptor value is considered to be very high and sensitivity to the effect is considered to be negligible. Consequently, any effects are considered likely to be of **negligible** significance.

Pollution (Direct e.g. Oil)

13.239. Receptors potentially affected by this effect are plankton, intertidal and subtidal habitats and species, fish, marine mammals and birds.

13.240. Strict protocols would be in place to minimise risks associated with oil spillages from the cruise ships utilising the new Cruise Terminal, as are currently in place for cruise ships currently using the area. The increase in the annual number of cruise ships using the new terminal compared to the existing terminal would be small.

Plankton, Intertidal and Subtidal Habitats and Species, Fish, Marine Mammals and Birds

13.241. Overall, this effect is expected to be 'no change' so any effects are n**eutral** for all receptors.

Collision Risk due to Vessel Movements

13.242. The receptor potentially affected by this effect is marine mammals.

13.243. As indicated above there would be a small increase in the number of cruise ships frequenting the area of the new Cruise Terminal, however, in relation to the wider Estuary environment the projected number of cruise ships per month is only slightly more than the number currently using the existing terminal.

Marine Mammals

13.244. The information considered previously when assessing this affect for the demolition and construction phase of the Development is relevant here. Marine mammals potentially present in the Mersey Estuary are expected to be habituated to the presence of vessels within the Estuary and Liverpool Bay and changes in the numbers of cruise ships transiting through the estuary are small with only a slight increase in the potential for collision to occur.

13.245. Any effects would be local and temporary at the population level and the magnitude of effect is considered to be negligible. Receptor value is considered to be very high and sensitivity to the effect is low. Consequently, any effects are considered likely to be of **minor adverse** significance.

Spread of Non-Native Species

13.246. The receptors potentially affected are plankton and intertidal and subtidal habitats and species.

13.247. Cruise liners using the new Cruise Liner Terminal would arrive from locations worldwide. Non-native species can be present within ballast water used to maintain stability of the vessel and non-native species could be transferred via the hulls of vessels.

13.248. The inherent mitigation design indicated for the demolition and construction phase is expected to be applied to the operational phase. The potential effect of spread and introduction of non-native species on zooplankton, intertidal and subtidal species has been assessed in the construction phase section above. It is considered that the assessment for the demolition and construction phase is applicable to the operational phase, although potential effects would be restricted to the potential introduction of non-native species via cruise ships.

Phytoplankton and Zooplankton

13.249. If any effects did occur and new non-native species were introduced to the plankton it is considered effects would be local and temporary at the population level and with the inherent mitigation design indicated above magnitude of effect is expected to be minor. The value of the receptor is considered to be medium (based on the higher value of phytoplankton) and sensitivity is low. Overall, any effects are considered likely to be of **negligible** significance.

Intertidal Habitats and Species

13.250. As indicated for the demolition and construction phase any effects would be local or national and permanent at the population level, and with the inherent mitigation design indicated above magnitude of effect is expected to be minor. The value and sensitivity of the receptor is considered to be medium. Overall, any effects are considered likely to be of **minor adverse** significance.

Subtidal Habitats and Species

13.251. If any effects did occur and new non-native species were introduced to the area it is considered effects would be local or national and permanent at the population level, and with the inherent mitigation design indicated above magnitude of effect is expected to be minor. The value and sensitivity of the receptor is assessed to be medium (i.e. value of subtidal species and habitats without *N. vectensis*) and any effects are considered likely to be of **minor adverse** significance.

Mitigation Measures and Likely Residual Effects

Demolition and Construction

13.252. It was determined that the only potential effect for which additional mitigation would be required to result in an effect of minor significance or less was the potential effect of underwater noise generated by pile driving activity during construction of the new jetty. This effect was assessed to be of moderate adverse significance for fish and marine mammals.

13.253. It is proposed that a soft-start piling approach is implemented. This involves gradually increasing the force of piling, thereby steadily increasing the SPLs generated over a period of time. This would alert individuals within the area, without exposing them to more intense SPLs, and provide an opportunity for them to move away from the noise source. This technique is recommended as best practice by the Joint Nature Conservation Committee for pile driving operations[74] and is considered appropriate for the proposed development.

13.254. Where possible, potential noise levels generated during construction would be reduced by using vibro-piling instead of percussion piling. The SPL generated by vibro-piling has lower sound pressure emission levels than for percussive piling, with noise levels from vibro-piling generally in the region of 20-35 dB re: 1 µ Pa lower[47,48].

13.255. With these measures in place it is considered that any effects would be local and temporary and magnitude of the effect is considered to be negligible. The value of the receptor is considered to be very high and sensitivity of the receptor to underwater noise is assessed to be high. Overall, residual significance of effect would be **minor adverse** significance.

Completed Development

13.256. For all of the effects assessed for the completed Development, significance of effect was considered to be minor adverse significance or lower for all receptors. Consequently, no additional mitigation measures are proposed for the completed Development.

Summary

13.257. In the absence of mitigation, the Development was assessed to have likely significant effects (as defined by the CIEEM Guidelines[9]) as follows:

- During demolition and construction, it is considered that the use of percussion pile driving would have a temporary, local effect of moderate adverse significance on fish and marine mammals;

13.258. Following the mitigation recommended in this chapter the following residual effects are expected:

- The use of a soft start approach to piling (i.e. gradually increasing the force of piling, thereby steadily increasing the level of noise generated over a period of time and giving fish and marine mammals an opportunity to move away from the area); and the use of vibro-piling where possible. With these measures in place it is considered that there would be a temporary, local effect of minor adverse significance on fish and marine mammals.

13.259. There would, therefore, be no significant effects to marine ecology, ornithology or terrestrial ecology as a result of the demolition and construction phase, or once the proposed Development is operational.

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14. Coastal Processes, Sediment Transport and Sediment Contamination

Introduction

14.1. This chapter, which was prepared by HR Wallingford Ltd, presents an assessment of the likely coastal processes, sediment transport and sediment contamination. In particular, consideration is given in the assessment to tidal flows, waves, sediment transport and sediment quality.

14.2. This chapter provides a description of the methods used in the assessment. This is followed by a description of the relevant baseline conditions of the Site and surrounding area, together with an assessment of the likely potential effects of the Development during the Site preparation and construction works and once the Development is completed and operational. Mitigation measures are identified where appropriate to avoid, reduce or offset any adverse effects identified and / or enhance likely beneficial effects. Taking account of the mitigation measures, the nature and significance of the likely residual effects are described.

14.3. The chapter is accompanied by the following appendix, provided in ES Volume 3:

- **Appendix 14.1:** Hydrodynamic and Coastal Process Studies; and
- **Appendix 14.2**: Legislation and Guidance.

Assessment Methodology and Significance Criteria

Data Collection Methods

Field Survey

14.4. A survey was undertaken in the Mersey Estuary by APEM to acquire sediment and water quality samples. The results of the sediment and water sample analysis are used to provide information on the status of potentially contaminated sediments at the Site and in the Mersey Estuary

14.5. The sediment and water samples were analysed for numerous physico-chemical parameters including heavy and trace metals, hydrocarbons (polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs)).

14.6. The analysis results are compared to the following standards and action levels to assess the level of potential contamination:

- CEFAS Action Levels 1 and 2;
- CCME thresholds; and
- OSPAR 2012 threshold.

Additional Data Sources

14.7. For the offshore boundary, data were extracted from the TOPEX/Poseidon Cross-Over Global Inverse Solution model (TPXO). The three tidal level series (Llandudno, Heysham and TPXO data) were all corrected to the same vertical datum as the model (Chart Datum at Liverpool).

14.8. The existing tidal model was previously calibrated using ADCP transect measurements during a spring tide in October 1995 and validated for a neap tide during January 1996[1].

14.9. As for the flow model the best available data for sediment transport was from the ADCP transect survey in 1995 undertaken across the Mersey Narrows. During the survey the data from regular water sampling was used to convert the ADCP backscatter to suspended sediment concentration.

Combination of the suspended sediment concentration with the water discharge taken from the ADCP data allowed calculation of the total sediment flux through the observed transect.

Forecasting Methods

14.10. Forecasting of wave, tidal flow and sediment transport was undertaken as part of the EIA process. The forecasting process included both numerical models and specialist desk studies:

1. **Wave desk study:** A desk study assessing the effect of the proposed Development. The assessment was based on previous work conducted in the area and included reactivating an existing model to allow data to be extracted from the Princes Jetty area. However, no specific modelling has been undertaken for the Site as part of this assessment as the effect of the proposed Development on waves was found to be small.
2. **Tidal flow modelling:** The TELEMAC-3D flow model is used for the tidal flow modelling due to the presence of a known longitudinal salinity gradient which would not be captured by a 2D model.

   Also for sediment transport modelling and predictions of channel infill it is important to have a 3D flow model as the highest sediment concentrations are typically near the bed and therefore accurate modelling of near bed currents is key.
3. **Sediment transport modelling:** For the estuarine sediment transport model the 3D mud transport module of TELEMAC-3D, namely SEDI-3D, was applied. This model couples the sediment transport directly with the 3D flow modelling which allows the increased density caused by the sediment to be included in the hydrodynamic modelling. This effect is important in a highly turbid estuarine area such as the Mersey.

14.11. Due to the expected negligible nature of water level changes as a result of climate change within the Mersey, the numerical modelling parameters have not included any assessment of climate change.

Wave Desk Study

14.12. For the majority of the time, wave conditions at the Site would be due to waves generated within the estuary by local winds. The locally generated wave conditions are largest when the wind is blowing along the estuary, either from the north and northwest or from the south and southeast.

14.13. HR Wallingford has carried out a number of wave studies in the Mersey Estuary. This includes a study in 2011[2] at a site on the Birkenhead shore using the numerical wave model, SWAN. This wave model was restored and wave conditions extracted for the Site at Princes Jetty. Note that the model was created for a different site and has not been revised for this study so the wave conditions are indicative only and hence not suitable for detailed design of the structure.

14.14. The desk study included the calculation of indicative extreme wave conditions for four wind directions, and for return periods of 1 year, 10 years and 50 years. The calculations were run with water levels of 9.3 mCD, equivalent to MHWS, and 1.1 m, equivalent to MLWS.

Tidal Flow Modelling

Choice of Model

14.15. A 3D flow model has been used for the modelling because the known influence of a longitudinal salinity gradient tends to create variation in the current magnitude in the water column which would not be captured by a 2D, depth averaged model. Also for sediment transport modelling and predictions of channel infill it is important to have a 3D flow model as the highest sediment

concentrations are typically near the bed and therefore accurate modelling of near bed currents is required.

14.16. The TELEMAC-3D flow model was used. It is based on a completely flexible grid made of triangles and runs on parallel high performance computers so provides high resolution results with a reasonable timeframe. HR Wallingford has 25 years' experience of using the TELEMAC suite of models, including the Mersey Estuary.

14.17. The flexible triangular grid employed by TELEMAC-3D allows accurate representation of complex coastlines and seabed features such as the jetty, pontoons and other existing nearby features. The grid also provides complete control on the level of detail to be modelled such that particular features can be modelled in detail whilst using a larger grid to keep any imposed boundary conditions distant. This process focusses the computational effort where it is needed to maintain practicable run times and file sizes.

Model Mesh

14.18. The applied TELEMAC-3D model covered the Mersey Estuary from approximately the tidal limit extending to the estuary mouth and out into Liverpool Bay. The full extent of the model mesh is shown in **Figure 14.1**. The horizontal extent of the mesh from the estuary mouth is around 45km in both the west and north directions, encompassing both the Dee and Ribble estuaries. The western flow boundary is at about the same longitude as Llandudno and the northern boundary is at Fleetwood (south of Heysham).

14.19. The flexible grid system, once established, can be further refined in additional areas of interest whilst keeping the mesh the same elsewhere and hence maintaining the accuracy of the calibrated model. This method was particularly suitable for the needs of the study for the proposed Development as the calibrated model could be further refined at the study Site.

14.20. The model mesh was refined to accurately include the form of the existing pontoons, the existing Princes Jetty and the proposed piled platform for the cruise terminal. To enable an accurate representation of the structures the smallest model mesh size was in the range 2-5 m.

14.21. To provide a practical tool the individual piles were not modelled, rather the drag force of the complied piles was calculated based on the size, shape and number of piles.

14.22. For the study, the TELEMAC-3D model used a sigma layer system to represent variation in currents in the vertical. Sigma layers divide the vertical into a user defined number of layers at each model node. For the present case, seven equally spaced vertical layers were used for the model simulations.

Model Layout

14.23. Three layouts were modelled;

1. The existing layout with Princes Jetty in place as well as the nearby pontoons and other structures (**Figure 14.2**),
2. The layout with Princes Jetty removed,
3. The layout with the piled platform for the cruise terminal added (**Figure 14.3**).

Boundary Conditions

14.24. The sea boundary data on the coast were taken from tidal predictions at Llandudno and Heysham. For the north tidal boundary, the Heysham predicted tidal levels were scaled by 5% since the model boundary was at Fleetwood. For the offshore boundary, data were extracted from the TOPEX/Poseidon Cross-Over Global Inverse Solution model (TPXO). The three tidal

level series (Llandudno, Heysham and TPXO data) were all corrected to the same vertical datum as the model (Chart Datum at Liverpool). The tidal levels were then linearly interpolated to each model node along the tidal boundaries.

14.25. The model was run for a one month duration, including a period of approximately average range spring tides (based on April 2007 data). Freshwater runoff during this period was assumed to be constant with discharges of 11 and 19 m^3 per second (equivalent to the mean daily gauged flow) applied at the Weaver and Mersey River boundaries respectively. No wind or wave forcing was included in the model as the tides are the main driving factor for currents at the Site.

Model Calibration

14.26. The existing model was previously calibrated using ADCP transect measurements during a spring tide in October 1995 and validated for a neap tide during January 1996[1]. The accuracy of the model following its refinements at the Princes Jetty study site was confirmed by comparison with the same data. **Figure 14.4** shows the comparison of the total discharge though the Mersey Narrows as observed in 1995 and as simulated by the model.

Sediment Transport Modelling

Choice of Model

14.27. For the estuarine sediment transport model, the 3D mud transport module of TELEMAC-3D (SEDI-3D) was applied. This model couples the sediment transport directly with the 3D flow modelling which allows the increased density caused by the sediment to be included in the hydrodynamic modelling. This effect is considered to be important in a highly turbid estuarine area such as the Mersey.

14.28. The mud transport model of the Mersey was first set up for the Liverpool2 container terminal studies[1] which describes the process of choosing the main parameter settings.

14.29. Settling of the suspended mud was parameterised using a constant settling velocity of 1 mm/s.

14.30. A two layer bed model was used for modelling the bed exchange processes in the model. Such an approach has been used previously by HR Wallingford for numerous studies of estuary mud transport and has been found to give robust results.

14.31. In the bed model, the uppermost sediment layer represents the mobile sediment that is picked up, advected and deposited each tide. Deposition is assumed to occur continuously into this top layer using a settling velocity of 1 mm/s multiplied by the near bed suspended concentration. Net erosion occurs in the model if the erosion flux from the bed is greater than the deposition flux. A critical shear stress value for erosion was set at 0.2 N/m^2 for the top bed layer. When this threshold is exceeded by the flows, erosion is initiated and material erodes from the top bed layer at a rate predefined by the erosion rate constant[3]. In this case the erosion rate constant was calibrated iteratively to a value of $5x10^{-5}$ $kg/m^2/s$. This value is within the range used by other researchers generally found in the literature[4].

14.32. The underlying bed layer represents the in situ sediment that has experienced previous consolidation and bed armouring. The critical shear stress for erosion for this layer was parameterised with spatially varied values. The values were calculated as the average of the shear stress experienced at each node during a set of mean spring tides. The minimum value was then limited to at least 0.4 N/m^2. The erosion rate for the lower bed layer was set to the same value as the top layer (5e-5 $kg/m^2/s$). The dry density for both of the bed layers was assumed to be 500 kg/m^3.

14.33. The Mersey Estuary and Liverpool Bay rarely experience completely calm conditions and therefore waves were included in the modelling. Waves are important for increasing the bed shear stresses and thus mobilising settled sediment and preventing deposition. A representative, though schematic, wave condition was applied throughout the model domain comprising a constant wave height of 0.5m with a 4s period applied to the model everywhere in the offshore region, reducing through the Narrows over a distance of 5 km to a value of 0.1 m within the estuary. These wave conditions are lower than the annual median wave height of 0.7 m predicted at the end of Queens Channel[5]. Additional wave data from a wave buoy at New Brighton over the period July 2013 to June 2014 shows a long term average wave height of 0.26 m with variation from summer to winter of +/- 30%.

Initial and Boundary Conditions

14.34. At the start of each model run, mud deposits were initialised everywhere except in shallow areas higher than -1m CD in the offshore area. These regions were assumed to be predominantly sandy and therefore unlikely to be a source of much fine sediment. In the other areas, for the upper and lower bed layer thicknesses were set to 0.01m and 0.2m respectively.

14.35. The suspended concentration in the model was initialised to zero everywhere. The time taken for the concentrations to "spin up" was observed to be of the order of two or three tidal cycles.

Model Calibration

14.36. As for the flow model the best available data for sediment transport was from the ADCP transect survey in 1995 undertaken across the Mersey Narrows. During the survey the data from regular water sampling was used to convert the ADCP backscatter to suspended sediment concentration. Combination of the suspended sediment concentration with the water discharge taken from the ADCP data allowed calculation of the total sediment flux through the observed transect.

14.37. **Figure 14.5** shows the comparison of the total sediment flux though the Mersey Narrows as observed in October 1995 and as simulated by the model. The comparison confirms that the model accurately represents the total amount of fine sediment passing the study site.

Assessment Methodology and Significance Criteria

14.38. The assessment methodology broadly follows the process outlined in BSI Standard PD 6900:2015[6]. The process was guided by the procedures set out in **Figure 14.6**.

Identifying Receptors

14.39. The process starts by identifying both the features of interest that could be affected and the environmental changes resulting from the proposed activities.

14.40. The response by the Merseyside Environmental Advisory Service to the EIA Scoping Report submitted by Waterman (refer to **Chapter 2: EIA Methodology**) stated that "*The physical and chemical composition of the dock sediments to be removed and/or disturbed by the proposed development will need to be known to inform impact assessment and mitigation, re-use potential and disposal options e.g. environmental permit requirements*".

14.41. For that reason, in addition to the assessment of sediment transport effects, the levels of potential sediment contamination have also been considered as part of the assessment and included in the baseline environment.

14.42. Therefore, the receptors identified for assessment in this chapter are as follows:

- Changes in tidal flow regime;

- Transport of estuarine sediments, including:
  - Deposition of sediments within the river;
  - Presence of potentially contaminated sediment;
- Effects of waves on the Development.

14.43. Assessment of effects on tidal flow, waves and sediment transport is a quantitative process; however, there are no established thresholds for determining significance. Therefore the significance assessment process is considered to be qualitative and based on expert judgement.

14.44. Assessment of the level of sediment contamination is quantitative as there are both site specific data on potential contaminant levels available, and established environmental thresholds from nature conservation bodies both within the UK and internationally.

Receptor Sensitivity

14.45. Once the receptors are identified the nature of environmental changes in terms of the natural conditions of the system (i.e. the baseline environment), level of environmental change and the sensitivity of the specific receptors must be understood. This provides a sensitivity assessment for the receptor.

Table 14.1: Receptor Sensitivity

Sensitivity	Description
Negligible	Peak tidal flow velocities at the Site exceed 1.5ms^{-1} The significant wave heights at the Site exceed 1.5m There is a high level of either erosion or accretion occurring at the Site Concentrations of sediment contamination do not exceed 1st tier thresholds (e.g. Cefas Action Level 1 or CCME Temporary Effect Levels)
Minor	Peak tidal flow velocities at the Site vary between 1.5 and 1.0ms^{-1} The significant wave heights at the Site lie between 1.5 and 1.0m There is a moderate level of either erosion or accretion occurring at the Site Concentrations of sediment contamination may exceed 1st tier thresholds (e.g. Cefas Action Level 1 or CCME Temporary Effect Levels) in some areas, but predominantly remain below these thresholds.
Moderate	Peak tidal flow velocities at the Site vary between 1.0 and 0.5ms^{-1} The significant wave heights at the Site lie between 1.0 and 0.5m There is a low level of either erosion or accretion occurring at the Site Concentrations of sediment contamination across the site all lie between the 1st and 2nd tier thresholds (e.g. Cefas Action Level 2 or CCME Permanent Effect Levels).
Major	Peak tidal flow velocities at the Site lie below 0.5ms^{-1} The significant wave heights at the Site lie below 0.5m There is a negligible level of either erosion or accretion occurring at the Site Levels of sediment contamination substantially exceed all 2nd tier thresholds (e.g. Cefas Action Level 2 or CCME Permanent Effect Levels)

14.46. The sensitivity of receptors assumes that those with a high level of natural temporal variation are implicitly less susceptible to effects from the Development.

Assessment of Significance

14.47. The potential environmental change has been assessed in terms of magnitude and the probability of the change occurring. Magnitude considers both temporal and spatial aspects (**Table 14.2**).

These terms will also be used to describe the initial and residual effects associated with the Development.

14.48. The probability and magnitude of the effect form a matrix (
Table 14.3) that is used to determine the level of change perceived by the receptor.

Table 14.2: Temporal and spatial terminology

Term	Description
Reversibility	• **Temporary** effects are those associated with the Site preparation and construction works; • **Permanent** effects are those associated with the completed and operational Development;
Scale	• **Site-wide** effects are those affecting receptors within the Site only; • **Local** effects are those affecting neighbouring receptors; • **District** effects are those which are likely to occur to receptors beyond the immediate neighbouring receptors, i.e. within central Liverpool; • **Regional** effects are those affecting receptors within the wider Liverpool area

Table 14.3: Environmental change combining magnitude and probability

Probability of Occurrence	Magnitude			
	Negligible	Minor	Moderate	Major
Negligible	Negligible	Negligible	Negligible	Negligible
Low	Negligible	Minor	Minor	Minor
Moderate	Negligible	Minor	Moderate	Moderate
High	Negligible	Minor	Moderate	Major

14.50. The sensitivity and environmental change inform the assessment of the significance of the effect. The significance of the effect was determined guided by the matrix presented in **Table 14.4**. In line with CIEEM guidance[7], and therefore unlike the other technical chapters in this ES, only effects that are of moderate or major significance represent those with the potential to be 'significant' in EIA terms. Significance descriptions used in this chapter are provided in

14.50. **Table** 14.5.

Table 14.4: Assessment of Significance

Sensitivity	Environmental Change			
	Negligible	Minor	Moderate	Major
Negligible	Minor	Minor	Minor	Minor
Minor	Minor	Minor	Moderate	Moderate
Moderate	Minor	Moderate	Moderate	Moderate
Major	Minor	Moderate	Moderate	Major

Table 14.5: Significance Criteria

Term	Description	Mitigation Recommended?
Beneficial effect	Major significance	No
	Moderate significance	No
	Minor significance	No
Negligible effect	No significant effect (either adverse or beneficial) to an environmental resource or receptor	No
Adverse effect	Minor significance	No
	Moderate significance	Yes
	Major significance	Yes

Assumptions and Limitations

14.52. There are a number of assumptions and limitations inherent in the assessment process. These are detailed below:

- Numerical modelling does not take into account sea level rise associated with climate change;
- It is assumed that the final Development design has incorporated technical consideration relating to aspects such as:
  - Scour (e.g. depth and dimensions of piles);
  - Sediment accretion; and
  - Emergency plans to reduce the potential for pollution from the Development.
- Cruise ships utilising the Development would be of various lengths, sizes, drafts and power ratings; and
- Qualitative assessment of significant effects is based on expert judgement.

Baseline Conditions

14.53. This section describes the existing aspects of the marine environment at the Site in the Mersey Estuary. This covers bathymetry, tidal flows, waves, sediment transport and sediment quality aspects relevant to this project

Bathymetry

General

14.54. The River Mersey flows west towards Liverpool and becomes tidal at Howley Weir. The River Weaver also enters at the head of the estuary.

14.55. The estuary has a total area of approximately 8,900 ha, 5,600 ha of which are intertidal sandflats and mudflats[8].

14.56. The estuary can be divided into four separate areas:

- Upper Estuary: A narrow (<1.5 km wide) upper estuary section between Howley Weir and Hale Head. This section is characterised by two main channels that meander through highly mobile intertidal sandflats and mudflats which are exposed at low tide. Areas of saltmarsh fringe both the north and south banks along the majority of this section[9];

- Middle Estuary: A wide inner estuary basin that extends from Hale head to Dingle point. This section is predominantly characterised by shifting sand banks and three meandering channels: the Garston Channel (along the north bank); the Eastham Channel (along the south bank) and the Middle Deep Channel;
- The Narrows: This section of the estuary extends from Dingle Point to New Brighton. The area is comprised of a narrow (1.5 km wide) entrance channel which is bounded by Permo-Triassic sandstone outcrops at New Brighton and Liverpool. The Narrows stretch for a distance of approximately 10km with a mean depth of 15m, although it may exceed 20m in certain areas[10]. The Site is located in this section of the estuary; and
- The Outer Estuary: This area extends seaward from New Brighton and includes large areas of inter-tidal sand and mud banks in Liverpool Bay on the Irish Sea.

14.57. Bathymetric changes within the Mersey have been subject to detailed monitoring for many years in relation to navigation. The effort has focussed on the major estuary channel and associated banks, with less attention given to the intertidal areas[11].

14.58. Dredging has been, and continues to be, required to maintain water depths in the navigation channels and docks[12,13]

14.59. Tidal propagation is affected by changes in bathymetry and, to a lesser degree, to variations in bed-roughness determined by surficial sediments. Sediment transport patterns modulate this response providing a longer term broad balance.

The Site

14.60. The Site is located within The Narrows section of the Mersey Estuary, on the north-eastern bank.

14.61. The water depths in the immediate vicinity of the river bank are less than 10m. This includes the area proposed for the Development footprint (**Figure 14.7**).

14.62. Towards the main estuary channel, the water depth increases rapidly to between 10 and 11m immediately offshore of the Site. The water depths continue to increase to between 11 and 15m water depth in the centre of the navigational channel.

Tidal Flow

Tidal Cycle and Range

14.63. The River Mersey is subject to a semi-diurnal macrotidal (range >4 m) regime. The tidal range in the estuary can vary from 4m at neap tides to approximately 10m during spring tides (**Table 14.6**). The largest ranges occur at the seaward end of the Upper Estuary[14].

Table 14.6: Example tidal heights and ranges in the Mersey estuary

Station	Metres above Liverpool Bay Datum								
	Mean Springs			Mean			Mean Neaps		
	HW	LW	Range	HW	LW	Range	HW	LW	Range
Gladstone Dock	8.7	0.5	8.2	7.9	1.4	6.4	7.0	2.3	4.6
Princes Pier	8.8	0.5	8.4	7.9	1.4	6.5	7.0	2.3	4.7
Eastham	9.1	0.3	8.9	8.2	1.3	6.9	7.3	2.3	5.0
Widnes	9.5	5.0	4.5	8.5	4.9	3.6	7.5	4.8	2.7
Fiddler's Ferry	9.8	6.9	2.9	8.7	6.9	1.8	7.6	6.8	0.8

14.64. The flow velocities (as measured at Gladstone Dock) during the spring tides can vary from 0.46 to 2.26 ms^{-1}. Neap tide velocities are lower, at between 0.26 and 1.23 ms^{-1} (**Table 14.7**).

14.65. The main tidal flows are located in the centre of the river channel at Dingle Point (in the vicinity of the Site). Recorded velocities of approximately 1.65 ms^{-1} have been measured[13]. The flow velocities were observed to decrease closer to the bank.

Table 14.7: Example tidal velocities in the Mersey Estuary

Gladstone Dock			
Hours	**Direction**	**Spring**	**Neap**
-6	319	0.46	0.26
-5	No data	No data	165
-4	146	0.98	0.51
-3	146	2.26	1.23
-2	145	1.95	1.08
-1	145	1.65	0.93
0	136	0.51	0.26
1	324	1.23	0.67
2	327	2.16	1.18
3	331	1.7	0.93
4	329	1.34	0.72
5	328	0.98	0.51
6	325	0.62	0.31

14.66. The Estuary is generally flood dominant with the ebb having a slightly longer phase compared to the flood. At Liverpool, the ebb tide duration is 6.75 hours, whilst the flood tide duration is 5.5 hours. The ebb and flood currents follow different courses within the estuary, resulting in complex and dynamic channels and sandbanks.

Tidal Excursion and Flushing

14.67. Sediment (coarse fraction) movement within the estuary is driven by the peak velocities on flood and ebb tides[15]. This movement of a water body between high and low waters is known as the tidal excursion, the magnitude of which can be calculated from bathymetric and tidal height and time data.

14.68. Tidal flushing refers to the systematic replacement of water in a bay or estuary as a result of tidal flow and the extents of the tidal excursion. The seaward movement of water in an estuary is governed by the input of fresh water at its head, from tributaries entering along its length and from effluent outfalls.

14.69. The flushing time of the whole of the Mersey estuary has been estimated at between 20 and 50 days[16]. However, the flushing time for the area around the Site (The Narrows) has been estimated at approximately 5 days[13,17] indicating a high tidal flow rate.

14.70. The existing current flows for the flood and ebb tide are shown in **Figure 14.9** and **Figure 14.10**, respectively. The figures also show tidal current vectors indicating the direction.

Extreme Events

14.71. Some of the highest storm surges in the UK are found on the West Coast in Liverpool Bay. Such surges can reach around 2m in height and can increase tidal currents by up to 0.6m/s[18]. Such surges are likely to lead to increases in water levels and currents in the Mersey Estuary.

14.72. The tidal bore on the Mersey River may occur during very high spring tides (above 10 metres CD at Liverpool). These conditions only occur a few days each year. However, lower tides can produce tidal bores if other factors are favourable such as a period of dry weather reducing fresh water flow in the rivers.

14.73. The River bore may be seen opposite Hale Point about 2hr 25 min before HW Liverpool. From the park at Widnes West Bank it may be seen passing under the Runcorn road and rail bridges about 1hr 50 min before HW Liverpool. Under good conditions the bore may be seen as far as Warrington passing under the rail bridge south of Bank Quay station about 20 min before HW Liverpool. It passes rapidly upstream and arrives at Howley Weir just before HW Liverpool[19].

Sensitive Receptors

14.74. The tidal streams in The Narrows regularly exceed 1.5ms^{-1} during periods of peak flow (**Table 14.7**). The assessment of the sensitivity of the changes in tidal flow regime (receptor) are presented in **Table 14.8**. The assessment demonstrates that tidal flows, as a receptor, have a negligible sensitivity.

Table 14.8: Sensitivity assessment for changes in tidal flow regime

Parameter	Description
Receptor	Changes in tidal flow regime
Features of interest	Current speeds and direction within the estuary
Temporal variability	High level of temporal variability due to the tidal cycle
Sensitivity	**Negligible**

Wave Effects

Wave Environment

14.75. The Site is located in The Narrows area of the Mersey estuary, approximately 4.5km south of the entrance.

14.76. Due to the shape (narrow entrance) and macrotidal nature of the estuary, there is a strong tidal influence on the wave regime in the estuary. At low tide the banks outside the Mersey entrance, e.g. Great Burbo Bank and Brazil Bank, are very shallow and dry in some areas and so will shelter the Site from most of the wave energy entering from Liverpool Bay and the Irish Sea.

14.77. The ebb tide is expected to block waves entering the estuary from the Irish Sea. It is likely to be only at high tide and with a wind from the northwest that some wave energy from the Irish Sea may reach the Site[20].

14.78. The existing wave heights within the estuary will be limited by the fetch length, as well as the bathymetric shape or features and the tidal range. The longest fetch distance will be along an axis orientated northwest-southeast.

14.79. For the majority of the time, wave conditions at the Site will be due to waves generated within the estuary by local wind conditions. The locally generated wave conditions will be largest when the

wind is blowing along the estuary, either from the north and northwest or from the south and southeast.

14.80. Indicative extreme wave conditions for four wind directions and return periods of 1 year, 10 years and 50 years at the Site are presented in **Table 14.9**. The model was run with water levels of 9.3 mCD, equivalent to MHWS, and 1.1 m, equivalent to MLWS.

14.81. The largest waves occur under winds from 300°N, where waves generated within the estuary combine with some wave energy from the Irish Sea. The next largest waves in the sample are caused by waves from 180°N.

14.82. Water level has a strong effect on wave conditions. The largest predicted wave height at MLWS, 1.1 m, is just more than half that at MHWS, 2.0 m. MHWS and MLWS occur at slack tide. Note that the effect of tidal currents was not included in the modelling.

Table 14.9: Indicative wave conditions at site of proposed cruise terminal.

Return Period (years)	Wind Direction (°N)	MHWS			MLWS		
		Hs (m)	Tp (s)	Dir (°N)	Hs (m)	Tp (s)	Dir (°N)
1	150	1.1	3.9	148	0.7	3.0	162
	180	1.2	3.9	153	0.8	3.1	169
	300	1.5	4.9	322	0.8	3.2	317
	330	1.2	4.4	326	0.6	3.2	327
10	150	1.3	4.1	149	0.8	3.3	164
	180	1.5	4.3	154	0.9	3.4	171
	300	1.8	5.2	321	1.0	3.6	314
	330	1.4	4.8	326	0.7	3.5	325
50	150	1.4	4.3	149	0.8	3.4	165
	180	1.7	4.4	154	1.0	3.6	172
	300	2.0	5.4	321	1.1	3.7	312
	330	1.6	5.0	326	0.8	3.6	324

Note: These calculations are not to be used for detailed design

Wind Environment

14.83. Wind speed and direction data was acquired from a meteorological station at Liverpool Airport. The dominant wind direction showed strong north-western and south-eastern components.

14.84. Maximum annual wind speeds in the vicinity of Liverpool were recorded at up to 27 knots, although the wind speeds could exceed 40 knots during storm events. Light to moderate winds (7 to 16 knots) predominate throughout the year, although winds are stronger during the winter months.

Table 14.10: Wind speed statistics at John Lennon Airport. Jan 1991 to Jan 20112

Wind Speed (Knots)	Wind Direction Degrees True											
	346 to 15	16 to 45	46 to 75	76 to 105	106 to 135	136 to 165	166 to 195	196 to 225	226 to 255	256 to 285	286 to 315	316 to 345
0	0	0	1	3	0	0	0	0	0	0	0	0
1 to 3	560	658	1175	1261	1571	2063	1409	995	934	780	1008	1021
4 to 6	2173	1925	3061	2677	3771	5373	3965	2724	2487	2713	3404	3096

Wind Speed (Knots)	Wind Direction Degrees True											
	346 to 15	16 to 45	46 to 75	76 to 105	106 to 135	136 to 165	166 to 195	196 to 225	226 to 255	256 to 285	286 to 315	316 to 345
7 to 10	2930	1602	2974	2445	3582	6824	6304	3927	4250	4142	6243	4485
11 to 16	1116	608	1827	1651	2035	4636	4615	3427	4874	5354	7821	3010
17 to 21	111	67	307	303	275	824	947	833	1705	2682	2296	551
22 to 27	11	2	23	29	24	128	183	219	569	1448	797	130
28 to 33	0	0	2	0	3	9	14	18	110	374	173	7
34 to 40	0	1	0	0	1	0	1	2	23	79	27	1
41 to 47	0	0	0	1	0	0	1	0	2	7	2	0
48 to 55	0	0	0	1	0	0	0	0	1	2	5	0
56 to 63	0	0	0	0	0	0	0	0	0	0	0	0
64 to 999	0	0	0	0	0	0	0	0	0	0	0	0
ALL OBS	**6901**	**4863**	**9370**	**8371**	**11262**	**19857**	**17439**	**12145**	**14955**	**17581**	**21776**	**12301**

14.85. As a result of the bathymetry and shape of the estuary, there is almost no penetration of open sea waves into the Mersey estuary and internally-generated waves are fetch limited. However, waves are capable of eroding soft sediment that do not have sufficient shoreline protection.

14.86. The existing Princes Jetty consists of an open structure including vertical and horizontal timber and concrete beams and other components such as decks and staircases. As the structure is relatively open, the majority of wave energy is likely to pass through the structure. Some scattering and dissipation is likely to occur and will depend on the water level, significant height and wavelength of the waves.

Sensitive Receptors

14.87. The assessment of the sensitivity of the changes in wave regime (receptor) is presented in **Table 14.11**. Significant wave heights (Hs) of between 1.1 and 1.5 m were observed for a 1 year return period, although larger significant wave heights were observed for longer return periods (**Table 14.9**). This suggests that the sensitivity of the receptor is minor

Table 14.11: Sensitivity assessment for changes in wave heights and directions

Parameter	Description
Receptor	Wave regime within the estuary
Features of interest	Wave heights and directions
Temporal variability	High levels of temporal variability due to the influence of tides and wind speed
Sensitivity	**Minor**

Transport of Estuarine Sediments

Sediment Sources within the Estuary

14.88. As previously established, the Mersey estuary is flood dominant. The Mersey experiences stronger velocities on the flood tide causing net movement of sediment into the estuary. The net direction of sediment transport is determined by the direction of peak tidal current and its velocity.

14.89. The Mersey estuary is constricted near its mouth, leading to local tidal scour. The banks of the Mersey are formed of low till slopes, with a few bedrock outcrops. Much of the Mersey coastline is defended in some places by bank protection and seawalls. As a result, the natural sediment transport processes have been altered.

14.90. There are large areas of the Mersey Estuary that are predominantly sandy, with fine sediment occurring in places along its inner margins towards the Upper Estuary. Sediment in the Mersey Estuary has two main sources, these are:

- Marine sources: Sediment moved into the estuary from the glacial and fluvio-glacial deposits found across Liverpool Bay and large parts of the eastern Irish seabed; and
- Fluvial sources: Riverine input from the River Mersey and River Weaver at the head of the estuary.

Offshore in Liverpool Bay the seabed is largely sandy with tide and wave action preventing the long term accumulation of muddy deposits

14.91. The clay fraction of the estuarine sediments has a broadly similar mineralogical assemblage to that seen in the tributary rivers (River Mersey and River Weaver)[13]. However, there are differences between the fluvial and estuarine sediments in terms of the relative proportions of the different clay mineral species[13]:

- Estuarine clay sediments were found to contain different levels of clay minerals (e.g. chlorite) compared to river sediments.
- Estuarine sediments also differ from those found in tributary rivers draining the Carboniferous terrain in that kaolinite is not the most abundant clay mineral.

14.92. Although the fluvial sources are believed to be small compared with offshore sources, the magnitude and duration of freshwater inputs may affect the lateral migration of low water channels within the estuary[21].

14.93. The Mersey estuary sediments have a broadly similar clay mineral assemblage to that reported from the Irish Sea seabed sediments. These observations would therefore be consistent with the movement of sediment from the Irish Sea into the Mersey estuary.

14.94. Price & Kendrick[22] concluded that the mechanism for sediment transport from these offshore sources is via density stratification, which causes a net inland movement along the bed. Studies of other estuaries in the Irish Sea area (West Cumbria[23] and Cardigan Bay[24]) also concluded that their sediments were largely derived from the Irish Sea, rather than being contributed by rivers draining into these estuaries.

Sediment Transport and Suspended Sediment

14.95. The tidal velocities drive the sediment transport in the Mersey Estuary. They are responsible for the patterns of erosion, and subsequent accretion of fine grained sediment within the estuary.

14.96. As a result of the shape of the estuary, the sea bed within The Narrows is largely swept clear of sediments by strong tidal currents. However the current speeds are less along the margins of the estuary (**Figure 14.9** and **Figure 14.10**) which leads to the accretion of both sand and mud[11].

14.97. Measurements made by Dredging Research in the winter of 1995/96[25] showed that suspended sediment concentrations in the Narrows were in the range 20-300 mg/l and that the fluxes of material passing through the Narrows on spring tides were in the region of 70,000 to 80,000 tonnes per tide. Approximately 50% of this mass was exchanged per tide on neap tides. Peak instantaneous fluxes were approximately 8,000 kg/s on spring tides and 3,000 kg/s on neap tides[25].

14.98. The Narrows of the Mersey Estuary are highly dynamic and any fine material disturbed in this area is expected to be dispersed rapidly by the strong tidal currents. It can be anticipated that any fine material introduced to the system through the Development would contribute to the background levels of suspended sediment in the system and would initially accumulate in the temporary locations of muddy material throughout the estuary and offshore region.

14.99. The baseline distribution of fine sediment deposition is shown in **Figure 14.11**. The baseline numerical modelling was run over an initial 30 day period to assess potential sediment accretion. This shows that there is no accumulation of fine sediment in the channel due to the high currents. There is a potential for sediment accumulation to the north and south of the study Site, particularly in the approaches to Princes Half Tide Dock.

14.100. The baseline scenario indicated a potential for fine sediment accumulation in and around the existing Princes Jetty which would be expected to be disturbed during the removal of the jetty structure.

Sensitive Receptors

14.101. The assessment of the sensitivity of for sediment transport (receptor) are presented in **Table 14.12**. The assessment demonstrates that the Site is in an area of moderate accretion due to the location on the banks of the estuary. Therefore the receptor is assessed as having a minor sensitivity.

Table 14.12: Sensitivity assessment for the transport of estuarine sediments

Parameter	Description
Receptor	Transport of estuarine sediments
Features of interest	Levels of accretion and deposition within the estuary
Temporal variability	Moderate levels of variability due to tidal flows and long-term accretion and erosion processes within the wider estuary
Sensitivity	**Minor**

Sediment Quality

Background

14.102. A marine ecology study was undertaken by APEM to describe baseline conditions for fish, plankton, marine mammals, benthic communities and river wall habitats. This involved grab sampling at selected locations, along with surveys of the walls (refer to **Chapter 13: Marine Ecology, Ornithology and Terrestrial Ecology**).

14.103. A site survey investigation was conducted by APEM in 2017[26] to acquire samples for physico-chemical analysis. A total of 9 grab samples were acquired from the Site and the immediate vicinity along the margins of the estuary (**Figure 14.12**).

Particle Size Analysis

14.104. Data from the grab samples, which sampled the top 0.2m of sediment (based on using a standard 0.1m^2 Day grab), showed that the sediment was predominantly sand with a substantial fines component and a minor coarse / gravel fraction.

14.105. Site specific data showed that the surface sediments had an average of 61% sand, although it should be noted that Stations G02, 06, 09 and 10 all recorded values of over 90%, with correspondingly low compositions of the other sediment fractions.

14.106. Three stations (G03, 07 and 08) recorded moderately high levels of fine material (between 70.9% and 74.1%). The sediment at these sites was considered to be predominantly silty using the Folk Classification. These stations were located on the inward side of the Site, and confirm the earlier observation regarding finer sediments are located on the margins of the Mersey Estuary.

Table 14.13: Sediment analysis - particle size results[26]

Sample	Mean Folk 1954 classification	Sorting	% Coarse (>2mm) %	% Sand (63µm to 2mm)	% Fines (<63µm)
G 01	Very Coarse Sand	Very Poorly Sorted	48.7	39.8	11.5
G 02	Medium Sand	Poorly Sorted	2.0	93.8	4.2
G 03	Medium Silt	Very Poorly Sorted	0.0	25.9	74.1
G 05	Medium Sand	Extremely Poorly Sorted	23.8	46.7	29.5
G 06	Fine Sand	Well Sorted	0.0	95.8	4.2
G 07	Coarse Silt	Very Poorly Sorted	0.0	29.1	70.9
G 08	Medium Silt	Very Poorly Sorted	0.0	26.3	73.7
G 09	Fine Sand	Well Sorted	0.0	96.0	4.0
G 10	Fine Sand	Moderately Well Sorted	0.0	96.8	3.2

Note that there is no station G04 as part of this survey.

Heavy Metal Analysis

14.107. The Centre for Environment, Fisheries and Aquaculture Science (Cefas) published threshold values for a number of sediment contaminants with respect to assessing their chemical suitability for disposal at sea. These thresholds, referred to as Action Levels, have been used to assess the level of potential contamination of the sediment acquired during the APEM survey of the Site.

14.108. There are two Cefas action levels:

- Cefas Action Level 1 (CAL1): The threshold concentration below which contaminant concentrations are generally assumed to be of no concern and are unlikely to influence the regulator decisions;
- Cefas Action level 2 (CAL2): Sediment contaminants in dredged material above the Action Level 2 thresholds are generally considered to be unsuitable for sea disposal and will need to be managed by a suitable waste contractor.

Table 14.14: Sediment analysis - heavy metal results (APEM, 2017). Concentrations in $mg.kg^{-1}$

Parameter	CAL1	CAL2	G01	G02	G03	G05	G06	G07	G08	G09	G10
Arsenic	20	100	3.9	4.2	5.9	5.2	4	9.5	7	4.1	4.6
Cadmium	0.4	5	0.17	0.13	0.32	0.26	0.19	0.65	0.39	0.21	0.13
Chromium	40	400	7.6	6.8	18.6	12.8	11.2	25.6	21.3	9.2	8
Copper	40	400	9.7	9.5	17.7	14.3	8.4	23.9	19.2	7.8	7.6
Lead	50	500	13.8	10.6	46.5	30	12	78	56.1	11.5	15.7
Mercury	0.3	3	0.16	0.11	0.57	0.35	0.12	1.14	0.71	0.1	0.1
Nickel	20	200	7.1	4.6	11.5	8.3	5.2	13.4	12.8	5.2	4.9
Zinc	130	800	50.2	47	94.5	82.4	50.5	136.6	108.7	48.5	43.4

14.109. The following metals were present in the sediments at concentrations of environmental interest when compared to the Cefas Action Levels: cadmium, lead, mercury and zinc. The remaining

metals were recorded at levels below the CAL1 threshold and are not considered to represent a risk to the environment.

14.110. Analysis of the sediment samples showed that Station G07 experienced a low level of heavy metal contamination. The levels of cadmium, lead, mercury and zinc in the sediments were all above the CAL1 threshold. However none of the levels approached the CAL2 threshold concentrations. Other stations (G03, 05 and 08) all recorded levels of mercury above the CAL1 threshold. In addition sediment from station G08 also returned levels of lead above the CAL1 limits.

14.111. Sediment samples from stations G01, 02, 06, 09 and 10 were all below the CAL1 thresholds for all metals.

14.112. Spatially, the stations with the sediment samples returning values above the CAL1 limits are all located within the Princes Jetty area. These stations were also observed to be comprised predominantly of fine material (with the exception of G05 which had a higher sand and coarse component). This could indicate that the area behind the Princes Jetty was acting as a historical area of accumulation of fine sediment, with higher levels of potential contamination due to the prevalence of fine material.

14.113. There are known historical sources of heavy metal input around the estuary from the levels of historic industrial activity. Based on this, it is reasonable to conclude that heavy metal contamination in the sediments is the result of historical run-off or discharges from the surrounding area.

14.114. Under the Water Framework Directive, the Mersey Estuary is considered to be heavily modified for navigation, ports and harbours, as per the current Development. The estuary is currently failing to achieve Good Status with respect to 'lead and its compounds' under its last review in 2016[27] (EA, 2017). There is potential that sediments with lead levels over CAL1 thresholds may be re-suspended during Development operations. However, the levels of lead observed in the grab samples, and the volume of material that could potentially be re-suspended are unlikely to pose a risk to the waterbody status. Although other heavy metal elements (e.g. cadmium, mercury and zinc) were observed to exceed the CAL1 thresholds, the WFD status for the waterbody does not identify them as elements of potential concern.

14.115. It should be noted that the proposed Development activities do not utilise equipment that is subject to heavy metal leaching (e.g. cadmium, lead, mercury or zinc), i.e. the proposed equipment and operations would not contribute to the existing heavy metal levels in the sediment.

Organotin Analysis

14.116. Tributyltin (TBT) was historically used as an antifoulant, over time it degrades to dibutyltin (DBT) and triphenlytin (TPT).

14.117. DBT levels were below the detection limits (<0.005 $mg.kg^{-1}$) at all 9 grab stations (**Table 14.15**). This is substantially lower than the CAL1 threshold of 0.100$mg.kg^{-1}$. Given the detection levels recorded at the Site, DBT contamination is not considered to be of environmental concern for this location

Table 14.15: Sediment analysis - organotin results[26]. Concentrations in $mg.kg^{-1}$

Parameter	CAL 1	CAL 2	G01	G02	G03	G05	G06	G07	G08	G09	G10
Dibutyltin	0.1	1.0	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005

Hydrocarbon analysis

14.118. In order to assess the levels of potential hydrocarbon contamination in the sediment at the Site, two sets of quality standards will be used to evaluate the sediment samples.

1) An initial set of threshold limits is provided by the Canadian Council of Ministers of the Environment (CCME). These are commonly used, globally, on marine and freshwater projects in the absence of other national or regional sediment quality thresholds. The CCME defines two assessment values:
   a) Interim Sediment Quality Guidelines (ISQG) / Threshold effect level (TEL): This represents the concentration below which adverse biological effects are rarely expected to occur.
   b) Probable effect level (PEL): The level above which adverse effects are expected to occur frequently.
2) OSPAR Effects Range Low (ERL): These levels were developed by the United States Environmental Protection Agency for assessing the ecological significance of sediment concentrations. These are concentrations below which effects are rarely observed or predicted among sensitive life stages and (or) species of biota for sediment[28]. The ERL levels are used to evaluate sediment concentrations of trace elements and synthetic organic compounds.

14.119. The results of the hydrocarbon analysis of the sediment samples is displayed in **Table 14.16** and **Table 14.17**. The majority of Polycyclic Aromatic Hydrocarbon (PAH) concentrations were above the CCME TEL criteria at stations G01, G03, G05, G07 and G08. All these stations recorded increased levels of fine material suggesting that there is a reduced current speed in this part of the Site which is located away from the main estuary channel. None of the sediment samples exceeded the PEL criterial. Stations G05, G05, G07 and G08 exceeded the OSPAR ERL levels for indenol[123,cd]pyrene and benzo[ghi]perylene. This suggests that the concentrations of PAHs may pose a risk to marine organisms at these stations.

Table 14.16: Sediment analysis – PAH results (Stations G01 to G06)[26]. Concentrations in mg.kg^{-1}

Parameter	ERL	TEL	PEL	G01	G02	G03	G05	G06
Naphthalene		34.6	391	16.4	5.7	76.5	67	2.1
Acenaphthylene		5.87	128	6.4	2.4	39.3	17.9	<1
Acenaphthene		6.71	88.9	15.1	1.9	31.4	47.1	<1
Fluorene		21.2	144	14.9	2.6	43.4	45.3	<1
Phenanthrene		86.7	544	104.3	16.6	183.7	291.6	3.3
Dibenzothiophene *	190			7.6	1.9	21	25	<1
Anthracene		46.9	245	27.9	5.8	60.5	89.6	1.3
Fluoranthene		113	1,494	165	30.8	289.5	429	4
Pyrene		153	1,398	160.1	32.5	301.9	410.2	5.1
Benzo[a]anthracene		74.8	693	78.4	19	171.1	224.7	2
Chrysene		108	846	95.9	22.4	216.5	268.7	3.1
Benzo[a]pyrene		88.8	763	96.8	25.4	273.1	274.8	4.8
Indeno[123,cd]pyrene	240			74.3	19	257.2	203	6.1
Dibenzo[a,h]anthracene				13.1	4	43.7	38.9	<1
Benzo[ghi]perylene	85			73	18.8	252.9	211.6	5.5

14.120. Stations G02, G06, G09 and G10 typically recorded low levels of PAH concentrations, and below the evaluation thresholds. These stations are located on the margins of the main estuary channel and outside of the Princes Jetty Area (**Figure 14.12**). These stations also recorded higher levels

of coarse sediment, compared to the other survey stations. It is expected that the levels of coarse sediment and increased exposure to tidal currents has contributed to the low PAH concentrations.

Table 14.17: Sediment analysis – PAH results (Stations G07 to G10)[26]. Concentrations in mg.kg^{-1}

Parameter	ERL	TEL	PEL	G07	G08	G09	G10
Naphthalene		34.6	391	94	66.6	2.4	1.1
Acenaphthylene		5.87	128	60.2	42.6	<1	<1
Acenaphthene		6.71	88.9	43.8	32.3	2.9	<1
Fluorene		21.2	144	59.3	43.5	2	<1
Phenanthrene		86.7	544	269.9	177.6	15.2	1.7
Dibenzothiophene *	190			28.9	20.7	1.2	<1
Anthracene		46.9	245	91.8	57.9	3.4	<1
Fluoranthene		113	1,494	492.5	250.9	21.7	3.3
Pyrene		153	1,398	524.9	264.2	20.7	3.9
Benzo[a]anthracene		74.8	693	276.1	144.4	9.3	1.9
Chrysene		108	846	328.2	193.1	10.7	2.6
Benzo[a]pyrene		88.8	763	448.2	256.3	10.4	6.6
Indeno[123,cd]pyrene	240			395.1	244.1	8.6	8.2
Dibenzo[a,h]anthracene				65.5	42.2	1.4	<1
Benzo[ghi]perylene	85			394.9	254	7.6	6.4

14.121. PCBs adhere to particles in the water column, resulting in their eventual deposition and accumulation in sediments. The highest concentrations of PCBs are typically found in fine grained sediment[29].

14.122. Polychlorinated biphenyls (PCBs) were detected at very low levels throughout the sediment samples. The majority of sediment samples recorded PCB levels below the detection limit of <0.00008mg/kg^{-1}. These concentrations are indicative of an uncontaminated environment.

14.123. The sediments at station G07 recorded a concentration of PCB 28 that matched the threshold of the OSPAR ERL limit. In addition, Stations G03 and G07 both recorded PCB concentrations exceeding the ERL threshold for PCB 118 (**Table 14.18**). The concentrations of PCB 28 and PCB 118 were marginally elevated above the ERL threshold, however there is a potential for these levels to cause an adverse effect on marine organisms.

Table 14.18: Sediment analysis – PCB results[26]. Concentrations in mg.kg^{-1}

Parameter	ERL	G01	G02	G03	G05	G06	G07	G08	G09	G10
PCB28	1.7	0.2	<0.08	1	0.6	<0.08	1.7	0.7	<0.08	<0.08
PCB52	2.7	0.1	<0.08	0.5	0.3	<0.08	0.9	0.4	<0.08	<0.08
PCB101	3	0.1	<0.08	0.6	0.3	<0.08	1	0.5	<0.08	<0.08
PCB118	0.6	<0.08	<0.08	0.6	0.4	<0.08	0.9	0.3	<0.08	<0.08
PCB153	40	0.1	<0.08	<0.08	<0.08	<0.08	1.1	0.5	<0.08	<0.08
PCB138	7.9	<0.08	<0.08	1	0.2	<0.08	1.4	0.5	<0.08	<0.08
PCB180	12	<0.08	<0.08	0.3	0.1	<0.08	0.6	0.2	<0.08	<0.08

Summary

14.124. Based on the results of the above analysis, it is considered that the sediments across the Site can be classified into two categories:

- Group 1: This group comprises stations G02, G06, G09 and G10. These stations have low levels of fine (<63µm) material, (between 3.2 and 4.2%) and are predominantly composed of sand. The stations were located on the margins of the main estuary channel, and are expected to be under the influence of tidal flows. The analytical results from these stations are indicative of a relatively uncontaminated environment. The variations in heavy metal and hydrocarbon concentrations at these sites could be considered indicative of natural variation in the sediment.
- Group 2: This group comprises stations G01, G03, G05, G07 and G08. The sediments at these stations presented a varying proportion of fine material, between 11.5% and 74.1%. The stations were all located in the immediate vicinity of either the structures and retaining walls at the side of the estuary that experience reduced tidal flow velocities (G01) or in a sheltered area outside of the area of main tidal flows (G05, G05, G07 and G08) with minimal tidal currents. The results of the sediment analysis from these stations showed that there were levels of heavy metals over the CAL1 thresholds, but below the CAL2 limits. The hydrocarbon concentrations in the sediment were typically above either the CCME TEL or OSPAR ERL levels, indicating that there is a potential risk to marine organisms.

14.125. The levels of heavy metals and hydrocarbons in the sediments in the Group 2 stations are indicative of a low level of contamination. This is most likely due to a combination of the historical industrial activity along the banks of the estuary, and the limited flows within the Group 2 station locations allowing the accumulation of fine grained sediment.

Sensitive Receptors

14.126. The assessment of the sensitivity of the changes in sediment concentration (receptor) are presented in **Table 14.19**. A total of 5 out of the 9 survey stations consistently recorded levels of heavy metal and hydrocarbon contamination in excess of the 1st tier thresholds. However there were no instances of the 2nd tier thresholds being exceeded at any stations. As a result of the levels of contamination at these 5 stations, and that 4 of the survey stations recorded levels of below the 1st tier thresholds, the sensitivity is considered to be minor.

Table 14.19: Sensitivity assessment for the movement of potentially contaminated sediments

Parameter	Description
Receptor	Sediment quality in the estuary
Features of interest	Mobilisation patterns from construction works at the Site
Temporal variability	Low levels of variation as the accumulation of potential contaminants is a long scale process.
Sensitivity	**Minor**

Likely Effects

Demolition and Construction

Tidal Flow

14.127. Numerical modelling was conducted to assess the effects on tidal flows following the demolition and removal of the existing Princes Jetty. The results are displayed in **Figure 14.13** to **Figure 14.16**.

14.128. The current speed magnitude and direction are plotted at times of peak ebb and flood tide followed by the difference in current magnitude resultant from the removal of the structure. In the speed difference plots yellow to red colours indicate speed magnitude increase with increasingly dark blue colours indicating speed magnitude decrease.

14.129. The most noticeable effect of removing Princes Jetty are the speed increases shown in **Figure 14.14** and **Figure 14.16**. This is due to the drag effect of the existing piled structure on the tidal flows being removed.

14.130. During the ebb tide maximum speed was modelled at 2.2 ms^{-1}, an increase of 0.8 ms^{-1}. The area of highest effect extends for approximately 225 m in a seaward direction. The overall footprint of effect during the ebb tide extends approximately 2km.

14.131. The removal of the jetty leads to a maximum increase in tidal flow velocity during the flood tide of approximately 0.4 ms^{-1}. During the flood tide, the overall footprint of effect extends approximately 1km up the estuary, although for the majority of the footprint the difference in tidal flows is between 0.1 and 0.2 ms^{-1}.

14.132. There is a small area that experiences a slight decrease in tidal flow velocity (approximately 0.1 ms^{-1}) immediately offshore of the original jetty location.

14.133. The effects during both flood and ebb tides are shown to be relatively confined to the eastern bank line of the Mersey Estuary. The removal of the existing structures does not show any effects on the main estuary channel. This indicates that there will be no overall effect on the general tidal propagation of the estuary or any overall effects on estuary water levels.

14.134. The results of the modelling show that the maximum flow speed in the vicinity of the existing jetty during the flood tide is increased to approximately 2ms^{-1} (an increase of 25%), and during the ebb tide the maximum velocity is increased to 2.2ms^{-1} (an increase of 57%). The area of effect is limited to approximately 24.3 ha (19.2 ha during the ebb tide, and 5.1 ha during the flood tide), an area which equates to approximately 0.27% of the overall Mersey Estuary (8,900 ha).

14.135. The Development has the potential to affect the Mersey Estuary with respect to either increasing or decreasing tidal flows in the vicinity of the Site as a result of the planned demolition of the existing jetty structure.

14.136. The initial likely effects of the removal of the existing structure and construction operations to tidal flows would be **local, temporary and of minor adverse significance** (**Table 14.20**).

Table 14.20: Initial effect to tidal flows – Demolition and construction

Assessment Factor	Value	Rationale
Receptor sensitivity	Negligible	See Paragraph 14.74
Probability	High	The removal of the existing jetty structure has to occur in order for the Development to progress.
Magnitude	Moderate	Change in tidal flows equates to a change of up to 57% on the ebb tide

Assessment Factor	Value	Rationale
Environmental change	Moderate	See Table 14.3
Scale	Local	The area affected by the variations in tidal flow extend to 2 km seaward and 1 km landward from the Site.
Reversibility	Temporary	Although the existing structure would be permanently removed as part of the Development operations, new structures would be emplaced as part of the project. Therefore any effect on tidal flows would be limited to the duration of demolition and construction operations.
Type	Adverse	
Initial effect	**Minor**	

14.137. The construction operations are not expected to have an effect on the tidal flows in the vicinity of the Site. As a result, the effects on tidal flows during construction are not considered as part of this assessment.

Wave Effects

14.138. The existing Princes Jetty consists of a complex open structure including vertical and horizontal timber and concrete beams and other components such as decks and staircases. As the structure is relatively open, the majority of wave energy is likely to pass through the structure. Some scattering and dissipation is likely to occur and will depend on the water level and the height and wavelength of the waves.

14.139. The construction operations are not expected to have an effect on the waves at the Site. There may be some vessels on site during the Works, however they are not expected to contribute to the wave regime in the Mersey estuary. As a result effects on the wave regime during construction are not considered as part of this assessment.

14.140. The likely effects of the removal and demolition of the existing structure on the wave regime would be **local, temporary and of minor adverse significance** (**Table 14.21**).

Table 14.21: Initial effect to the wave regime – Demolition and construction

Assessment Factor	Value	Rationale
Receptor sensitivity	Minor	See Paragraph 14.87
Probability	High	The removal of the existing jetty structure has to occur in order for the Development to progress.
Magnitude	Negligible	The current jetty structure does not have a substantial effect on the baseline wave regime. Therefore the removal of this structure is not expected to cause a substantial change in the wave regime.
Environmental change	Negligible	See Table 14.3
Scale	Local	Waves affected by the removal of the existing structure would be absorbed into the general wave regime of the Mersey Estuary immediately adjacent to the Site.
Reversibility	Temporary	Although the existing structure would be permanently removed as part of the Development operations, new structures would be emplaced as part of the project. Therefore any effect on waves would be limited to the duration of demolition and construction operations.

Assessment Factor	Value	Rationale
Type	Adverse	
Initial effect	**Minor**	

Transport of Estuarine Sediments

14.141. Numerical modelling was conducted to assess the effects on sediment transport patterns over a period of 30 days following the demolition and removal of the existing Princes Jetty. All the predicted effects on bed levels are limited to approximately 1.1 km of the existing jetty.

14.142. The pattern of sediment accumulation is shown by **Figure 14.17** whereas the difference between this result and that predicted for the baseline case (**Figure 14.11**) is shown by **Figure 14.18**. In the sediment transport plots dark yellow to brown indicate increasing levels of sediment movement. In the accumulation difference plots yellow to red colours indicate (compared to the baseline environment) increasing levels of accretion with green and blue colours indicating areas where levels of accretion are reduced.

14.143. The area affected by the removal of the jetty extends both seaward to the West Waterloo Dock and landward down the margins of the estuary towards the Albert Dock area. The size of the area was modelled at approximately 12.2 ha (or 0.14% of the overall estuary area).

14.144. There is a small area adjacent to the Princes Half Tide Dock that is expected to be an area of marginally increased accretion rate. The model predicted that an additional 0.05 to 0.1m of sediment would accrete there over a 30 day period following removal of the jetty

14.145. **Figure 14.25** shows that there would be a low level of erosion in an area extending seawards from the Site. The depth of erosion is estimated at approximately 0.2m and the area is located immediately to the south of the Princes Half Tide Dock. The total volume of estuary bed eroded over a 20 day period is estimated at 1760 m^3 which is equivalent to approximately 0.5 kgs^{-1}. This rate of erosion is less than the expected rate of sediment loss during the piling removal. This calculation assumes that sediment at depths of more than 0.2m below the bed would be less erodible and would not erode under the predicted increased speeds of tidal flow.

14.146. The overall effect of removing the existing jetty reduces the potential for fine sediment accretion particularly in the area north of the structure, around the Princes Half Tide Dock approaches, with an estimated reduction in accretion of 0.3 to 0.4m of sediment.

14.147. The reduction in accretion in these areas results in some areas experiencing a small increase in the potential for fine sediment accumulation as material which would have settled further towards the channel is now able to settle nearer the bank line.

14.148. The likely effects of the removal and demolition of the existing structure on the sediment transport process would be **local, temporary and of minor adverse significance** (**Table 14.22**).

Table 14.22: Initial effect to sediment transport processes – Demolition and construction

Assessment Factor	Value	Rationale
Receptor sensitivity	Minor	See Paragraph 14.101
Probability	High	The removal of the existing jetty structure has to occur in order for the Development to progress.
Magnitude	Minor	The removal of the existing jetty would have an effect on the tidal flows and wave regime in the area. Changes to these processes which drive the sediment transport pathways would have an effect on the baseline sediment transport environment.

Assessment Factor	Value	Rationale
		The process of removing the existing jetty piles, may lead to the resuspension of potentially contaminated sediment.
Environmental change	Minor	See Table 14.3
Scale	Local	Potential effects on the sediment transport process are limited to within 1.1km of the Site.
Reversibility	Temporary	Although the existing structure would be permanently removed as part of the Development operations, new structures would be emplaced as part of the project. Therefore any effect on sediment transport processes would be limited to the duration of demolition and construction operations.
Type	Adverse	
Initial effect	**Minor**	

14.149. The construction operations are not expected to have an effect on the sediment transport processes in the vicinity of the Site as the majority of operations and plant would be land based. As a result, effects on these processes during construction are not considered as part of this assessment.

Presence of Potentially Contaminated Sediments

14.150. As previous established (see 14.102 to 14.126), there is a low level of sediment contamination at the Site. However it should be noted that the demolition and construction operations are not expected to contribute to the existing levels of potential contaminants in the sediments.

14.151. The levels of heavy metal contamination lie between the CAL1 and CAL2 thresholds. This level of concentration indicates that the sediments requires further evaluation. This may include additional sampling for further analysis or the use of bioassays to more effectively assess the risk to the environment. As a result, the potential for the re-use of any sediment dredged as part of the works would be limited.

14.152. During demolition and construction activities at the Site a certain level of sediment disturbance is unavoidable. The level of disturbance is considered similar to that of sediment released during backhoe or grab dredging operations (1 $kg.s^{-1}$). The rate of sediment release during the demolition and construction is anticipated to be insignificant compared to the ambient sediment flux in the Mersey Estuary (refer also to the Water Framework Directive Scoping Assessment that is submitted in support of the planning application).

14.153. The Mersey Narrows and Wirral Northshore Special Protection Area (SPA) conservation area is located on the opposite side of the estuary. There is no indication from the modelling of estuary bed levels that potentially contaminated sediment would be mobilised across the main flow of the Mersey estuary. Distribution of the sediments is anticipated to follow the spatial pattern extent identified by the sediment transport modelling, i.e. restricted to within 1.1 km of the Site. As a result, the demolition and construction activities are not expected to have an effect on the SPA.

14.154. The movement of potentially contaminated sediment may lead to a localised deterioration in sediment (and water quality) around the Site and in the immediate vicinity. The level of potential contamination is relatively low, however it may provide a cumulative effect to the concentrations of potential contaminants in other areas of the estuary.

14.155. The likely effects of the removal and demolition of the existing structure on the movement of potentially contaminated sediments would be **local, temporary and of minor adverse significance** (**Table 14.23**).

Table 14.23: Initial effect on potentially contaminated sediment – Demolition and construction

Assessment Factor	Value	Rationale
Receptor sensitivity	Minor	See Paragraph 14.126
Probability	High	The removal of the existing jetty structure and subsequent construction piling has to occur in order for the Development to progress. Therefore the sediment is expected to be disturbed.
Magnitude	Minor	The volume of sediment likely to be disturbed during demolition and construction is expected to be very low.
Environmental change	Minor	See Table 14.3
Scale	Site-wide	The demolition and construction works are only expected to affect sediments within the Site.
Reversibility	Temporary	Although the existing structure would be permanently removed as part of the Development operations, new structures would be emplaced as part of the project. Therefore any effect on potentially contaminated sediments would be limited to the duration of demolition and construction operations.
Type	Adverse	
Initial effect	**Minor**	

Completed Development

Tidal Flow

14.156. The results for the completed Development are shown in **Figure 14.19** to **Figure 14.22**. The tidal current speed magnitude and direction are plotted at times of peak ebb and flood tide followed by the difference in current magnitude from the completed Development.

14.157. The speed difference plots (**Figure 14.20** and **Figure 14.22**) compare the currents for the completed Development with the baseline conditions as this is the long term effect of the permanent works.

14.158. As the cruise terminal would reintroduce a piled structure (rather than a solid design) in the area of the existing Princes Jetty the effects shown above of the jetty removal are, to some extent, countered. The effects of the completed Development compared to baseline (existing) conditions are much less in magnitude and footprint than the effects of removing the existing jetty.

14.159. The effect shown at the time of peak ebb tide is a speed increase of 0.2 - 0.4 ms^{-1}. The footprint of effect extends approximately 0.6km seawards during the ebb tide and 0.2km landwards during the flood tide. The effects are shown to be confined to the eastern bank line of the Mersey Estuary, no effects mid channel are shown, indicating no predicted effect on the general tidal propagation of the estuary or any overall effects on water levels.

14.160. The completed Development has the potential to offset the effects caused by the removal of the existing jetty. The likely effects of the completed Development relating to tidal flows would be **local, permanent and of minor adverse significance** (**Table 14.24**).

Table 14.24: Initial effect to tidal flows – Completed Development

Assessment Factor	Value	Rationale
Receptor sensitivity	Negligible	See Paragraph 14.74

Assessment Factor	Value	Rationale
Probability	High	The construction of the completed Development is a key objective of the project.
Magnitude	Minor	Change in tidal flows from the baseline are limited to a maximum of 0.4 ms^{-1} during the ebb tide.
Environmental change	Minor	See Table 14.3
Scale	Local	The area affected by the variations in tidal flow extends approximately 0.6 km seawards during the ebb tide and 0.2 km landwards during the flood tide.
Reversibility	Permanent	Although the structure may eventually be upgraded or decommissioned, for the purposes of this ES it is considered as a permanent structure.
Type	Adverse	
Initial effect	**Minor**	

Wave Effects

14.161. The cruise terminal is proposed to be suspended on piles. The preliminary designs show piles at spacings of between about 5m and 15m. This is more open than the existing structure and therefore would transmit more wave energy and dissipate and disperse less wave energy than the existing structure. Most of the wave energy would pass under the deck of the proposed Development and impact on the sea wall. The sea wall is vertical and would reflect most of the wave energy incident upon it.

14.162. Under northerly and north-westerly wind conditions, this is likely to result in a small localised increase of waves at the north end of the landing stage and at the northern end of ships on berth.

14.163. In the context of the whole estuary, it should be noted that the combination of new terminal structure and existing sea wall would reflect no more wave energy than the vertical sea walls that make up the majority of the shoreline. Therefore it is expected that any effects of Princes Jetty structure on the wave climate in the estuary would be minimal.

14.164. The likely effects of the completed Development on the wave regime would be **local, permanent and of minor adverse significance** (**Table 14.25**).

Table 14.25: Initial effect to the wave regime – Completed Development

Assessment Factor	Value	Rationale
Receptor sensitivity	Minor	See Paragraph 14.87
Probability	High	The construction of the completed Development is a key objective of the project.
Magnitude	Negligible	The new terminal structure and existing sea wall would reflect no more wave energy than the vertical sea walls that make up the majority of the shoreline.
Environmental change	Negligible	See Table 14.3
Scale	Local	Most of the wave energy would pass under the deck of the proposed terminal and impact on the sea wall. The sea wall is vertical and would reflect most of the wave energy incident upon it
Reversibility	Permanent	Although the structure may eventually be upgraded or decommissioned, for the purposes of this ES it is considered

Assessment Factor	Value	Rationale
		as a permanent structure.
Type	Adverse	
Initial effect	**Minor**	

Transport of Estuarine Sediments

14.165. Numerical modelling was conducted for the completed Development. **Figure 14.23** shows the potential for fine sediment accretion with the cruise terminal completed. **Figure 14.24** shows the difference in potential accretion compared to baseline (existing) conditions. All the predicted effects are limited to approximately 1.1km of the existing jetty.

14.166. As indicated by the flow modelling, the introduction of piled structures associated with the cruise terminal counters some of the effect of removing the existing structure. The remaining effects are broadly small and localised.

14.167. The change in the extent of the piled structure results in a small area with an increase in the potential for accretion underneath the proposed piled structure (**Figure 14.24**). This is estimated at a minor increase in the rate of sediment accretion between 0.05 and 0.2m.

14.168. Further afield, along the banks of the estuary there are minor, localised areas of reductions in the rates of accretion rate outside the Site. The levels show a 0.01 and 0.05m reduction in the rate of accretion in these areas.

14.169. There would be various types of cruise ships using the new terminal, of various lengths and power ratings. From an operational perspective, vessel docking procedures may utilise manoeuvring thrusters (e.g. bow thrusters, stern thrusters or azimuth thrusters). Modern cruise ships typically have three or more manoeuvring thrusters to assist in docking and low velocity movements within ports and harbours. These thrusters are required to produce powerful flows in order to move the vessels. Propeller thrust may also be generated by pilot vessels or tugs assisting the cruise ships with navigation.

14.170. The manoeuvring thrusters are likely to generate sufficiently powerful localised flows during docking operations to re-suspend sediment and lead to scouring of the estuary bed and the movement of sediment within and from the Site.

14.171. Sediment transport modelling indicates that the area under the new jetty would be subject to accretion, this is likely to be relatively fine grained. The sediment inshore of the Development was observed to be predominantly fine grained (**Table 14.13**), which would be particularly susceptible to scouring.

14.172. There would be an initial period where the level of scouring would be quite high while the system reaches an equilibrium. Following this period the levels of accretion and scouring are expected to stabilise.

14.173. The likely effects of the completed Development on the sediment transport process would be **local, permanent and of minor adverse significance** (**Table 14.26**).

Table 14.26: Initial effect to sediment transport processes – Completed Development

Assessment Factor	Value	Rationale
Receptor sensitivity	Minor	See Paragraph 14.101
Probability	High	The construction of the completed Development is a key objective of the project.

Assessment Factor	Value	Rationale
Magnitude	Minor	Likely effects on the completed Development on the rates of accretion are relatively small.
Environmental change	Minor	See Table 14.3
Scale	Site-wide	Potential effects on the sediment transport process are limited to within 1km of the Site.
Reversibility	Permanent	Although the structure may eventually be upgraded or decommissioned, for the purposes of this ES it is considered as a permanent structure.
Type	Adverse	
Initial effect	**Minor**	

14.174. The likely effects of vessel operations on the sediment transport process would be **local, permanent and of moderate adverse significance** (**Table 14.27**).

Table 14.27: Initial effect to sediment transport processes – Completed Development (Vessel Operations)

Assessment Factor	Value	Rationale
Receptor sensitivity	Minor	See Paragraph 14.126
Probability	High	Cruise ships would utilise the Development for loading and unloading purposes.
Magnitude	Moderate	The size of the cruise ship and the strength of the current flows would determine the level of propeller thrust generated by the manoeuvring thrusters (and pilot tugs). This could lead to initially high levels of localised scour underneath and inshore of the Development before the estuary.
Environmental change	Moderate	See Table 14.3
Scale	Site-wide	Propeller thrust effects from vessel operations are expected to be limited to the Site
Reversibility	Permanent	Once the Site has undergone scouring as a result of vessel operations, the sediment would be redistributed throughout the Mersey Estuary. Natural levels of accretion are the only method of replenishing the sediment, and the level of accretion under the jetty (and inshore) is not expected to fully replenish the amount of disturbed sediment.
Type	Adverse	
Initial effect	**Moderate**	

Presence of Potentially Contaminated Sediment

14.175. The completed Development would have an effect on the sediment transport processes within the estuary as outlined in the preceding section. However, the mobilisation of existing sediments would be negligible in relation to the size of the tidal sediment flux passing through The Narrows.

14.176. Re-suspension of potentially contaminated sediment may occur as a result of vessel operations at the Development from the movement of cruise ships (see Paragraphs 14.169 to 14.172).

14.177. The mobilisation of re-suspended and potentially contaminated sediments is anticipated to follow the spatial patterns and distributions identified by the sediment transport modelling. The footprint of any changes in bed level are likely to be limited to within 1.1km of the Site and would be constrained to the north-eastern bank of the estuary.

14.178. The Mersey Narrows and Wirral Northshore SPA is located on the opposite side of the estuary. There is no indication from the modelling of estuary bed levels that potentially contaminated sediment would be mobilised across the main flow of the Mersey estuary. Distribution of the sediments is anticipated to follow the spatial pattern extent identified by the sediment transport modelling, i.e. restricted to within 1.1km of the Site. As a result, the demolition and construction activities are not expected to have an effect on the SPA.

14.179. The likely effects of the completed Development of the existing structure on the mobilisation of contaminated sediment would be **local, permanent and of minor adverse significance** (**Table 14.28**).

Table 14.28: Initial effect on potentially contaminated sediment – Completed Development (Structure)

Assessment Factor	Value	Rationale
Receptor sensitivity	Minor	See Paragraph 14.126
Probability	High	The construction of the completed Development is a key objective of the project.
Magnitude	Minor	Effects to the sediment bed level would be limited to 1 km as detailed in the sediment transport modelling.
Environmental change	Minor	See Table 14.3
Scale	Local	Potential effects on the erosion / accretion are likely to be limited to within 1.1 km of the Site.
Reversibility	Permanent	If any sediments are disturbed they would enter the sediment background system of the Mersey Estuary. It would not be possible to return these sediments to their original site.
Type	Adverse	
Initial effect	**Minor**	

14.180. The likely effects of the completed Development of vessel operations on the mobilisation of contaminated sediment would be **local, permanent and of minor adverse significance** (**Table 14.29**).

Table 14.29: Initial effect on the mobilisation of potentially contaminated sediment – Completed Development (Vessel Operations)

Assessment Factor	Value	Rationale
Receptor sensitivity	Minor	See Paragraph 14.126
Probability	High	Cruise ships would utilise the Development for loading and unloading purposes.
Magnitude	Minor	The size of the cruise ship and the strength of the current flows would determine the level of propeller thrust generated by the manoeuvring thrusters (and pilot tugs).
Environmental change	Minor	See Table 14.3

Assessment Factor	Value	Rationale
Scale	Site-wide	Propeller thrust effects from vessel operations are expected to be limited to the Site
Reversibility	Permanent	If any sediments are disturbed they would enter the sediment background system of the Mersey Estuary. It would not be possible to return these sediments to their original site.
Type	Adverse	
Initial effect	**Minor**	

Mitigation Measures and Likely Residual Effects

Demolition and Construction

14.181. For all of the effects assessed for the demolition and construction phases, significance of effect was considered to be minor adverse significance or lower for all receptors. Consequently, no additional specific mitigation measures are proposed during demolition and construction.

Completed Development

14.182. It was determined that the only potential effect for which additional mitigation would be required was the potential effect of the completed Development on the sediment transport processes at the Site due to vessel operations. In the absence of any mitigation measures, the likely effects of vessel operations on the sediment transport process would be local, permanent and of moderate adverse significance. The safety of the vessel is paramount and the full range of manoeuvring thruster power must be available during docking and undocking operations to ensure that the safety of the cruise ships is not compromised.

14.183. To reduce the probability of scouring and sediment redistribution occurring as a result of vessel operations, the use of concrete mattresses or rock placement could be used to protect the fine-grained sediment from the increased flow velocities. The extent of estuary bed protection would determine the extent that vessel operations would affect sediment transport processes at the Site.

14.184. The residual effects of vessel operations on sediment transport following the application of the identified mitigation measures have been assessed. **Table 14.30** shows the assessment of residual effects. Changes to the original assessment which was presented in **Table 14.27** are presented as *italic text.*

14.185. The implementation of the mitigation measures has lowered the probability of the Development having an effect on the sediment transport processes occurring at the Site. However, despite the reduction in probability, the residual effect on sediment transport processes remains **local, permanent and of moderate adverse significance**.

Table 14.30: Likely residual effects of vessel operations on sediment transport processes

Assessment Factor	Value	Rationale
Receptor sensitivity	Minor	See Paragraph 14.126
Probability	*Moderate*	*Concrete mattresses and rock placement will reduce the potential for manoeuvring thrusters to disturb the sediments on the estuary bed.*
Magnitude	Moderate	The size of the cruise ship and the strength of the current flows would determine the level of propeller thrust generated by the manoeuvring thrusters (and pilot tugs) would remain

Assessment Factor	Value	Rationale
		unchanged.
Environmental change	Moderate	See Table 14.3
Scale	Site-wide	Propeller thrust effects from vessel operations are still expected to be limited to the Site
Reversibility	Permanent	Once the Site has undergone scouring as a result of vessel operations, the sediment would be redistributed throughout the Mersey Estuary. Natural levels of accretion are the only method of replenishing the sediment, and the level of accretion under the jetty (and inshore) are not expected to fully replenish the amount of disturbed sediment.
Type	Adverse	
Residual effect	**Moderate**	

Summary

14.186. In the absence of mitigation, the Development was assessed to have likely effects as follows:

- During demolition and construction, the effect of operations on tidal flows would have a **temporary, local effect of minor adverse significance**;
- During demolition and construction, the effect of operations on the wave regime would have a **temporary, local effect of minor adverse significance**;
- During demolition and construction, the effect of the operations on sediment transport would have a **temporary, local effect of minor adverse significance**;
- During demolition and construction, the effect of the operations on potentially contaminated sediments would be **temporary, local effect of minor adverse significance**;
- Once completed the Development will create a change in tidal flows that would have a **permanent, local effect of minor adverse significance**;
- Once completed the Development will create a change on the wave regime that would have a **permanent, local effect of minor adverse significance**;
- Once completed the Development will create a change on sediment transport processes that would have a **permanent, local effect of minor adverse significance**;
- Once completed, vessel operations at the Development will create a change in the sediment transport process that would have a **permanent, local effect of moderate adverse significance**;
- Once completed the Development (and cruise ship vessel operations) will have limited potential to affect the levels of sediment contamination, and is expected to a create a change that would have a **permanent, local effect of minor adverse significance**;

14.187. Following the mitigation recommended in this chapter the following residual effects are expected:

- The majority of likely effects are considered insignificant or negligible in terms of the wider Site. Due to the low significance of predicted effects, additional mitigation measures are generally not required to reduce the effect further.
- The use of scour protection assets (e.g. concrete mattresses or rock placement) on the estuary bed within the Development would reduce the probability of vessel operations having an effect on sediment transport processes. However, it does not reduce the source of the

effect and it is expected to result in a **permanent, local effect of moderate adverse significance.**

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15. Cumulative Effects

Introduction

15.1. This chapter presents an assessment of the likely significant cumulative effects of the Development. The chapter has been prepared by Waterman with input from the technical specialists who have contributed to each of the technical chapters of the Environmental Statement (ES).

Assessment Methodology

15.2. This chapter considers two types of cumulative effects:

- **Type 1 Effects:** The combination of individual effects (for example noise, dust, and visual effects) from one development (in this case, the Development proposed in this application) on a particular receptor; and
- **Type 2 Effects:** The combination of effects from several developments (in this case, the Development proposed in this application together with other reasonably foreseeable schemes (hereafter referred to as 'cumulative schemes')), which individually might be insignificant, but when considered together could create a significant cumulative effect.

Type 1 Cumulative Effects

15.3. Type 1 cumulative effects were assessed qualitatively using professional judgement, and no attempt was made to ascribe any levels of significance to the likely effects identified.

15.4. The combination of different types of effects, or effect interactions, from the proposed Development on particular receptors has only been considered applicable to the demolition and construction works and not to the operation of the completed Development. This is because the greatest likelihood of effect interaction occurring is during demolition and construction phases, which are generally more adverse in nature, albeit temporary in duration. It should be noted that some effects, by their nature, would not give rise to combined effects (e.g. effects on ground conditions or sedimentation) and are therefore not considered within the assessment of Type 1 effects.

15.5. The criteria for identifying those receptors that were considered to be the most potentially sensitive included the land use/activity, proximity to the Works and extent of exposure to effects or effect interactions. The effects considered within this assessment include construction vehicle exhaust emissions, noise, vibration and visual intrusion because these are considered to have the greatest potential demolition and construction-related adverse effects.

Type 2 Cumulative Effects

15.6. There is no formal guidance as to what should be considered as a cumulative scheme. Therefore, in determining the cumulative schemes to be considered in the assessment the following factors were taken into account:

- The distance from the Site;
- The planning status (i.e. usually schemes with a valid planning permission or a resolution to grant planning permission);
- The proposed use and scale of the development; and
- The proposed floor area of the development or uplift in floor area.

15.7. **Table 16.1** lists the schemes which have been included within the assessment of Type 2 cumulative effects following pre-application consultation with Liverpool City Council (LCC). Summary

descriptions of these schemes are provided, which should be read in conjunction with **Figures 15.1** to **15.4**. For the purposes of this assessment, the information in **Table 16.1** is correct as of September 2017.

Table 16.1: Schemes Included within the Cumulative Effects Assessment

Ref	Cumulative Scheme	Reference Number and Status	Approximate Distance from Site	Summary Description
n/a	Liverpool Waters Masterplan	10O/2424; approved July 2013	On-site	Comprehensive redevelopment of up to 60ha of former dock land to provide a mixed-use development of up to 1,691,100sqm, including residential, commercial/retail units and public spaces.
1	The Hive, William Jessop Way	17F/0456; approved subject to Section 106	80m	Erection of 31 storey residential tower comprising of 278 private apartments, parking spaces and recreational facilities.
2	The Lexington, William Jessop Way	16F/1370; permission granted September 2016	120m	Erection of a 34-storey residential tower comprising 304 apartments, parking spaces and associated residential amenity areas.
3	William Jessop House	15F/0560; registered March 2015	130m	Erection of an eight-storey office building with flexible ground floor space for retail, financial and professional, food and drink and office use.
4	Ovatus 1, Leeds Street	17F/0042; permission granted April 2017	220m	Erection of 27 storey residential development plus basement levels, comprising 168 dwellings, plus associated public spaces.
5	Infinity, Leeds Street	17F/0340; application submitted February 2017	370m	Demolition of existing buildings and construction of three towers (39, 33 and 27 storeys) together with a two-storey podium and basement, comprising 1,002 residential units together with commercial/retail uses, offices, leisure and parking spaces.
6	30-36 Pall Mall	16F/2634; application submitted November 2016	540m	Demolition of existing buildings and structures and erection of part 10 and part 22 storey residential development comprising 336 apartments with associated communal facilities, commercial units and parking areas.
7	North Point, 70-90 Pall Mall	14F/2543; on site, completion spring/summer 2018	440m	Demolition of industrial buildings with facade retention of 70-90 Pall Mall and erection of a 4 to 8 storey mixed use development comprising 426 residential units a multi-storey car park, offices, retail units and leisure areas.
8	Land to west of Waterloo Road Plot C04 and C06 Central Docks Liverpool Waters	17F/1628; registered September 2017	430m	Erection of a part 14 and part 8 storey residential block comprising 237 apartments, commercial spaces and parking spaces.
9	Vacant Land William Jessop Way Liverpool	17F/0913; approved subject to Section 106	110m	Erection of 15 storey residential tower comprising 105 apartments and commercial units and associated parking spaces.

15.8. Type 2 cumulative effects are only considered in terms of the predicted residual effects of the proposed Development and how these might interact with anticipated effects of the 'cumulative schemes' listed in **Table 16.1**. Likely cumulative effects are assessed for each of the environmental topics assessed within Chapters 7 to 14 of this ES. In some cases, cumulative effects are not anticipated. Where this is the case, justification is provided.

15.9. The Liverpool Waters Masterplan cannot be built-out in its approved form in combination with all the other nine cumulative schemes. The Liverpool Waters Masterplan and the nine other cumulative schemes cannot and will not all be built-out together because of various clashes of footprint, specifically with schemes 1, 2, 3 and 9 in **Table 16.1**.

15.10. Therefore, in the assessment of Type 2 cumulative effects, for both the demolition and construction phases and the operational phase, an assessment of the proposed Liverpool Cruise Terminal Development in combination with the Liverpool Waters Masterplan is provided, followed by a separate assessment of the proposed Liverpool Cruise Terminal Development in combination with the nine 'other' cumulative schemes.

15.11. For the purposes of the Type 2 assessment, it has generally been assumed that construction activities on the Site and at the cumulative schemes would occur simultaneously. However, particularly in the case of outline planning consents, this is unlikely to actually occur.

15.12. Typically, where negligible effects are predicted for the Development, the likelihood of any cumulative effects with other schemes occurring is minimal. However, it is acknowledged that a combination of negligible effects can, in certain instances, create a combined significant effect. Where relevant this is highlighted.

Assessment of Type 1 Cumulative Effects

15.13. In view of the assessment methodology employed and the results of the technical assessments reported within this ES, the likely significant Type 1 effects interactions during the demolition and construction phases of the Development are likely to result from:

- **Temporary, local, adverse effects** of **minor significance** in relation to emissions from construction generated traffic on the local highway network;
- **Temporary, local, adverse effects** of **moderate significance** at worst in relation to construction generated noise;
- **Temporary, local, adverse effects** of **minor significance** at worst in relation to construction generated vibration; and
- **Temporary, district and regional, adverse effects** of **minor significance** in relation to visual effects along the waterfront and across the River Mersey.

15.14. The likely significant Type 1 cumulative effects for various sensitive receptors during various stages of the construction works of the Development (refer to **Chapter 6: Development Programme and Construction**) are listed in **Table 15.2**.

Table 15.2: Type 1 Cumulative Effects

Sensitive Receptors	Phase of Development			
	Demolition of Existing Structures	Piling for New Jetty	Construction of Cruise Terminal	Highway Works & Landscaping
Residents at Alexandra Tower	T, N, Vis	T, N, Vib, Vis	T, N, Vis	T, (N), (Vis)
Residents at 1 Princes Dock (Liverpool City Lofts) and Waterside Apartments	T, Vis	T, Vis	T, Vis	T, (Vis)
Occupants and users of existing commercial premises on Princes Parade	T, N, Vis	T, N, Vib, Vis	T, N, Vis	T, (N), (Vis)
Cyclists, pedestrians and other road users on local road network.	T, Vis	T, Vis	T, Vis	T, (Vis)

Key: T: Adverse construction traffic effects
N: Adverse construction noise effects
Vib: Adverse construction vibration effects
Vis: Adverse visual effects
(.): Possible very minor effects

Assessment of Type 2 Cumulative Effects

Air Quality

Demolition and Construction

In Combination with Liverpool Waters Masterplan

Nuisance Dust

15.15. As noted within **Chapter 7: Air Quality**, the main effects to air quality because of demolition and construction works would be in relation to dust nuisance. Based on professional judgement, owing to the typical dispersal and deposition rates of dust with distance from their source only those schemes within 350m of the Site boundary would have the potential to cause a cumulative effect. The Liverpool Waters Masterplan boundary overlaps most of the proposed Development's Site boundary.

15.16. Condition 39 of the Liverpool Waters Masterplan Decision Notice (June 2013) states that "*details of dust suppression measures*" must be set out in a Construction Environmental Management Plan (CEMP) to be approved by LCC. Similarly, a CEMP would be implemented for the proposed cruise terminal Development. As a result, it is considered that cumulative dust effects from the proposed Development and the Liverpool Waters Masterplan would likely be of **negligible** significance.

Construction Vehicle Exhaust and Plant Emissions

15.17. Exhaust emissions from the combined construction traffic of the proposed Development and the Liverpool Waters Masterplan could give rise to cumulative residual effects on local air quality. However, this would depend upon the extent to which the implementation of the proposed Development and the various elements of the Liverpool Waters Masterplan overlap.

15.18. It is generally the case that demolition and construction traffic adds a very small proportion of additional traffic to the local highway network. As noted in **Chapter 7: Air Quality**, it is assumed that appropriate traffic management measures would be implemented to reduce as much traffic

disruption as is practically possible. Condition 39 of the Liverpool Waters Masterplan Decision Notice states that a CEMP should provide "*details of construction traffic movements and management*".

15.19. In the worst-case scenario, whereby the demolition and construction of the closest elements of the Liverpool Waters Masterplan overlap with the construction of the proposed Development, and use the same, or nearby construction traffic routes, the likely residual cumulative effect would be **temporary, short-term, local, adverse and of minor significance**.

15.20. Regarding exhaust emissions from plant operating on the Site and on nearby parts of the Liverpool Waters Masterplan site concurrently, it is considered that even in a combined situation, the likely residual cumulative effects would be of **negligible** significance in the context of the existing adjacent road traffic and exhaust emissions.

In Combination with the Other Nine Cumulative Schemes

Nuisance Dust

15.21. It is expected that CEMPs would be developed for the other nine cumulative schemes with measures agreed to ensure dust suppression during demolition and construction activities. As a result, it is considered that cumulative dust effects from the proposed Development and the other nine cumulative schemes would likely be of **negligible** significance.

Construction Vehicle Exhaust and Plant Emissions

15.22. Similar to above, exhaust emissions from the combined construction traffic of the proposed Development and the other nine cumulative schemes could give rise to cumulative residual effects on local air quality. However, this would depend upon the extent to which the implementation of the proposed Development and the other nine cumulative schemes overlap.

15.23. In the worst-case scenario, whereby the demolition and construction of the other nine cumulative schemes, particularly those closest to the Site, overlap with the construction of the proposed Development, and use the same, or nearby construction traffic routes, the likely residual cumulative effect would be **temporary, short-term, local, adverse and of minor significance**.

15.24. Regarding exhaust emissions from plant operating on the Site and on the other nine cumulative schemes concurrently, it is considered that even in a combined situation, the likely residual cumulative effects would be of **negligible** significance in the context of the existing adjacent road traffic and exhaust emissions.

Completed Development

In Combination with Liverpool Waters Masterplan

15.25. The air quality assessment is closely linked to the Transport Assessment (TA) and the predicted changes in traffic flows. The traffic data used within the air quality assessment for the future years of 2019 and 2029 includes traffic related to other relevant cumulative schemes in the surrounding area, including within the Liverpool Waters Masterplan area, and therefore comprises a cumulative effect assessment in this regard.

15.26. The proposed Development would provide a new cruise ship passenger terminal for Liverpool to cater for increases in passenger numbers with upgrades to the existing cruise berth. The Liverpool Waters Masterplan proposes a new cruise ship terminal at Central Docks, approximately 250m to the north of the Site.

15.27. The Liverpool Waters outline planning permission was granted taking into account the operation of the existing cruise liner terminal which is capable of handling approximately 900 passengers on turnaround. The proposed Development is designed to cater for approximately 3,600 passengers on turnaround and for annual growth in cruise ships visiting Liverpool.

15.28. However, the Environmental Impact Assessment for the Liverpool Waters Masterplan carried out in 2011 did not include any assessment of likely air quality effects from cruise ships at the proposed Central Docks cruise terminal. An assessment of cumulative air quality effects of cruise ships cannot therefore be undertaken at present.

15.29. In the event that proposals for a cruise ship terminal as part of the Liverpool Waters Masterplan are brought forward once the proposed Development is operational, for example by way of a reserved matters application, it would be expected that the applicant for that application would be required to undertake an assessment of cumulative air quality effects of cruise ships at that stage to promote the necessary Harbour Revision Order for the construction of the second Cruise Terminal.

In Combination with the Other Nine Cumulative Schemes

15.30. As noted above, the traffic data used within the air quality assessment for the future years of 2019 and 2029 includes traffic related to other relevant cumulative schemes in the surrounding area and therefore comprises a cumulative effect assessment in this regard. It is therefore considered that the likely cumulative residual effects of traffic emissions upon local air quality of the proposed Development and the other nine cumulative schemes would be of **negligible** significance.

Noise and Vibration

Demolition and Construction

In Combination with Liverpool Waters Masterplan

15.31. The potential for demolition and construction noise and vibration cumulative effects with the Liverpool Waters Masterplan would be limited to the Princes Dock and King Edward Triangle neighbourhoods in the southern end of the Masterplan area. This is because the northern part of the Masterplan area is planned to be built out after completion of the proposed Development.

15.32. The King Edward Triangle neighbourhood is located at a distance of more than 100m from the Site and therefore Type 2 demolition and construction cumulative residual effects would be **negligible**.

15.33. Should other schemes which form part of the Princes Dock neighbourhood be brought forward concurrently with the proposed Development, then there is the potential for Type 2 demolition and construction noise and vibration cumulative residual effects. With the implementation of a CEMP, as required by Condition 39 of the Liverpool Waters Masterplan Decision Notice, these would be at worst **temporary, local, adverse and of moderate significance** at the closest sensitive receptors.

15.34. It is expected that a Construction Transport Management Plan would be adhered to for the construction of the Princes Dock neighbourhood of the Liverpool Waters Masterplan. With this in place, Type 2 cumulative residual effects from road traffic noise are likely to be **temporary, local, adverse and of minor significance** at the closest sensitive receptors.

In Combination with the Other Nine Cumulative Schemes

15.35. If the cumulative schemes located within approximately 100m of the Site were to be constructed concurrently with the Development, Type 2 cumulative noise and vibration effects could occur. With reference to **Table 16.1**, There are three schemes within or just further than 100m of the Site.

15.36. Should works be undertaken concurrently, provided CEMPs are implemented at each site, the likely Type 2 cumulative residual effects in relation to demolition and construction generated noise and vibration are expected, at worst, to be **temporary**, **local**, **adverse and of moderate significance**.

15.37. The other six cumulative schemes are considered to be of sufficient distance from the Site so that there would be no Type 2 cumulative residual effects with regards to noise and vibration from demolition and construction.

15.38. Cumulative effects resultant from construction traffic would have the potential to cause Type 2 cumulative effects from road traffic noise, should the demolition and construction phases of each scheme overlap. However, provided each cumulative scheme implements its own Construction Traffic Management Plan including consideration of concurrent construction schemes to minimise the combined effects of construction traffic, Type 2 cumulative residual effects from road traffic noise are likely to be **temporary, local, adverse and of minor significance**.

Completed Development

In Combination with Liverpool Waters Masterplan

15.39. Noise from fixed plant and building services within the Liverpool Waters Masterplan will have to satisfy Condition 51 which states that "*The rating level of the noise emitted from any plant in the development hereby approved, including mechanical ventilation serving any basement car park, decentralised energy centres or renewable energy generating sources, shall not exceed existing background noise levels*". Type 2 cumulative effects would therefore be **negligible**.

15.40. The traffic data used within the noise assessment in **Chapter 8: Noise and Vibration** includes traffic related to other relevant cumulative schemes in the surrounding area, including within the Liverpool Waters Masterplan area, and therefore comprises a cumulative effect assessment in this regard.

15.41. The road traffic noise assessment of the Development has already taken account of all cumulative schemes. Type 2 cumulative residual effects of traffic noise from the Development and the cumulative schemes would be equivalent to the identified residual effects presented in Chapter 8, and would therefore be generally **negligible**.

15.42. The proposed Development would provide a new cruise ship passenger terminal for Liverpool to cater for increases in passenger numbers with upgrades to the existing cruise berth. The Liverpool Waters Masterplan proposes a new cruise ship terminal at Central Docks, approximately 250m to the north of the Site.

15.43. The Liverpool Waters outline planning permission was granted taking into account the operation of the existing cruise liner terminal which is capable of handling approximately 900 passengers on turnaround. The proposed Development is designed to cater for approximately 3,600 passengers on turnaround and for annual growth in cruise ships visiting Liverpool.

15.44. However, the Environmental Impact Assessment for the Liverpool Waters Masterplan carried out in 2011 did not include any assessment of likely noise and vibration effects from cruise ships at the proposed Central Docks cruise terminal. An assessment of cumulative noise and vibration effects of cruise ships cannot therefore be undertaken at present.

15.45. In the event that proposals for a cruise ship terminal as part of the Liverpool Waters Masterplan are brought forward once the proposed Development is operational, for example by way of a reserved matters application, it would be expected that the applicant for that application would be required to undertake an assessment of cumulative noise and vibration effects of cruise ships at that stage to promote the necessary Harbour Revision Order for the construction of the second Cruise Terminal.

In Combination with the Other Nine Cumulative Schemes

15.46. It is considered that all of the other nine cumulative schemes, with the exception of The Hive, The Lexington, William Jessop House, and Vacant Land (17F/0913), are too distant from the Development to cause any significant Type 2 cumulative residual effects in terms of noise and vibration once the proposed Development is completed and operational.

15.47. Noise from fixed plant and building services would be subject to a standard planning condition which would limit the potential for cumulative effects. As such, noise from fixed plant from all cumulative schemes and the Development would be **negligible**.

15.48. The traffic data used to establish the likely significant noise effects of the Development has already accounted for all cumulative schemes. Therefore, the traffic noise assessment in **Chapter 8: Noise and Vibration** presents the results of a comprehensive cumulative traffic noise assessment. It is therefore considered that the likely residual Type 2 cumulative effects of traffic noise from the proposed Development and the other nine cumulative schemes would be generally **negligible**.

Townscape and Visual Impact

15.49. The assessment of cumulative townscape and visual effects follows the same approach as that used in **Chapter 9: Townscape and Visual Impact** and the assessment uses the same viewpoints and visual receptors.

15.50. In making judgements, the assessment considers:

- the susceptibility of the townscape and visual receptors (as set out in Chapter 9);
- the value attached to the townscape or view (as set out in Chapter 9); and
- the nature or magnitude of likely change, both in terms of size and geographic area. This differs from the magnitude of effects identified in Chapter 9 due to the addition of the other schemes.

15.51. In accordance with GLVIA3[1] (para. 7.28), "*the emphasis [of the assessment] must always remain on the main project being assessed and how or whether it adds or combines with the others being considered to create a significant cumulative effect"*. This is an important point because, although the cumulative assessment records some significant effects, these are primarily due to the cumulative effects of the much taller and more geographical extensive Liverpool Waters Masterplan and the nine other cumulative schemes rather than to the proposed Development itself. The predicted cumulative townscape and visual effects identified would arise with or without the proposed Development. This is because the proposed Development would be perceived as a very small part of the overall scene and result in a very small change to the cityscape compared to the cumulative schemes.

15.52. The full findings of this cumulative assessment are provided at **Appendix 15.1** where for each of the 21 viewpoints the baseline views are illustrated with 3D visualisations for the Development with the Liverpool Waters Masterplan and the other nine cumulative schemes. To fully convey the height, scale and massing of these cumulative scenarios, these visualisations illustrate the proposed Development and the cumulative schemes as rendered 3D models but without any architectural detailing.

Demolition and Construction

15.53. The new Cruise Liner Terminal is anticipated to be constructed between 2018 and 2020. As is commonplace with major building works, the scale of the activities means that the demolition and construction activities would potentially be visible from many locations (particularly from the

opposite side of the Mersey). It would have the potential to give rise to effects that cannot practicably be mitigated when seen cumulatively with other developments. These effects would vary over the construction period depending on the scale and intensity of the works at a particular time. Importantly, however, such effects would be temporary (to a maximum of approximately 24 months). Similarly, the demolition and construction activities associated with the cumulative schemes would result in significant townscape and visual change yet the effects of construction of the proposed Cruise Liner Terminal would, relative to these wider schemes, be insignificant. For that reason, cumulative demolition and construction townscape and visual effects are not considered further.

Completed Development

15.54. **Appendix 15.1** shows that although significant operational cumulative townscape and visual effects are identified, none of these are attributable to the proposed Development. The results are summarised in **Table 15.3** below.

Table 15.3: Cumulative Operational Landscape and Visual Effects on Viewpoints

Ref	Viewpoint Location	Sensi-tivity	Magnitude of Change of the Development[1]	Liverpool Waters Masterplan		Other Nine Cumulative Schemes		Contribution of the Proposed Development to the Overall Cumulative Effect
				Magnitude	Significance	Magnitude	Significance	
VP01	Magazine Promenade, New Brighton	High	Low	High	Major	Medium	Moderate	LW Masterplan – **Minor** Other 9 Schemes – **Minor**
VP02	Egremont Promenade, Egremont	High	Low	High	Major	Medium	Moderate	LW Masterplan – **Minor** Other 9 Schemes – **Minor**
VP03	Seacombe Promenade, Wallasey	High	Low	High	Major	Medium	Moderate	LW Masterplan – **Minor** Other 9 Schemes – **Minor**
VP04	Woodside Ferry Terminal, Birkenhead	High	Low	High	Major	Medium	Moderate	LW Masterplan – **Minor** Other 9 Schemes – **Minor**
VP05	Port Sunlight River Park, Wirral	High	Negligible	Medium	Moderate	Low	Minor	LW Masterplan – **Negligible** Other 9 Schemes – **Negligible**
VP06	Albert Dock	High	Low	Medium	Moderate	Low	Minor	LW Masterplan – **Minor** Other 9 Schemes – **Minor**

Ref	Viewpoint Location	Sensi-tivity	Magnitude of Change of the Development[1]	Liverpool Waters Masterplan		Other Nine Cumulative Schemes		Contribution of the Proposed Development to the Overall Cumulative Effect
				Magnitude	Significance	Magnitude	Significance	
VP07	Museum of Liverpool	High	Low	High	Major	Medium	Moderate	LW Masterplan – **Minor** Other 9 Schemes – **Minor**
VP08	Canada Boulevard	High	Negligible	Medium	Moderate	Medium	Moderate	LW Masterplan – **No contribution** (as the Development is completely screened by Liverpool Waters and therefore no cumulative effect) Other 9 Schemes – **Negligible**
VP09	King Edward Street	Low	Medium	High	Major	High	Major	**No contribution** (as Development is completely screened by other developments in both scenarios)
VP10	Princes Parade North	Low	Medium	High	Moderate	Medium	Minor	LW Masterplan – **Minor** Other 9 Schemes – As none of the other developments are visible there is **no cumulative effect**
VP11	Everton Park	High	Negligible	High	Major	Medium	Moderate	LW Masterplan – **No contribution** (as the Development is completely screened by Liverpool Waters and therefore no cumulative effect) Other 9 Schemes – **Negligible**
VP12	Echo Arena	High	Low	Low	Minor	Low	Minor	LW Masterplan – **Minor** Other 9 Schemes – As none of the other developments are visible there is **no cumulative effect**
VP13	Pier Head	High	Low	Medium	Moderate	Low	Minor	LW Masterplan – **Minor** Other 9 Schemes – As none of the other developments are visible there is **no cumulative effect**
VP14	Princes Parade South	Low	Medium	High	Moderate	Medium	Minor	LW Masterplan – **Minor** Other 9 Schemes – As none of the other developments are visible there is **no cumulative effect**

Ref	Viewpoint Location	Sensi-tivity	Magnitude of Change of the Development[1]	Liverpool Waters Masterplan		Other Nine Cumulative Schemes		Contribution of the Proposed Development to the Overall Cumulative Effect
				Magnitude	Significance	Magnitude	Significance	
VP15	Leeds Street/King Edward Street	Low	Low	High	Moderate	Medium	Minor	No contribution to either scenario (as the Development is completely screened by other developments and therefore **no cumulative effect**)
VP16	Metropolitan Cathedral	Medium	No change	No change	No effect	No change	No effect	No developments visible therefore **no cumulative effects**
VP17	Anglican Cathedral	Medium	No change	Medium	Moderate	Low	Minor	No contribution to either scenario (as the Development is completely screened by existing buildings and therefore **no cumulative effect**)
VP18	Bidston Hill, Wirral	High	Negligible	Medium	Moderate	Low	Minor	LW Masterplan – **Negligible** Other 9 Schemes – **Negligible**
VP19	Holt Hill, Birkenhead	High	Negligible	Medium	Moderate	Low	Minor	LW Masterplan – **Negligible** Other 9 Schemes - **Negligible**
VP20	Waterloo Dock	Low	Medium	High	Moderate	Medium	Minor	LW Masterplan – **Negligible** (as the Development would be mostly screened by Liverpool Waters) Other 9 Schemes – **Minor**
VP21	Victoria Tower	Medium	Low	High	Major	Medium	Moderate	LW Masterplan – **No contribution** (as the Development is completely screened by other developments and therefore no cumulative effect) Other 9 Schemes – **Minor**

1: Refer to Appendix 9.3

15.55. The conclusions of the assessment of cumulative townscape and visual effects from the agreed viewpoints are as follows. Firstly, that the degree of change resulting from either the Liverpool Waters Masterplan or the other nine cumulative schemes in combination would be mostly moderate or major and therefore significant. And secondly, that the effect of the proposed Cruise Liner

Terminal within the context of this degree of change would, from most viewpoints, be negligible or minor and therefore not significant, or there would be no cumulative effects as developments would not be seen together.

15.56. Scoping consultations with LCC identified that the TVIA for the proposed Development should focus on terrestrial effects only and as such an assessment of possible temporary cumulative visual effects of cruise liners using the new terminal has not been undertaken.

Built Heritage

Demolition and Construction

15.57. During the demolition and construction phases, hoardings would be used to enclose the Site and the cumulative schemes and it is likely that tower cranes would be used, particularly in relation to the larger cumulative schemes. Owing to the proximity of some of the cumulative schemes, potential cumulative effects on the setting of heritage assets could arise because of the presence of these elements, should the construction works coincide simultaneously. As such, when tower cranes are present concurrently, the likely cumulative effects on the setting of the heritage assets could, at worst, be **temporary and minor adverse**. This assessment is equally applicable to consideration of the Liverpool Waters Masterplan and the other nine cumulative schemes.

Completed Development

In Combination with Liverpool Waters Masterplan

15.58. In general terms, the proposed phased development of the Liverpool Waters Masterplan area would result in the continued regeneration of this area within and in proximity to the Site, enabling the renewed use of the historic waterfront, which forms a fundamental part of Liverpool's dockland history.

15.59. Part of the World Heritage Site and the Stanley Dock Conservation Area are located within the Liverpool Waters Masterplan area, as well as the listed Princes Half Tide Dock and Entrance to Princes Half Tide Dock and part of the listed dock wall and dock wall gates. The conservation of these heritage assets as part of the Liverpool Waters Masterplan would allow a better understanding and appreciation of their significance and a reinstatement of their historic context. As such, the cumulative effects would be **permanent, local and of minor to moderate beneficial significance**.

15.60. In relation to the remainder of the heritage assets located within the environs of the Site, the Liverpool Waters Masterplan would provide a regeneration of an area that forms part of their historic waterfront context and therefore would potentially further enhance the appreciation of their significance. Therefore, the cumulative effects would be **permanent, local and of minor beneficial significance**.

In Combination with the Other Nine Cumulative Schemes

15.61. Four of the other cumulative schemes (numbers 4, 5, 6 and 7 on **Figure 15.2**) are located within the dense urban townscape of Liverpool to the east of the Site beyond Bath Street. A fifth (number 8 on **Figure 15.2**) is located well to the north of the Site beyond East Waterloo Dock. Due to the separation distances and the interposing built form, it is considered that there would be **no cumulative effects** arising from these five other cumulative schemes.

15.62. The remaining four other cumulative schemes (numbers 1, 2, 3 and 9 on **Figure 15.2**) are close to the Site, to the east of William Jessop Way beyond Princes Dock. The proposed tower blocks in

these locations would be located adjacent to the listed dock wall and dock wall gates. As identified, there is a visual relationship between these heritage assets and the Site and as such, these four cumulative schemes would obscure the principal views between them, which would lessen the effect of the built form of the proposed Development in the northern section of the Site.

15.63. It has been assessed however, that there would be a beneficial effect of slight significance (resulting from development within the Site) on the heritage significance of the dock wall and dock wall gates arising from the reinstatement of the historic use in the northern part of the Site. It is considered that the four cumulative schemes on William Jessop Way would not alter the beneficial effect of the change in land use on the Site and therefore there would be **no cumulative effect** on the heritage assets as a result of these four cumulative schemes.

15.64. With regard to the remainder of the heritage assets within the environs of the Site, these four cumulative schemes would not have any effect on their particular significance and therefore there would be **no cumulative effects**.

Archaeology

Demolition and Construction

In Combination with Liverpool Waters Masterplan

15.65. The Liverpool Waters Masterplan proposes the retention and restoration of Princes Jetty for recreational purposes and the construction of two medium-rise buildings on Plot 11. The proposed cruise terminal Development would supersede these proposals. Therefore, the demolition of Princes Jetty and the construction of the new cruise terminal and the drop off / pick up area on Plot 11 would result in **no cumulative effects** to the archaeological features within the Site since the proposals for this part of the Liverpool Waters Masterplan would not be built-out.

15.66. The build-out of the Liverpool Waters Masterplan would also have the potential to contribute to the **permanent, regional, adverse effects of minor significance** which the potential truncation and / or removal of any surviving elements of the eighteenth-century fort or associated infrastructure of Princes Dock would cause.

In Combination with the Other Nine Cumulative Schemes

15.67. Four of the other cumulative schemes (numbers 1, 2, 3 and 9 on **Figure 15.2**) are close to the Site, to the east of William Jessop Way beyond Princes Dock. These four cumulative schemes do not include any basement excavations but excavations for piling for the tall buildings would be part of their construction phases. These may disturb possible paleo-environmental deposits and numbers 1 and 9 are also potentially within the area of the former eighteenth-century fort (as described in **Chapter 11: Archaeology**) and may therefore impact upon hitherto unknown remains of this feature. It is not envisaged that numbers 2 or 3 would have any effect upon the potential remains of the eighteenth-century fort as they are further south than its indicated location in historic mapping and on the Historic Environment Record. These four cumulative schemes would also remove known associated infrastructure of the Princes Dock, i.e. cobbled surfaces and railway tracks which are present within their development footprints and would be removed prior to construction.

15.68. Should mitigation equivalent to that recommended for the proposed Development be applied to these four cumulative schemes, the cumulative effect would be **negligible** for paleo-environmental deposits. Cumulative schemes numbers 1 and 9 also have the potential to contribute to the **permanent, regional, adverse effects of minor significance** which the potential truncation and /

or removal of any surviving elements of the eighteenth-century fort or associated infrastructure of Princes Dock would cause.

15.69. The remaining five cumulative schemes are more than 220m from the Site boundary. There would, therefore, be **no cumulative effects** with these five schemes in terms of archaeology.

Completed Development

15.70. There would be **no cumulative effects** on below-ground archaeological resources once the individual cumulative schemes are completed and operational. All effects on sub-surface archaeological heritage assets would have been mitigated ahead of the construction phase.

Ground Conditions and Contamination

Demolition and Construction

15.71. This assessment is equally applicable to consideration of the Liverpool Waters Masterplan and the other nine cumulative schemes.

15.72. The principal potential effects associated with ground conditions and contamination are predominantly specific to an individual site. However, since the construction of each of the cumulative schemes could overlap with the demolition and construction works associated with the proposed Development, there is the potential for an increase in the likelihood for pollution incidents to occur, which could potentially impact upon underlying groundwater aquifers, surface waters (including the Mersey Estuary) and sensitive ecological receptors. There is also a potential for the additional generation of contaminated airborne dusts.

15.73. As with the proposed Development, all the cumulative schemes would, if necessary, be remediated so as to be 'suitable for use' in accordance with Part 2A of the Environmental Protection Act 1990[2]. This could potentially result in less overall ground contamination at the sites of the cumulative schemes and the proposed Development in combination, thereby reducing the risk of disturbing and mobilising ground contamination during construction works.

15.74. However, sources of contamination such as oil, chemicals and concrete would likely be introduced during the demolition and construction of the proposed Development and each of the cumulative schemes, thereby increasing the potential for accidental spillages and contamination of underlying aquifers, surface waters and sensitive ecological receptors. Such occurrences would be minimised as far as practicable through the implementation and adherence to best practice control measures and site-specific CEMPs; however, risks cannot be completely eradicated.

15.75. Therefore, the predicted cumulative effect on the quality of controlled waters and sensitive ecological receptors can be regarded as generally **negligible** and, at worst, **temporary, local and of minor adverse significance**, assuming adherence to relevant regulatory and best practice standards.

Completed Development

15.76. This assessment is equally applicable to consideration of the Liverpool Waters Masterplan and the other nine cumulative schemes.

15.77. None of the cumulative schemes include land uses that would be likely to result in significant contamination of soil or controlled waters. Once the proposed Development and any of the cumulative schemes are completed and operational, no significant effects to human health, controlled waters, sensitive ecological receptors, plants and landscaped areas or buried services and structures would be expected, although the potential for pollution incidents associated with the

day to day activities of the proposed cruise terminal and associated infrastructure cannot be completely discounted. For these reasons, the predicted cumulative effect on the quality of controlled waters and sensitive ecological receptors can be regarded as generally **negligible** and, at worst, **permanent, local and of minor adverse significance**.

Marine Ecology, Ornithology and Terrestrial Ecology

Demolition and Construction

In Combination with Liverpool Waters Masterplan

15.78. Five internationally designated statutory sites are located within a 15km radius of the Liverpool Waters Masterplan site.

15.79. As reported in the Liverpool Waters Masterplan Environmental Statement (2011)[3] the Liverpool Waters Masterplan site supports low numbers of waterbirds, notably a small high tide roost of oystercatcher and redshank at Waterloo Dock. Cormorant has also been recorded. Nine breeding bird species have been confirmed at the site, including seven species of conservation concern (Birds of Conservation Concern, Red and Amber list species), none of which were in or around Princes Dock. In addition, one Schedule 1 species (black redstart) was recorded as holding territory on the Liverpool Waters Masterplan site (close to the Clarence Graving Docks), and peregrine (a Schedule 1 species) bred adjacent to the site on the Tobacco Warehouse.

15.80. The ES non-technical summary identified that the adjacent Mersey Estuary supports four migratory fish species (salmon, sea lamprey, river lamprey and sea-trout) which pass adjacent up and down the estuary adjacent to the Liverpool Waters Masterplan site. In addition, the summary notes that there are records of bottlenose dolphin, harbour porpoise and grey seal within the estuary.

15.81. The main potential significant effects arising at a local level during the construction phase were considered to be:

- Loss of areas of scrub, plant colonisers of disturbed ground (ruderals) and short patchy low-growing plants typical of derelict urban sites (short perennial) vegetation; and
- The effect of the loss of habitat on all species of breeding birds.

15.82. It is considered that any cumulative effects would be of **negligible** significance for all marine ecology receptors.

15.83. Breeding and wintering birds of relevance to the Liverpool Waters Masterplan site include oystercatcher, turnstone, redshank, common tern and black redstart. The proposed cruise terminal Site (which is largely within the Liverpool Waters Masterplan site (refer to **Figure 15.1**)) does not offer much suitable habitat for these species, as set out in **Chapter 13: Marine Ecology, Ornithology and Terrestrial Ecology**. It can be concluded, therefore, that any cumulative effects would be of **negligible** significance for all breeding and wintering bird receptors.

In Combination with the Other Nine Cumulative Schemes

15.84. None of the nine other cumulative schemes are in the immediate vicinity of the Mersey Estuary. They are each located in areas of low ecological potential and none contain habitats of any significant ecological value. No potential sources of significant cumulative effects with any of the receptors could be identified. It is considered that there would be **negligible** cumulative ecological effects.

Completed Development

In Combination with Liverpool Waters Masterplan

15.85. The main ecological findings of the Liverpool Waters Masterplan ES are indicated above. The assessment concluded that operational effects of the proposed scheme on ecology, taking account of proposed mitigation measures, would not be significant. It is therefore considered that were would be **negligible** cumulative ecological effects for all receptors.

In Combination with the Other Nine Cumulative Schemes

15.86. No potential sources of significant cumulative effects with any of the receptors could be identified. It is considered that there would be **negligible** cumulative ecological effects.

Coastal Processes, Sediment Transport and Sediment Contamination

Demolition and Construction

In Combination with Liverpool Waters Masterplan

15.87. Most of the elements of the Liverpool Waters Masterplan are land-based and are therefore not expected to influence coastal processes in the marine environment. The only aspect that may influence the marine environment would be proposed dock works.

15.88. The Liverpool Waters ES identified potential effects of minor adverse significance associated with accidental releases of chemicals or and site water into the Mersey as part of the regeneration works on Princes Dock. Accidental discharges by their nature are typically small in volume and duration. As a result, these are not expected to influence either the tidal flows, wave regime or sediment transport processes at the Site.

15.89. The potential for any accidental discharges to influence the level of sediment contamination would depend on the volume and chemical content of the discharge. Although there may be a low potential effect for the discharges to affect the levels of sediment contamination, in reality this is considered to be **negligible** due to the hydrodynamic regime and tidal flows within the Mersey Estuary.

15.90. Any construction works taking place within the estuary as part of the Liverpool Waters Masterplan would have the potential to influence coastal processes in the marine environment. Any adverse effects in terms of the wave regime, sediment transport or erosion would be likely to be small and localised. Nevertheless, in combination with the predicted effects during demolition and construction reported in **Chapter 14: Coastal Processes, Sediment Transport and Sediment Contamination**, **temporary, local cumulative effects of minor adverse significance** cannot be ruled out.

In Combination with the Other Nine Cumulative Schemes

15.91. The other nine cumulative schemes are not located adjacent to the Mersey Estuary. There would be **no cumulative effects** on coastal processes, sediment transport and sediment contamination.

Completed Development

In Combination with Liverpool Waters Masterplan

15.92. The Environmental Impact Assessment for the Liverpool Waters Masterplan carried out in 2011 did not include any assessment of likely coastal processes, sediment transport and sediment

contamination effects from cruise ships at the proposed Central Docks cruise terminal. An assessment of cumulative coastal processes, sediment transport and sediment contamination effects of cruise ships cannot therefore be undertaken at present.

15.93. In the event that proposals for a cruise ship terminal as part of the Liverpool Waters Masterplan are brought forward once the proposed Development is operational, for example by way of a reserved matters application, it would be expected that the applicant for that application would be required to undertake an assessment of cumulative coastal processes, sediment transport and sediment contamination effects of cruise ships at that stage to promote the necessary Harbour Revision Order for the construction of the second Cruise Terminal.

In Combination with the Other Nine Cumulative Schemes

15.94. None of the nine cumulative schemes include operations that are predicted to have any effects on coastal processes, sediment transport and sediment contamination within the Mersey Estuary. It is therefore considered that were would be **negligible** cumulative effects.

References

1 Landscape Institute and Institute of Environmental Management & Assessment, 2013, Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3)

2 UK Parliament (1990): Environmental Protection Act, Part I and II. HMSO, London

3 ARUP (2011) Liverpool Waters Masterplan Environmental Statement

UK and Ireland Office Locations