The London Resort Development Consent Order

BC080001

Environmental Statement
Volume 2: Appendices

Appendix 13.9 – Biosecurity Plan

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Planning Act 2008
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009
Regulation 5(2)(a)
The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017
Regulation 12(1)

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Revisions

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Executive Summary

A non-native species (NNS) (also known as alien, non-indigenous, foreign or exotic) is a species or subspecies occurring outside its native range and it is estimated that there are currently over 100 marine non-native species in the UK (Payne *et al*. 2014, Kakkonen *et al*. 2019). According to the Convention on Biological Diversity, 'invasive' NNS (INNS) are one of the greatest threats to biodiversity and the objective of this Biosecurity Plan is to minimise risks of introduction and spread of NNS/INNS during the Construction and Operation Phases of the London Resort Proposed Development.

This plan has been prepared following guidance in Cook *et al*. (2015) which indicates there are two types of biosecurity plans which are 'Site' and 'Operations' plans, both of which have been considered when producing the plan:

- A 'Site' Biosecurity Plan covers the long-term, on-going activities at a single location such as a marina (e.g. vessel activity or routine dredging activities).

- The 'Operations' Biosecurity Plan is for a particular activity or set of activities which are time-limited (e.g. construction of marine infrastructure or one-off dredging activities) (Cook *et al*. 2015).

Within this framework a number of key construction and operational risks associated with the Proposed Development have been identified and control measures suggested for each specific task. Further contingency plans have also been outlined along with a responsibilities and actions of a biosecurity manager in the event of control measures being breached.

Key considerations during the construction phase were arrival and departure of barges/Ro-Ro vessels/Dredger and other supply/support vessels to the Kent and Essex Project Sites and introduction of plant and construction materials to the marine environment.

During operation a key consideration was the daily arrival and departure of passenger ferries at Kent and Essex Project Sites along with more occasional use of the sites by barges/Ro-Ro vessels and other supply/support vessels.

The risk assessment has identified biofouling as one of the key risks for introduction and spread of INNS across the construction and operation phases of the project and outlines a ranked control procedure with different levels of mitigation based on the level of fouling.

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Glossary

Biofouling	Biological growth which develops on manmade structures in the aquatic environment.
Biosecurity	Taking action in order to minimise the introduction or spread of invasive non-native species or disease.
Convention on Biological Diversity	A multilateral treaty known informally as the Biodiversity Convention. The convention has three main goals: the conservation of biological diversity; the sustainable use of its components; and the fair and equitable sharing of benefits arising from genetic resources.
Control Measures	Refers to actions which are undertaken in order to prevent the introduction or spread of an invasive non-native species.
Establishment	Refers to the process of a non-native species in a new location successfully producing viable offspring with the likelihood of continued survival.
Introduction	Refers to the movement by human means, indirect or direct, of a species outside its natural range. This movement can be within a country or between countries.
Native Species	Also known as indigenous species, means a species occurring within its natural range (past or present) and dispersal potential, i.e. within the range it occupies naturally or could occupy without direct or indirect introduction or intervention by humans.
Non-Native Species	Non-native species (also known as alien, non-indigenous, foreign or exotic) means a species or subspecies occurring outside its native range i.e. the range it occupies naturally without the intervention of human activity. This includes any part of the species that might survive and subsequently reproduce
Invasive Non-Native Species	An invasive non-native species (INNS) is defined as a 'non-native species that threatens native biological diversity, human health or economic activity.
Prop Wash: propulsion systems	An aviation and nautical term used to define a mass of air or water pushed aft or fore by the propeller of an aircraft or propeller-driven watercraft. This term is synonymous with any water disturbance created by a vessel's propeller.

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Chapter One ◆ Introduction

BACKGROUND

1.1 A non-native species (NNS) (also known as alien, non-indigenous, foreign or exotic) is a species or subspecies occurring outside its native range i.e. the range it occupies naturally without the intervention of human activity. This includes any part of the species that might survive and subsequently reproduce (Cook *et al*. 2015).

1.2 The number of marine NNS in the UK and Ireland is increasing each year, with their spread primarily due to shipping (ballast water, biofouling of hulls) and imported consignments of cultured species (Nall *et al*. 2016, Cook *et al*. 2015). Current estimates suggest that approximately 10–12 new NNS are established annually in both the terrestrial and aquatic environments (GB NNSS 2015, Kakkonen *et al*. 2019). It is estimated that there are currently over 100 marine NNS in the UK (Payne *et al*. 2014, Kakkonen *et al*. 2019).

1.3 According to the Convention on Biological Diversity, 'invasive' NNS (INNS) are one of the greatest threats to biodiversity as they can rapidly colonise a wide range of habitats and exclude native flora and fauna. It is important to understand, however, that the majority of NNS are not 'invasive' (i.e. they are not defined as INNS which is a NNS that has the ability to spread causing damage to the environment, the economy and our health (GB NNSS 2019)).

1.4 The objective of this London Resort Marine Biosecurity Plan is to indicate the potential risks of introduction and spread of NNS/INNS during the Construction and Operation Phases of the project and the measures to reduce these risks which will be implemented during construction and operation. This Biosecurity Plan will be part of the Construction Environmental Management Plan (CEMP) and the Operational Environmental Management Plan (OEMP) for the project.

1.5 The London Gateway Proposed Development is split across the north and south bank of the River Thames. For clarity, the section of the Project Site that is to the south of the Thames is referred to in this report as the 'Kent Project Site' and that to the north of the river is identified as the 'Essex Project Site' (see ES Figure 13.1: Order Limits; figure reference 6.3.13.1).

1.6 The Kent Project Site is bisected by the municipal boundary between the boroughs of Dartford Borough Council (to the west) and Gravesham Borough Council (to the east) and It lies mostly in the designated area of the Ebbsfleet Garden City, established in March 2015. The development is primarily on the Swanscombe Peninsula, but also includes a corridor of land along to the south east past Ebbsfleet International train station toward Watling Street. The Order Limits also include a stretch of Watling Street from the B255 junction to Pepper Hill. This will be where a new access road and upgrades to existing road junctions are likely to be made.

1.7 The Essex Project Site is within the administrative area of Thurrock Borough Council. The majority of the Essex Project Site is on the River Thames between Tilbury Fort and Tilbury Docks. A much smaller part of the Order Limits encompasses a roundabout to the North West involving Dock Road and St Andrew's Road.

RELEVANT POLICY/LEGISLATION

1.8 National and international policy/legislation set out requirements for compliance with the implementation of biosecurity measures and the control of NNS. In the UK at present the primary drivers include:

- EC Marine Strategy Framework Directive (2008/56/EC) - Requires 'Good Environmental Status' (GES) of marine waters by 2020. Requires that Non-Native species introduction is at levels that do not adversely alter ecosystems and there are targets to reduce spread and impact of INNS.

- EU Water Framework Directive (2000) (2000/60/EC) - achieve 'Good Ecological Status' by 2020, no deterioration in ecological status is permitted.

- The Wildlife and Countryside Act: Section 14 (1981) - It is illegal to allow any animal which is not ordinarily resident in Great Britain, or that is listed on Schedule 9 to the Act, to escape into the wild, or to release it into the wild. It is also illegal to plant or otherwise cause to grow in the wild any plant listed on Schedule 9 of the Act.

- The EU invasive alien species regulation (EU Regulation 1143/2014) - Came into force on 1st January 2015. The list of species to which the regulation applies is still being developed. However, a requirement of the legislation is to have in place pathways action plans to control the introduction and spread of listed species. Pathways action plans for marine species may include future requirements for biosecurity plans.

Chapter Two ◆ Methodology

2.1 This plan has been prepared following guidance in Cook *et al*. (2015) which indicates there are two types of biosecurity plans which are 'Site' and 'Operations' plans:

- A 'Site' Biosecurity Plan covers the long-term, on-going activities at a single location such as a marina (e.g. vessel activity or routine dredging activities).
- The 'Operations' Biosecurity Plan is for a particular activity or set of activities which are time-limited (e.g. construction of marine infrastructure or one-off dredging activities) (Cook *et al*. 2015).

2.2 This assessment has been conducted following the guidance taking account of both types of plan to cover the construction and operation phases for the Proposed Development.

2.3 The preparation of the Biosecurity Plan involved the following aspects:

- Defining the construction works to be undertaken – methods, frequency, size of operation, location etc.
    - Review proposed vessel activities (e.g. arrival, activity, leaving site).
    - Other construction activities including piling to install infrastructure.
- Defining the operational usage of the project:
    - Number and frequency of vessels using the terminals/berths
    - Number and frequency of other vessels
    - Itinerary of vessels (e.g. arriving from, travelling to and time at the terminal).
- Site description – including environmental information (water flow, salinity etc.).
- Review of NNS recorded in the vicinity of the Project site.
- Assigning a risk level for each activity (High, Medium, Low).
- Proposing biosecurity control measures for the medium and high-risk tasks associated with the construction works and with operation, along with instructions for staff and contractors.
- Proposing a contingency plan, e.g. rapid response and containment measures if there is any evidence of high-risk incidents or if new NNS are detected.

DESIGN OPTIONS

2.4 The marine biosecurity plan has been subdivided into two main groups of activities to be undertaken for the London Resort project: Construction and Operation activities. Within the Kent Project Site, three design options are being considered with a view to confirming a preferred option upon completion of further studies.

2.5 There are three main options at the Kent Project Site as follows: Option A (Figure 13.9.1); Option B (Figure 13.9.2); and Option C (Figure 13.9.3) (see ES Chapter 3: *Project Description*).

Option A

1. New ferry terminal and ferry pontoon with linkspan
2. Refurbishment of Bell Wharf – an open-piled quay deck
3. Construction of a new floating Roll-on / Roll-off (Ro-Ro) platform and linkspan

Option B

1. New ferry terminal and ferry pontoon with linkspan
2. Refurbishment of Bell Wharf – an open-piled quay deck
3. Refurbishment/reinforcement of White's Jetty – an open-piled deck structure in an uncertain state of repair

Option C

Note that Option C involves dredging and would only be pursued if Options A and B prove to be unfeasible.

1. New ferry terminal and ferry pontoon with linkspan
2. Refurbishment of Bell Wharf – an open-piled quay deck
3. Dredging to deepen access to Bell Wharf

2.6 As part of the project, new saltmarsh will be created within the Kent Project Site through managed retreat of the flood defences in the area south of Bell Wharf and interventions at the shoreline to create an enhanced intertidal zone and encourage saltmarsh habitat to form along the north and northwest coast of the Peninsula. This will increase areas of mud flat, salt marsh, small pools, rocks and shingle areas, with reeds, sedges and grasses transitioning into scrub vegetation. It is estimated that creation of c.3 ha of saltmarsh habitat will be achievable. Further details are provided in ES Appendix 12.3: *Ecological Mitigation and Management Framework*.

2.7 The proposed works at the Tilbury Site will involve construction of a new ferry pontoon with linkspan (Figure 13.9.4).

CONSTRUCTION AND OPERATION ACTIVITIES

2.8 Certain construction activities will only take place if a particular design option is chosen but activities across all options have been considered here (see ES Chapter 3: Project Description).

Construction Activities

- Construction of ferry pontoon with linkspan at Kent Project Site;
- Refurbishment of Bell Wharf (open-piled quay deck) at Kent Project Site;
- Construction of new floating roll on, roll off slipway and linkspan at Kent Project Site (Option A only);
- Refurbishment/reinforcement of White's Jetty (open-piled quay deck), (Option B only);
- Dredging at the Kent Project Site (only relevant to Option C and will only be undertaken if Options A and B prove to be unfeasible);
- Wastewater treatment plant outfall at Kent Project Site. Water released from this facility will be treated prior to discharge to ensure it complies with the relevant legislation. The location of this outfall will be on the north east coast of the Peninsula. The construction of the outfalls could require the construction of a temporary cofferdam within the subtidal zone.
- Surface water outfalls. Surface water runoff outfalls will be installed at up to five locations along the Kent Project Site coastline. The construction of the outfalls will likely require the construction of temporary cofferdams. A single outfall is anticipated to be installed at the Essex Project Site and will be sited to pass between existing infrastructure.
- Extension of jetty at Essex Project Site.

Operational Activities

- Movement and berthing of barges/Ro-Ro vessels and other supply/support vessels
- Movement and berthing of passenger ferries at both the Kent and Essex Project Sites.
- Discharge of water from wastewater treatment plant outfall to the estuary at Kent Project Site. Details of discharge volumes are not currently available but the discharge

will comply with regulatory requirements from the EA in terms of water quality and any other requirements;

- Discharge of water from surface water outfalls. Details of discharge volumes are not currently available but the discharge will comply with regulatory requirements from the EA in terms of water quality and any other requirements;

- Maintenance of structures;

- If Option C is chosen, it is the intention that Bell Wharf will only be used during high tide during the operational phase and therefore maintenance dredging will not be conducted. However, if it was decided that Bell Wharf is to be used at all tides during operation of the Proposed Development, maintenance dredging may be required periodically which would cause disturbance and re-suspension of sediments. If maintenance dredging was required it would be conducted by a backhoe dredger.

Description of construction activities

2.9 Details are provided in the Outline Construction Method Statement (document reference 6.2.3.1) with key information summarised below.

Construction of ferry pontoon with linkspan at Kent Project site

2.10 The floating pontoon and linkspan will allow for passenger ferry access through all tidal levels. The floating pontoon will require a series of guide piles to be driven or bore; most likely undertaken by an anchored or 'spud' barge. The passenger jetty will be a floating pontoon structure with two 0.9 m piles. Floating pontoons and linkspan are expected to be constructed off-site and installed from a floating or anchored barge. Some final finishing such as surfacing, balustrades and signage may be installed *in-situ*.

Refurbishment of Bell Wharf (open-piled quay deck) at Kent Project Site

2.11 Waste materials being moved off-site will predominantly utilise Bell Wharf, with container and palletised waste exported via both Bell Wharf and Tower Wharf. During construction it is anticipated that Bell Wharf will be the primary point for materials and bulk fill delivery.

2.12 Works to existing structures would depend on the option pursued and the outcome of structural surveys. Typical works for refurbishment of steel structures would be shot-blasting, possibly plating, and repainting. Reinforced concrete structures might require new casting to increase cover depths to steel. Such works must be undertaken in the dry, and so dewatering of the structures and their immediate environment would be required combined with encasement of the underneath of the structures. This could be through temporary sheetpiling or the installation of a bund with a diaphragm wall.

Construction of new floating roll on roll off slipway and linkspan at Kent Project Site

2.13 The floating roll-on / roll-off ferry pontoon is designed to support the day-to-day servicing of the Resort, ferrying goods via a roll-on/roll-off ferry. Additionally, the linkspan will allow

for passenger ferry access through all tidal levels. There will be two 2 m diameter piles for the Ro-Ro guide piles and four 1 m diameter piles. The roll-on / roll-off slipway and linkspan are expected to be constructed off-site, delivered by barge or lorry and installed from a barge or crane.

Refurbishment/reinforcement of White's Jetty (open-piled quay deck)

2.14 The requirements for refurbishment of White's Jetty will be similar to those indicated for Bell Wharf as it is an open-piled quay. It will also utilise a large number of piles (50 round) driven into the seabed, to support the overlying structure.

Dredging at the Kent Project Site (only relevant to Option C)

2.15 It should be noted that Option C and dredging will only be pursued if Options A and B prove to be unfeasible.

2.16 Excavation of the riverbed could be achieved by a number of techniques which would depend on the ground conditions to be confirmed by further investigations. The task could be undertaken using floating vessels, either anchored barges with mounted excavators or specialised dredging vessels, or by dewatering the area through use of a bund of sheetpiling, and excavation undertaken using standard land-based equipment. The excavated material would either be disposed of in a licensed offshore spoil area, or, if possible, used beneficially in either the works for this site or others. Use of dredging vessels has been assumed for this assessment.

Wastewater treatment plant outfall at Kent Project Site and surface water outfalls at Kent and Essex Project sites

2.17 The construction of outfalls is anticipated to involve the construction of cofferdams and associated piling.

Extension of jetty at Essex Project Site

2.18 The extension of the jetty will consist of a floating pontoon and piles. The types of piles are yet to be determined but there are currently expected to be a number of floating pontoons with a 1 m draft, held in place by eight, 0.9 m diameter piles. Floating pontoons and piles are expected to be constructed off-site, delivered by barge or lorry and installed from a barge or crane.

Vessel requirements during construction

2.19 It is estimated that there would be 10 barge movements per day during the construction phase.

2.20 Vessel requirements are outlined in the Navigation Risk Assessment submitted as part of the DCO application (Appendix 10.1: *Preliminary Navigation Risk Assessment*) with key points summarised below.

- Barge operations – Waste removal (construction phase)
- Barge operations – Material supply (construction phase)
- Barge operations – Removal of dredged material (construction phase – if Option C is pursued, which would only be the case if Options A and B proved to be unfeasible)
- Ro-Ro operations – Waste removal and material supply (partial during construction)
- Passenger vessel operations (partial during construction phase).

2.21 The following assumptions apply (Appendix 10.1: *Preliminary Navigation Risk Assessment*):

- Waste removal and material supply by barge will be undertaken during the construction phase;
- Waste will be transported from the London Resort and taken further upstream and/or downstream. Materials will be carried between the Port of Tilbury and London Resort, and following unloading, empty barges will return to the Port of Tilbury;
- The contractor will use barges of a capacity of approximately 1,000 tonnes (approximately 35 m length, 10 m width, 3 m loaded draught);
- Barges will be berthed at either the Seacon Terminal or Bell Wharf (dependent on the status of Bell Wharf) during the construction phase;
- A total of two barges (either waste or material) will be able to berth alongside at Bell Wharf during the construction phase (dependent on the status of Bell Wharf);
- At Bell Wharf the minimum navigable window will be one hour either side of high tide (two hours total) however if dredging is undertaken at Bell Wharf it is anticipated there would then be no restriction. There is no restriction to when berthing can be conducted at White's Jetty or the Seacon Terminal;
- Due to the potential small navigable window, arrival, unloading and departure may not be possible on the same high tide. It is assumed that a 'not always afloat but safely aground' (NAABSA) condition will be acceptable at Bell Wharf.

2.22 If dredging is undertaken the following assumptions apply (Appendix 10.1: *Preliminary Navigation Risk Assessment*):

- Hopper barges for dredging will be during the construction phase only;
- Dredged material will be transported from the area adjacent to Bell Wharf to a designated licenced offshore disposal site located outside of the Thames Estuary (to be confirmed based on level of contamination);
- The contractor will use hopper barges of a capacity of approximately 1,000 tonnes (approximately 35m length, 10m width, 3m loaded draught);
- Barges will be moored alongside the dredging plant (assumed to be backhoe dredge) for loading of material; and
- Assumed that two barges will be used for the dredging operations.

2.23 Assumptions related to Ro-Ro operations are as follows (Appendix 10.1: *Preliminary Navigation Risk Assessment*):

- Ro-Ro vessels (i.e. for waste removal and material supply) will be used during part of the construction phase;
- Ro-Ro vessels will operate between the London Resort and Tilbury2 as well as the Port of Tilbury;
- The contractor will use Ro-Ro vessels with a capacity of 1,000 tonnes;
- Ro-Ro vessels will be berthed at the new Ro-Ro platform on the Kent Project Site;

2.24 Indicative vessel routes are provided in the ES Appendix 10.1: *Preliminary Navigation Risk Assessment* submitted as part of the DCO application with key points summarised below.

Description of operational activities

Vessel requirements during operation

2.25 Vessel requirements are outlined in the ES Appendix 10.1: *Preliminary Navigation Risk Assessment* with key points summarised below.

- Barge operations – Waste removal (operational phase)
- Barge operations – Material supply (operational phase)
- Ro-Ro operations – Waste removal and material supply (operational phase)
- Passenger vessel operations (operational phase).

Barge activity

2.26 It is anticipated that there would be less than 10 barge movements per day during the construction phase.

2.27 The assumptions indicated above for barges during the construction phase apply.

Passenger ferry movements

2.28 It is anticipated that there would be 27 passenger vessel movements per day between upstream locations and London Resort (extension of existing route).

2.29 There would also be 42 passenger vessel movements per day between London Resort and Tilbury (new passenger ferry services).

2.30 Assumptions related to passenger vessel operations are as follows:

- Passenger vessel operations relating to guest arrivals through the Thames Clippers services will be undertaken during part of the construction phase and during the operational phase;
- Thames Clippers will operate a ferry service between central London and both the Kent and Essex Project Sites of the Resort, with a separate shuttle service operating between the Essex and Kent Project Sites;
- Passenger vessels will be berthed at a new floating pontoon located off the upstream end of Bell Wharf (Kent Project Site) and on the downstream end of the Landing Stage (Essex Project Site);
- At the Kent Project Site up to two vessels may be berthed at any one time;
- At the Essex Project Site up to eight vessels may be berthed at any one time (two berths for operating Thames Clippers ferries and six berths for maintenance);
- Berthing will be possible at any stage of the tide;
- Embarkation/disembarkation will be via a floating pontoon and access gangways;
- During the initial phase (Gate One) of the Proposed Development a single vessel will arrive/depart at approximately 30-minute intervals during peak times, times for embarkation/disembarkation will vary according to number of passengers;
- Following full build-out, the arrival/departure of vessels may decrease to a 15-minute interval;
- Thames Clippers will operate 220-seater catamarans for passenger operations (40m length overall (LOA)).

2.31 Indicative vessel routes are provided in ES Appendix 10.1: *Preliminary Navigation Risk Assessment* submitted as part of the DCO application with key points summarised below.

Maintenance dredging activity at the Kent Project Site (only relevant to Option C)

2.32 As indicated above, maintenance dredging would only be required if Option C was pursued (which would only be the case if Options A and B proved to be unfeasible), and if it was decided that Bell Wharf needed to be used at all tides during operation of the Proposed Development.

2.33 If maintenance dredging is undertaken, for the purposes of assessment, the assumptions indicated above for dredging during the construction phase are considered to apply (see *Vessel requirements during construction* section).

PLAN PERIOD

Construction Phase

2.34 As indicated in the Outline Construction Method Statement that accompanies the DCO application (appended to ES Chapter Three: *Project Description*) construction of Gate One is scheduled to commence in 2022. The peak construction year is anticipated to be 2023, with Gate One opening in 2024 and Gate Two opening in 2029. The construction work is anticipated to cease in 2029. The anticipated construction hours of work are Monday to Friday 8am to 6pm / Saturday 8am to 1pm and work outside these core times will need to be agreed with the Local Planning Authorities (LPA).

Operational phase

2.35 The current operational life span of The London Resort is predicted to begin in 2029 (the predicted year of opening) and has no specified end date as the attraction is designed to evolve over time.

BIOSECURITY MANAGER

2.36 A Biosecurity Manager will be appointed for the Construction phase and during the Operation phase to ensure appropriate management measures are in place and being implemented.

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Chapter Three ◆ Environmental Information

SALINITY, TEMPERATURE AND TIDAL FLOW

3.1 The mean salinity in the study site is typical of mid-estuarine salinity at 21.33. The study site is tidal and displays extensive diurnal fluctuation in salinity correlated with tidal hight (lower salinity at low tide and higher salinity high tide). Typical estuarine pulsed variations in salinity are caused by high riverine input and will typically decrease in salinity during flood events.

3.2 Water temperature in the Thames fluctuates diurnally across the tidal cycle and from mesoscale environmental conditions (air temperature, water run off), however, water temperatures typically range between 20°C during the seasonal summer peak to lows of 4-5°C. pH values for the study site are within a 'normal' expected estuarine range, i.e. between ~6.5 and 8.5.

3.3 Hydrodynamic modelling undertaken for the Proposed Development indicated that the currents around the Swanscombe Peninsula are relatively complex with a large eddy forming during the flood tide adjacent to the Kent Project Site and a similarly large eddy forming on the eastern side of the peninsula during the ebb tide (ES Appendix 17.4, document reference: 6.2.17.4).

3.4 The general current direction at the Kent Project Site is towards the north east for the majority of the time. Maximum peak currents of more than 2 m/s (4 knots) are evident mid-channel at both the times of peak ebb and flood tide (ES Appendix 17.4, document reference: 6.2.17.4).

3.5 The modelling suggested the presence of piles associated with White's Jetty reduces the current speeds during the ebb tide, but the effect is less evident during the flood tide, when the current speeds are lower.

3.6 At the Essex Project Site, modelling indicated that the currents are almost exactly rectilinear with flood and ebb currents going in the opposite directions. Peak current magnitudes approaching 2 m/s are evident for both tidal phases.

3.7 Modelled changes to current speed due to the installation of proposed infrastructure are in the region of 0.05 m/s at distances of up to 700 m from structures, to 0.2 m/s up to 300 m from structures.

SITE HABITATS & DESIGNATED SITES

3.8 Project specific subtidal and intertidal surveys were conducted in August and September 2020 which included intertidal and subtidal benthic habitat characterisation at the Kent Project Site and subtidal benthic habitat characterisation at the Essex Project Site (see Appendices 13.4: *Intertidal Benthic Ecology Survey Report* and 13.5: *Subtidal Benthic Ecology Survey Report* of the ES). An initial summary of habitat present at the Kent and Essex Project Sites is provided below, followed by a specific section on NNS recorded at these sites.

Intertidal habitats

Kent Project Site

3.9 At the Kent Site sediment type within the intertidal zone was found to be fairly homogenous, generally consisting of sandy mud with areas of muddy gravel and patches of muddy sandy gravel, mud, slightly gravelly sandy mud and sand (Appendix 13.4: *Intertidal Benthic Ecology Survey Report*).

3.10 Much of the intertidal area consisted of firm sandy mud with a surface veneer of 2-3 inches of softer silty mud, assigned to the habitat '*Hediste diversicolor* and *Streblospio shrubsolii* in littoral sandy mud' (EUNIS A2.3221; JNCC code: LS.LMu.Uest.Hed.Str). Either side of White's Jetty, sediment was dominated by *Corophium volutator* with visible surface burrows and was assigned to '*Hediste diversicolor* and *Corophium volutator* in littoral mud' (A2.4115; LS.Lmu.Uest.Hed.Cvol). *Fucus vesiculosus* colonised areas where sea defences were present at the top of the shore or larger artificial boulders or historical fish traps were present and these areas were assigned to the habitat '*Fucus vesiculosus* on variable salinity mid eulittoral boulders and stable mixed substrata' (A1.323; LR.LLR.FVS.FvesVS). On some areas of the lower shore cobbles and boulders were present with the invasive barnacles *A. improvisus* and *A. modestus*. The area was classified as an impoverished variant of 'Barnacles and *Littorina* spp. on unstable eulittoral mixed substrata' (A2.431, JNCC code: LR.FLR.Eph.BlitX) with *A. improvisus* replacing the native barnacle *Semibalanus balanoides*.

Essex Project Site

3.11 Previous data for intertidal invertebrate assemblages from the Environment Agency within the vicinity of the Essex Project Site are available from 14 intertidal coring surveys conducted for the 'Thames Biological Programme' between 1991 and 2003, with samples also being collected using a core of 11.28 cm diameter and being sieved through a 500 µm mesh. A total of 27 taxa were recorded from four different groups (18 taxa were Annelida, four were Crustacea, four were Mollusca and one was a Nematoda). Samples were largely dominated by *T. benedii* and *B. costata*. Other species recorded in high abundance included *C. volutator, Caulleriella* spp., Nematoda and *H. diversicolor*.

Subtidal habitats

Kent Project Site

3.12 To complement the data available from previous surveys within the wider Thames Estuary and the site-specific data obtained from previous surveys, a subtidal benthic ecology survey was undertaken in August and September 2020. Sampling stations were targeted to the Kent project site located to the western side of Swanscombe peninsula. A total of 14 grab stations were sampled (ES Appendix 13.5: *Subtidal Benthic Survey Report* (document reference 6.2.13.5)).

3.13 Sediment type within the Kent Project Area was found to be fairly homogenous with eight of the 14 stations classified as gravelly mud whilst the remaining stations were classified as muddy sandy gravel, sandy mud, muddy gravel and mud.

3.14 Subtidal benthic communities were assigned to three habitat types: a variant of '*Polydora ciliata* and *Corophium volutator* in variable salinity infralittoral firm mud or clay' (EUNIS A5.321; JNCC: SS.SMu.SMuVS.PolCvol) (seven stations); a variant of A5.421: 'Aphelochaeta spp. and Polydora spp. in variable salinity infralittoral mixed sediment' (A5.421; SS.SMx.SMxVS.AphPol (six stations) and A5.422: *Crepidula fornicata* and *Mediomastus fragilis* in variable salinity infralittoral mixed sediment (SS.SMx.SMxVS) (1 station adjacent to White's Jetty).

3.15 Sessilia was the most abundant taxon across the subtidal grab samples within the Kent Project Area and biomass data indicated that annelids dominated subtidal grab stations (influenced primarily by high numbers of *Streblospio* spp., *A. succinea, P. cornuta* and *T. benedii*).

3.16 A total of four NNS were recorded within the Kent survey area (*C. caspia, R. philippinarum, E. zostericola* and *M. gigas*).

Essex Project Site

3.17 Samples were collected at eight stations at the Essex Project Site during the project-specific 2020 survey (ES Appendix 13.5: *Subtidal Benthic Survey Report* (document reference 6.2.13.5).

3.18 Sediment type within the Essex Project Site was fairly homogenous with most stations assigned the substrate type muddy sand, with some areas of sandy mud, gravelly muddy sand and gravel.

3.19 The benthic communities sampled were assigned to three habitat types: '*Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud' (EUNIS code A5.322; JNCC code: SS.SMu.SMuVS.AphTubi) (six stations); '*Polydora ciliata* and *Corophium volutator* in variable salinity infralittoral firm mud or clay' (A5.321; SS.SMu.SMuVS.PolCvol) (one stations), and a variant of '*Aphelochaeta* spp. and *Polydora*

spp. in variable salinity infralittoral mixed sediment' (A5.421; SS.SMx.SMxVS.AphPol) (one station).

3.20 The oligochaete *Tubificoides benedii* was the most abundant taxon recorded at the Essex Project Site and biomass data indicated that annelids dominated subtidal grab stations (influenced primarily by high numbers of *Streblospio* spp., *A. succinea, P. cornuta* and *T. benedii*).

3.21 Four NNS were recorded within the survey area (*M. nitida, P. macrodactylus, E. zostericola* and *M. gigas*).

Designated sites

3.22 The Kent Project Site is located within the Swanscombe MCZ, a small inshore site which covers an area of approximately 3 km2 to the west of Swanscombe peninsula. The site is designated for the following protected features:

- The tentacled lagoon worm *A. rominji* and;
- Intertidal mud.

3.23 The following designated sites including Special Protection Areas (SPAs), Special Areas of Conservation (SAC), Sites of Special Scientific Interest (SSSI) and Local Wildlife Sites (LWS) are located within close proximity to the Kent and Essex project sites (Figure 13.9.5):

- Thames estuary and Marshes SPA/Ramsar.
- Medway estuary and Marshes SPA/Ramsar.
- North Downs Woodland SAC.
- Inner Thames Marshes SSSI.
- South Thames estuary and Marshes SSSI.
- West Thurrock Lagoon and Marshes SSSI.
- Wouldham to Detling Escarpment SSSI.
- Botany Marshes LWS.
- Ebsfleet Marshes, Northfleet LWS.
- Alkerden Lane Pits LWS.
- Tilbury Marshes LWS.

NON-NATIVE SPECIES

3.24 NNS reported to be present within the tidal River Thames include the following (ZSL 2016; Thames21 2017; PLA 2017):

- Chinese mitten crab *Eriocheir sinensis*;
- Asian clam *Corbicula fluminea*;
- zebra mussel *Dreissena polymorpha*;
- quagga mussel *Dreissena rostiformis bugensis*;
- slipper limpet *Crepidula fornicata*;
- Pacific oyster *Magallana gigas*;
- veined whelk *Rapana venosa*;
- killer shrimp *Dikerogammarus villosus*;
- signal crayfish *Pacifastacus leniusculus*;
- carpet sea squirt *Didemnum vexillum*;
- the polychaete *Boccardiella ligerica*;
- topmouth gudgeon *Pseudorasbora parva*;
- New Zealand pigmyweed *Crassula helmsii*;
- wakame *Undaria pinnatifida*;
- Pacific wireweed *Sargassum muticum*; and
- water primrose *Ludwigia grandiflora*.

Non-native species at the Kent Project Site

3.25 Records from the NBN Atlas from 1965 to 2017 were examined for the Kent Project Site area and indicated the following two records of NNS (which can be found in intertidal or shallow subtidal environments) and the cryptogenic species (i.e. neither demonstrably native nor non-native) sea grape *Molgula manhattensis* (4 records)):

- Chinese mitten crab, *Eriocheir sinensis* (1 record); and
- Jenkins' spire snail *Potamopyrgus antipodarum* (1 record).

3.26 Records from the Kent and Medway Biological Records Centre from 1971 to 2018 indicated the following three NNS within the vicinity of the Kent Project Site for the London Resort (with nine separate records):

- Slipper limpet *Crepidula fornicata* (2 records);
- Pacific oyster *Magallana gigas* (1 record); and
- Chinese mitten crab *Eriocheir sinensis* (6 records).

3.27 In April 2015 a survey of the western edge of the Kent Project Site and representative intertidal habitats (natural and artificial) on the eastern side of Swanscombe Peninsula was undertaken by Aquatonics Ltd (Aquatonics 2016). The following NNS were abundant on middle and lower shore hard substrates:

- Pacific oyster *Magallana gigas* (previously *Crassostrea gigas*);
- Acorn barnacle *Amphibalanus improvisus*; and
- Acorn barnacle *Austrominius modestus*.

3.28 Additionally, the non-native serpulid tube worm *Ficopomatus enigmaticus* (native to the southern hemisphere) was recorded at low densities on stones beneath the jetty.

3.29 The non-native tubificid oligochaete worm *T. heterochaetus* was also found within the vicinity of the jetty.

3.30 During a saltmarsh fish survey by Colclough and Coates in 2015 (Colclough & Coates 2015) there was isolated evidence at multiple sites of burrowing by Chinese mitten crab *E. sinensis*.

3.31 During the project-specific survey in 2020 four NNS were recorded during the intertidal Phase I survey (the Chinese mitten crab *E. sinensis*, the Pacific oyster *Magallana gigas*, Australian tube worm *Ficopomatus enigmaticus* and the bay barnacle *Amphibalanus improvisus*) and two non-native species were recorded during the Phase II intertidal coring survey (the barnacle *Austrominius modestus* and the crustacean *Sinelobus vanhaareni*). *Streblospio* sp., Sessilia and Chironomidae were also recorded in samples and at least one species in each of these taxa is considered non-native in the UK. Five species recorded in samples were considered to be cryptogenic (*Alitta succinea, Polydora cornuta, Tubificoides galiciensis, Tubificoides heterochaetus* and *Amphibalanus improvisus*), (for further details see Appendix 13.4: *Intertidal Benthic Survey Report*, document reference 6.2.13.4).

3.32 Five NNS were recorded during the subtidal survey (A. *modestus, Cordylophora caspia, Eusarsiella zostericola, Magallana gigas* and *Ruditapes philippinarum*). A total of nine species considered to be cryptogenic were recorded (*Alitta succinea, Amphibalanus improvisus, Apocorophium lacustre, Boccardiella ligerica, Eteone lighti, Monocorophium*

insidiosum, Polydora cornuta, Teredo navalis and *Tubificoides heterochaetus*)(for further details see Appendix 13.5: *Subtidal Benthic Survey Report*, document reference 6.2.13.5).

3.33 In June and September 2020 a Project-specific intertidal fish survey was conducted at the Kent Project Site using double-fyke nets at four locations and seine netting. Two specimens of Chinese mitten crab *E. sinensis* were recorded within the catch in the fyke nets (see for further details Appendix 13.6: *Intertidal Fish Survey Report,* document reference 6.2.13.6).

Non-native species at the Essex Project Site

3.34 Between 1965 and 2017 the NBN Atlas indicated 11 records of NNS and cryptogenic species (i.e. neither demonstrably native nor non-native) within the vicinity of the Essex Project Site, downstream on the opposite bank at Gravesend. These include one cryptogenic species, the sea grape *M. manhattensis* (4 records) and three NNS (which can be found in intertidal or shallow subtidal environments):

- *A. modestus* (5 records);
- *A. improvisus* (1 record); and
- *P. pholadiformis* (1 record).

3.35 Project-specific subtidal benthic ecology surveys were conducted in August and September 2020. A total of eight sampling stations were targeted at the Essex Project Site. The following NNS were recorded within the subtidal survey:

- *A. modestus*;
- the North American ostracod *Eusarsiella zostericola*;
- *M. gigas*;
- the amphipod *Melita nitida*; and
- the oriental shrimp *Palaemon macrodactylus*.

3.36 A total of four species considered to be cryptogenic were recorded (*Alitta succinea, Amphibalanus improvisus* and *Polydora cornuta*), (for further details see Appendix 13.5: *Subtidal Benthic Survey Report*, document reference 6.2.13.5).

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Chapter Four ◆ Risk Assessment

CONSTRUCTION

Risk of introducing or spreading non-native species

4.1 The construction works in the estuary has been broken down into the following main activities, although they will likely be occurring simultaneously at times:

- Vessel arrival and construction works (including the introduction of materials/structures to the water column);
- Vessels stationary during construction or berthed at the terminals/wharfs;
- Vessel departure.

4.2 The main risk of introduction and spread of NNS is considered to be associated with the fact that stock and supply vessels could be travelling long distances and could be arriving at the London Resort or neighbouring ports from ports across the UK and potentially worldwide.

4.3 Arriving/departing vessels could have biofouling on the hull and another primary consideration for large vessels such as stock and supply vessels are niche areas on the vessel. Niche areas are intricate areas of vessels such as sea chest, seawater intake and outflows, positioning thrusters, vents and grills, prop shafts and other complex hull structures which could become biofouled.

4.4 Non-native species can also be present within ballast water used to maintain stability of vessels. This is closely managed, however, via requirements of the International Maritime Organization (IMO) Ballast Water Management Convention (i.e. International Convention for the Control and Management of Ships' Ballast Water and Sediments).

4.5 For each of these activities the biosecurity risks have been identified and the level of risk has been assessed using the Marine Biosecurity Planning guidelines (Cook *et al.* 2015) and professional judgement (Table 4-1). The greatest risk of introducing a NNS is when a vessel (particularly slow moving barges for example), equipment or stock arrives at the site from another country region or water body with similar environmental conditions to the worksite (e.g. in terms of temperature) and/or is covered in biofouling or contains additional algae and animals within the equipment/stock.

4.6 For any plant or materials coming into contact with the water column in the dock, the measures indicated in Table 4-1 in relation to the assessment of the levels of biofouling of plant/materials will be applied.

4.7 As a precautionary approach, the overall activity risk has been categorised at the highest risk level of any of the component tasks.

Biosecurity control measures

4.8 Biosecurity control measures have been proposed for the activities/tasks assessed to be Medium and High risk in Table 4-1. These control measures (provided in Table 4-2) will be listed in a biosecurity log and the date when each control measure is carried out will be recorded in the log. This process will allow the identification of any breaches in control measures. If such a breach occurs it will be recorded in the biosecurity log and the contingency plan will be triggered as outlined in the 'Contingency plan' and 'Monitoring, site surveillance and reporting procedure' sections in this document.

Table 4-1: Construction Phase: Risk assessment of introduction and spread of NNS during the marine construction elements of the London Resort. Risk categories were assigned using guidelines in Cook *et al.* (2015) and professional judgement.

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium /Low)	Overall activity risk (High/Medium/ Low)
CONSTRUCTION				
Arrival of construction vessels and introduction of structures				
Arrival of barges/Ro-Ro vessels/dredgers (option C only)/ other supply and support vessels	Introduction of new NNS	Vessel with no notable biofouling (just green slime (see Appendix 1))[1]. To be checked each time vessel arrives from outside the Thames Estuary.	Low	High
		Vessel with notable biofouling (more than green slime (see Appendix 1)). To be checked each time vessel arrives from outside the Thames Estuary.	High	
		Vessel will remain stationary for prolonged periods of time	High	
		Vessel will be mobilised regularly	Medium	
Exchange of ballast or bilge water of vessels on site during construction	Introduction of new NNS	Any exchange of ballast or bilge water would be undertaken away from the Kent and Essex Project Sites and follow stringent protocols/standards (International Maritime Organisation regulations)	Low	Low

[1] When indicating levels of biofouling it is assumed inspection of vessels or materials will be undertaken visually, within dry dock (prior to deployment to site) or via inspection camera (still and video), as appropriate.

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium /Low)	Overall activity risk (High/Medium/ Low)
Introduction of new construction materials/structures to the marine environment	Introduction of new NNS	Structures (e.g. piles) without antifouling coating	Medium	Medium
		Structures (e.g. piles) with antifouling coating	Low	
Pile removal and construction activities (if required)	Spreading of NNS via fragmentation or dispersal of NNS into the water column from hard structures due to physical disturbance	Disturbance of heavily biofouled construction material/plant	High	High
		Prop wash from vessel could fragment NNS from hard structures	Low	
	Dispersal of NNS from suspension of sediment	Prop wash from vessel or sediment disturbance could mobilise or displace NNS if present in sediments	Low	

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium /Low)	Overall activity risk (High/Medium/ Low)
Arrival of passenger ferries (there will be some passenger ferry operation towards the end of the construction phase)				
Arrival of passenger ferry to the Kent or Essex Project Site	Introduction of new NNS	Vessel with no notable biofouling (just green slime (see Appendix 1)). It is assumed that passenger ferries will remain operating within the same section of the Thames Estuary for prolonged periods. It is proposed that biofouling checks are conducted at 6 month intervals or whenever vessel are removed from the water for maintenance checks. Whichever is most frequent.	Low	High
		Vessel with notable biofouling (more than green slime (see Appendix 1)). To be checked each time vessel arrives from outside the Thames Estuary. It is assumed that passenger ferries will remain operating within the same section of the Thames Estuary for prolonged periods. It is proposed that biofouling checks are conducted at 6 month intervals or whenever vessel are removed from the water for maintenance checks. Whichever is most frequent.	High	

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium /Low)	Overall activity risk (High/Medium/ Low)
Vessels stationary or berthed at terminals/wharfs				
Use of positioning thrusters	Spreading of NNS via fragmentation or dispersal of NNS into the water column from hard	Disturbance of heavily biofouled structures Prop wash from vessel could fragment NNS from hard structures	Low	Low
	Dispersal of NNS from suspension of sediment	Prop wash from vessel or sediment disturbance could mobilise or displace NNS if present in sediments	Low	
Staying alongside terminal (exchange of sea water through the vessel)	Interaction with niche areas spreading NNS	Potential biofouling of niche areas (e.g. sea chest, seawater intake and outflows, positioning thrusters, vents and grills, prop shafts) could introduce NNS	Medium	Medium
Exchange of ballast or bilge to stabilise cargo transfer	Introduction of new NNS	Any exchange of ballast or bilge water would be undertaken away from the Kent and Essex Project Sites and follow stringent protocols/standards (International Maritime Organisation regulations)	Low	Low

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium /Low)	Overall activity risk (High/Medium/ Low)
Departure of vessels				
Departure of barges/Ro-Ro vessels/dredgers (option C only)/ other supply and support vessels	Spread of NNS from the Kent and Essex sites due to biofouling of hulls of vessels leaving the site	Vessel with no notable biofouling (just green slime). To be checked each time vessel departs from the Kent or Essex Project Site to a destination outside the Thames Estuary.	Low	High
		Vessel with notable biofouling (more than green slime). To be checked each time vessel departs from the Kent or Essex Project Site to a destination outside the Thames Estuary.	High	
Exchange of ballast or bilge water of vessels before departure	Introduction of new NNS	Any exchange of ballast or bilge water would be undertaken away from the Kent and Essex Project Sites and follow stringent protocols/standards (International Maritime Organisation regulations)	Low	Low
Departure of passenger ferry from the Kent or Essex Project Site	Spread of NNS from the Kent and Essex sites due to biofouling of hulls of vessels leaving the site if the vessel is leaving the Thames Estuary	Vessel with no notable biofouling (just green slime (see Appendix 1)). It is assumed that passenger ferries will remain operating within the same section of the Thames Estuary for prolonged periods. It is proposed that biofouling checks are conducted at 6 month intervals or whenever vessel are removed from the water for maintenance checks. Whichever is most frequent.	Low	High
		Vessel with notable biofouling (more than green slime (see Appendix 1)). To be checked each time vessel departs to a location outside the Thames Estuary. It is assumed that passenger ferries will remain operating	High	

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium /Low)	Overall activity risk (High/Medium/ Low)
		within the same section of the Thames Estuary for prolonged periods. It is proposed that biofouling checks are conducted at 6 month intervals or whenever vessel are removed from the water for maintenance checks. Whichever is most frequent.		

Table 4-2: Construction Phase: Biosecurity control measures proposed for the London Resort.

Activity and biosecurity risk	Risk	Control measure	Where	When
CONSTRUCTION				
Arrival of vessels and introduction of structures				
Arrival of barges/Ro-Ro vessels/dredgers (option C only)/ other supply and support vessels Arrival of passenger ferries	Commercial vessels with potential regular movement between unknown ports, biofouling removal regime is unknown	Vessels are expected to remain within the Thames Estuary during the Construction phase, as opposed to arriving at site, leaving to enter another water body and then returning to site	Estuary at Kent and Essex Project sites	On arrival of vessel at the Kent and Essex Project sites
		Biosecurity assessments to be undertaken for all vessels		
		Request anti-fouling treatment record (if applicable) and bio-fouling removal record from all vessel operators		
		Apply the biofouling rapid visual inspection criteria indicated in Cook *et al*. 2015 (see Appendix 1 of this document) on vessel arrival <u>when it is arriving from outside the Thames Estuary</u> If the level of biofouling is ranked at level 3 or higher biofouling should be removed. Removal must be in a controlled manner with all removed material contained and not released to the marine environment An alternative to physical removal is to air dry biofouled areas for at least 48-72 hr to eradicate NNS (where air		

Activity and biosecurity risk	Risk	Control measure	Where	When
		drying is possible) and/or use of appropriate chemicals to accelerate eradication of organisms		
Introduction of new construction materials/ structures to the marine environment	Assumed construction materials/new structures are all new with no previous exposure to biofouling	Apply the biofouling rapid visual inspection criteria indicated in Cook *et al*. 2015 (see Appendix 1 of this document) to any materials/structures to be introduced to the water column at the Kent and Essex Project sites. If the level of biofouling is ranked at level 3 or higher the materials/structure should not be introduced until biofouling is removed. Removal must be in a controlled manner with all removed material contained and not released to the marine environment An alternative to physical removal is to air dry biofouled areas for at least 48-72 hr to eradicate NNS (where air drying is possible) and/or use of appropriate chemicals to accelerate eradication of organisms	Estuary at Kent and Essex Project sites	Before introduction of new materials/structures to the water column
Construction activity				
Construction - Fragmentation and dispersal of NNS	Fragmentation/spreading of INNS due to disturbance of construction materials	Addressed by measures indicated above for introduction of new construction materials/structures	Estuary at Kent and Essex Project sites	Before introduction of new materials/ structures to the water column

Activity and biosecurity risk	Risk	Control measure	Where	When
Vessels stationary or berthed at terminals/wharfs				
Exchange of sea water and interaction with niche areas	Introduction of new NNS via a range of dispersal methods (larval, fragmentation or other)	Inspection of niche areas following IMO guidance for any vessels arriving from outside the Thames Estuary.	Thames Estuary at Kent and Essex Project sites	Whilst alongside the terminal
Departure of vessels				
Departure of barges/Ro-Ro vessels/dredgers (option C only)/ other supply and support vessels Departure of passenger ferries	Some NNS present within the estuary at the Project site are invasive	Apply the biofouling rapid visual inspection criteria indicated in Cook *et al*. 2015 (see Appendix 1 of this document) prior to vessel departure <u>if going to a destination outside the Thames Estuary</u>. If vessel is ranked at level 3 or higher the vessel should be refused entry until biofouling is removed. Removal must be in a controlled manner with all removed material contained and not released to the marine environment An alternative to physical removal is to air dry biofouled areas for at least 48-72 hr to eradicate NNS (where air drying is possible) and/or use of appropriate chemicals to accelerate eradication of organisms	Estuary at Kent and Essex Project sites	After cessation of associated construction activities

Activity and biosecurity risk	Risk	Control measure	Where	When
Additional measures				
All	All	A Biosecurity Manager will be appointed for the Construction phase to ensure appropriate management measures are in place and being implemented.	Kent and Essex Project sites	Ongoing during construction
All	All	Training will be given to key staff at the Kent and Essex Project sites in the identification of key INNS from the region and using the visual inspection scheme (see Appendix 1 of this document). These reference materials should be printed off and placed in the Biosecurity Plan folder along with this plan Staff are encouraged to report any unusual sightings or suspected INNS to the Biosecurity Manager	Kent and Essex Project sites	Ongoing during construction
Chinese mitten crab	This species has been recorded at the Kent Project Site as indicated in the baseline summary text above. It is highly invasive and of national concern and steps should be taken to minimise its distribution.	Workers on site should be familiar with identifying the crab and if one is found it should be removed, isolated and reported to either the EA or NWIFCA with photographs. Care must be taken to dispose of them properly and to not reintroduce specimens back into the estuary. If the specimen is 'berried', i.e. carrying eggs, special care must be taken in handling of the crab so that eggs are not washed into the estuary	Kent and Essex Project sites	Ongoing during construction

OPERATION

Risk of introducing or spreading non-native species

4.9 The operational phase considerations for the Proposed Development are similar to those indicated for the construction phase apart from the following:

- Activity of barges/Ro-Ro vessels/dredgers (if required for Option C) and other supply and support vessels will be reduced
- Activity of passenger ferries would be increased
- There would no introduction of construction materials to the water column.

4.10 For each of the activities associated with operation of the Proposed Development the biosecurity risks have been identified and the level of risk has been assessed using the Marine Biosecurity Planning guidelines (Cook *et al.* 2015) and professional judgement (Table 4-3).

Biosecurity control measures

Biosecurity control measures have been proposed for the activities assessed to be Medium and High risk in Table 4-3. As indicated for the construction phase, these control measures (provided in Table 4-4) will be listed in a biosecurity log and the date when each control measure is carried out will be recorded in the log.

Table 4-3: Operational Phase: Risk assessment of introduction and spread of NNS during operation of the London Resort. Risk categories were assigned using guidelines in Cook *et al.* (2015) and professional judgement.

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium /Low)	Overall activity risk (High/Medium/ Low)
OPERATION				
Arrival of vessels				
Arrival of barges/Ro-Ro vessels/dredgers (if required for Option C)/ other supply and support vessels	Introduction of new NNS	Vessel with no notable biofouling (just green slime (see Appendix 1))[2]. To be checked each time vessel arrives from outside the Thames Estuary.	Low	High
		Vessel with notable biofouling (more than green slime (see Appendix 1)). To be checked each time vessel arrives from outside the Thames Estuary.	High	
		Vessel will remain stationary for prolonged periods of time	High	
		Vessel will be mobilised regularly	Medium	
Exchange of ballast or bilge water of vessels on site during construction	Introduction of new NNS	Any exchange of ballast or bilge water would be undertaken away from the Kent and Essex Project Sites and follow stringent protocols/standards (International Maritime Organisation regulations)	Low	Low

[2] When indicating levels of biofouling it is assumed inspection of vessels or materials will be undertaken visually, within dry dock (prior to deployment to site) or via inspection camera (still and video), as appropriate.

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium /Low)	Overall activity risk (High/Medium/ Low)
Arrival of passenger ferry to the Kent or Essex Project Site	Introduction of new NNS	Vessel with no notable biofouling (just green slime (see Appendix 1)). It is assumed that passenger ferries will remain operating within the same section of the Thames Estuary for prolonged periods. It is proposed that biofouling checks are conducted at 6 month intervals or whenever vessel are removed from the water for maintenance checks. Whichever is most frequent.	Low	High
		Vessel with notable biofouling (more than green slime (see Appendix 1)). To be checked each time vessel arrives from outside the Thames Estuary. It is assumed that passenger ferries will remain operating within the same section of the Thames Estuary for prolonged periods. It is proposed that biofouling checks are conducted at 6 month intervals or whenever vessel are removed from the water for maintenance checks. Whichever is most frequent.	High	

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium /Low)	Overall activity risk (High/Medium/ Low)
Vessels stationary or berthed at terminals/wharfs				
Use of positioning thrusters	Spreading of NNS via fragmentation or dispersal of NNS into the water column from hard	Disturbance of heavily biofouled structures Prop wash from vessel could fragment NNS from hard structures	Low	Low
	Dispersal of NNS from suspension of sediment	Prop wash from vessel or sediment disturbance could mobilise or displace NNS if present in sediments	Low	
Staying alongside terminal (exchange of sea water through the vessel)	Interaction with niche areas spreading NNS	Potential biofouling of niche areas (e.g. sea chest, seawater intake and outflows, positioning thrusters, vents and grills, prop shafts) could introduce NNS	Medium	Medium
Exchange of ballast or bilge to stabilise cargo transfer	Introduction of new NNS	Any exchange of ballast or bilge water would be undertaken away from the Kent and Essex Project Sites and follow stringent protocols/standards (International Maritime Organisation regulations)	Low	Low

Activity	Biosecurity risk	Risk factor assessment	Task risk (High/ Medium /Low)	Overall activity risk (High/Medium/ Low)
Departure of vessels				
Departure of barges/Ro-Ro vessels/dredgers (if required for Option C)/other supply and support vessels	Spread of NNS from the Kent and Essex sites due to biofouling of hulls of vessels leaving the site	Vessel with no notable biofouling (just green slime). To be checked each time vessel departs from the Kent or Essex Project Site to a destination outside the Thames Estuary.	Low	High
		Vessel with notable biofouling (more than green slime). To be checked each time vessel departs from the Kent or Essex Project Site to a destination outside the Thames Estuary.	High	
Exchange of ballast or bilge water of vessels before departure	Introduction of new NNS	Any exchange of ballast or bilge water would be undertaken away from the Kent and Essex Project Sites and follow stringent protocols/standards (International Maritime Organisation regulations)	Low	Low

Table 4-4: Operational Phase: Biosecurity control measures proposed for the London Resort.

Activity and biosecurity risk	Risk	Control measure	Where	When
OPERATION				
Arrival of vessels				
Arrival of barges/Ro-Ro vessels/dredgers (if required for Option C)/ other supply and support vessels Arrival of passenger ferries	Biofouling removal regime is unknown	Biosecurity assessments to be undertaken for all vessels	Thames Estuary at Kent and Essex Project sites	On arrival of vessel at the Kent and Essex Project sites
		Request anti-fouling treatment record (if applicable) and bio-fouling removal record from all vessel operators		
		Apply the biofouling rapid visual inspection criteria indicated in Cook *et al*. 2015 (see Appendix 1 of this document) for vessel arrival when it is arriving from outside the Thames Estuary If the level of biofouling is ranked at level 3 or higher biofouling should be removed. Removal must be in a controlled manner with all removed material contained and not released to the marine environment An alternative to physical removal is to air dry biofouled areas for at least 48-72 hr to eradicate NNS (where air drying is possible) and/or use of appropriate chemicals to accelerate eradication of organisms		

Activity and biosecurity risk	Risk	Control measure	Where	When
Vessels stationary or berthed at terminals/wharfs				
Exchange of sea water and interaction with niche areas	Introduction of new NNS via a range of dispersal methods (larval, fragmentation or other)	Inspection of niche areas following IMO guidance for any vessels arriving from outside the Thames Estuary.	Thames Estuary	Whilst alongside the terminal
Departure of vessels				
Departure of vessels	Some NNS present within the estuary at the Project site are invasive	Apply the biofouling rapid visual inspection criteria indicated in Cook *et al*. 2015 (see Appendix 1 of this document) prior to vessel departure if going to a destination outside the Thames Estuary. If vessel is ranked at level 3 or higher the vessel should be refused entry until biofouling is removed. Removal must be in a controlled manner with all removed material contained and not released to the marine environment An alternative to physical removal is to air dry biofouled areas for at least 48-72 hr to eradicate NNS (where air drying is possible) and/or use of appropriate chemicals to accelerate eradication of organisms	Thames Estuary at Kent and Essex Project sites	On vessel departure

Activity and biosecurity risk	Risk	Control measure	Where	When
Additional measures				
All	All	A Biosecurity Manager will be appointed for the Operation phase to ensure appropriate management measures are in place and being implemented.	Kent and Essex Project sites	Ongoing during operation
All	All	Training will be given to key staff at the Project site in the identification of key invasive NNS from the region and using the visual inspection scheme (see Appendix 1 of this document). These reference materials should be printed off and placed in the Biosecurity Plan folder along with this plan. Staff are encouraged to report any unusual sightings or suspected INNS to the Biosecurity Manager.	Kent and Essex Project sites	Ongoing during operation
Chinese mitten crab	This species has been recorded at the Kent Project Site as indicated in the baseline summary text above. It is highly invasive and of national concern and steps should be taken to minimise its distribution.	Workers on site should be familiar with identifying the crab and if one is found it should be removed, isolated and reported to either the EA or NWIFCA with photographs. Care must be taken to dispose of them properly and to not reintroduce specimens back into the estuary. If the specimen is 'berried', i.e. carrying eggs, special care must be taken in handling of the crab so that eggs are not washed into the estuary.	Kent and Essex Project sites	Ongoing during operation

Chapter Five ◆ Contingency Plan

CONSTRUCTION & OPERATION

5.1 In the event of any of any control measures being breached or the detection of a new INNS all necessary steps should be taken to control the spread and dispersal of the INNS. Contingency plans for specific scenarios are provided in Table 5-1.

Table 5-1: London Resort Construction and Operation Phase Contingency Plan.

Issue	Action	Responsibility	Equipment
Fragmentation or dispersal of conspicuous INNS into the water column – most likely source is during cleaning/removal of biofouling	Remove any observed INNS from the water column and dispose to landfill.	The Biosecurity Manager should inform Project staff to inform them of any observed fragmentation/dispersal into the water column.	Hand nets
Vessel biofouling is ranked at class 3 or above in the visual inspection (Appendix 1).	The vessel is not allowed entry to the Kent or Essex Project site. Remove vessel from water at home port or appropriate designated alternative port, clean and antifoul (if appropriate). Biofouling removal must be in a controlled manner with all removed material contained and not released to the marine environment.	Biosecurity Manager/Project staff to carry out visual inspection of all vessels prior to entry to the Project site.	Laminated copy of visual inspection table to be readily available.
Vessel leaves site without visual biofouling inspection (i.e. where this represents a breach of protocol)	Recommended visual inspection at next port of call to minimise risk of spread of INNS to other areas.	London Resort would notify the vessel owner of the requirement	NA

New records of INNS at Project site during construction or operation, or identified by project team in wider area.	The GB Non-native Species Secretariat would also be informed so they can update species distribution and abundance databases for NNS. Relevant details are located on their website: http://www.nonnativespecies.org	Workforce to inform the Biosecurity Manager.	NA

Chapter Six ◆ Monitoring, Site Surveillance and Reporting Procedure

6.1 The Marine Biosecurity Planning guidelines (Cook *et al*. 2015) require the use of a biosecurity logbook to record training, surveillance, control measures carried out and any other activities of concern regarding the biosecurity of the operation. Formal steps should be put in place to quickly inform the Biosecurity Manager of any potential introduction of INNS.

6.2 Information to be recorded in the logbook includes:

- Any routine inspections of vessels, construction equipment, materials and structures in the water column;
- Inspections of 'high risk' vessels;
- Details of when the Biosecurity Manager was informed if any INNS were found;
- Any biosecurity measures that were taken if INNS were found;
- Which organisations were notified when INNS were found (e.g. GB NNSS (non-native species secretariat);
- The application of any antifouling or cleaning of vessels, equipment and materials/structures undertaken on site;
- Any events undertaken to raise NNS/INNS awareness.

6.3 All logbook entries should be dated and signed by the Biosecurity Manager.

6.4 A table template indicating the key information required in the Biosecurity Plan to be completed on site is provided in Section 6 of Cook *et al*. (2015).

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Chapter Seven ◆ Key sources of advice

7.1 As recommended in Cook *et al*. (2015), a list of reference sources with additional information relating to NNS and the control of the spread of NNS is provided here.

- Guidance on Marine Biosecurity planning
  - England and Wales (Cooke *et al*. 2015) - www.nonnativespecies.org/downloadDocument.cfm?id=1401

- GB NNSS Website
  - Biosecurity in the field (including biosecurity for boat users, submerged structures and event biosecurity support pack) http://www.nonnativespecies.org/index.cfm?pageid=174

- National Biodiversity Network
  - Distribution maps and information about species: NBN Atlas www.nbnatlas.org

- European Commission
  - EC Alien Species Information http://ec.europa.eu/environment/nature/invasivealien/index_en.htm

- Royal Yachting Association (RYA)
  - www.rya.org.uk/go/alienspecies

- The Green Blue
  - Antifoul and Invasive Species https://www.thegreenblue.org.uk/Boat-Users

- Invasive Species Ireland
  - Marina Operators Code of Good Practice http://invasivespeciesireland.com/cops/marina-operators/
  - Water Users Code of Good Practice http://invasivespeciesireland.com/cops/water-users/

- IMO (International Maritime Organization) Guidelines For The Control And Management Of Ships' Biofouling To Minimise The Transfer Of Invasive Aquatic Species
  - http://www.imo.org/blast/blastDataHelper.asp?data_id=30766&filename=207(62).pdf

- IMO Guidance For Minimizing The Transfer Of Invasive Aquatic Species As Biofouling (Hull Fouling) For Recreational Craft
    - http://www.imo.org/en/OurWork/Environment/Biofouling/Documents/MEPC.1-Circ.792.pdf

- DEFRA – http://jncc.defra.gov.uk/page-5150

- DASSH - The Archive for Marine Species and Habitats Data

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Appendix

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Appendix 1.0 Figures

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Figure 13.9.1: Option A design at the Kent Project Site.

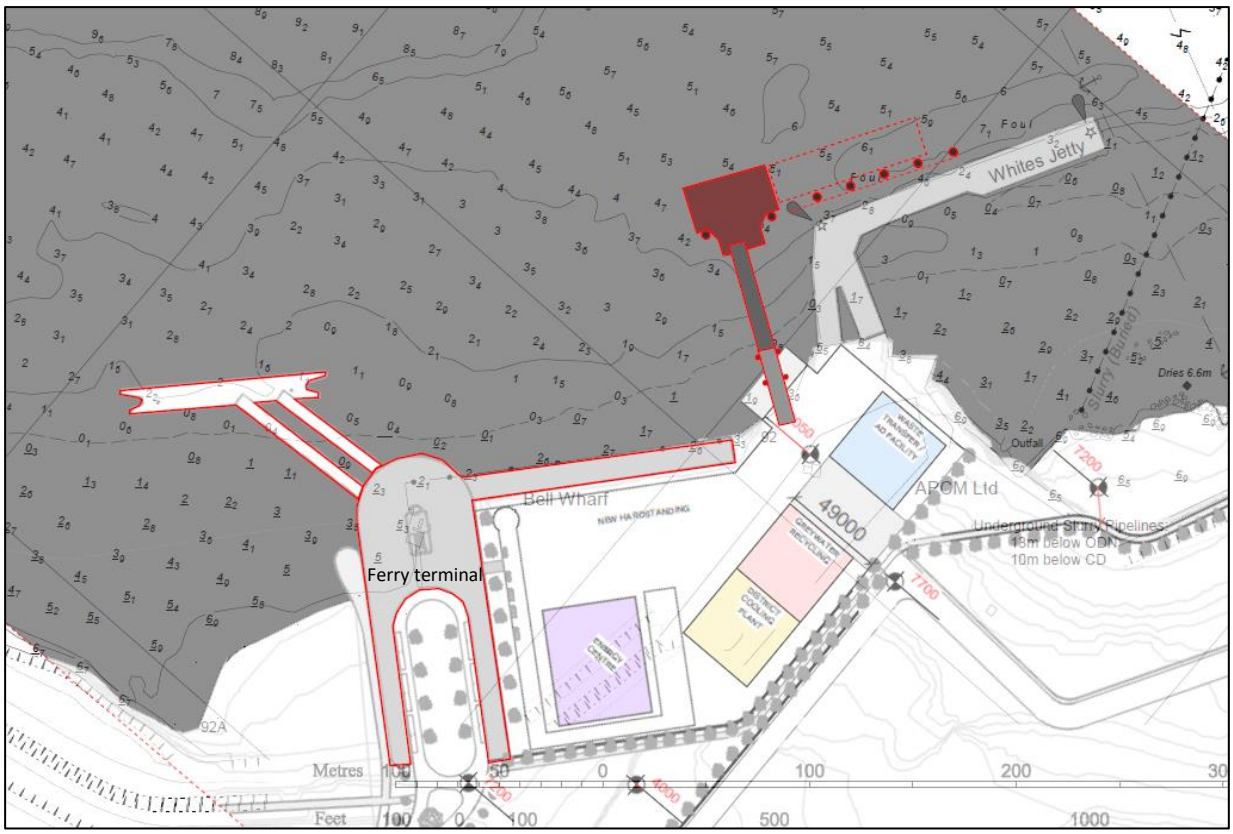


Figure 13.9.2: Option B design at the Kent Project Site.

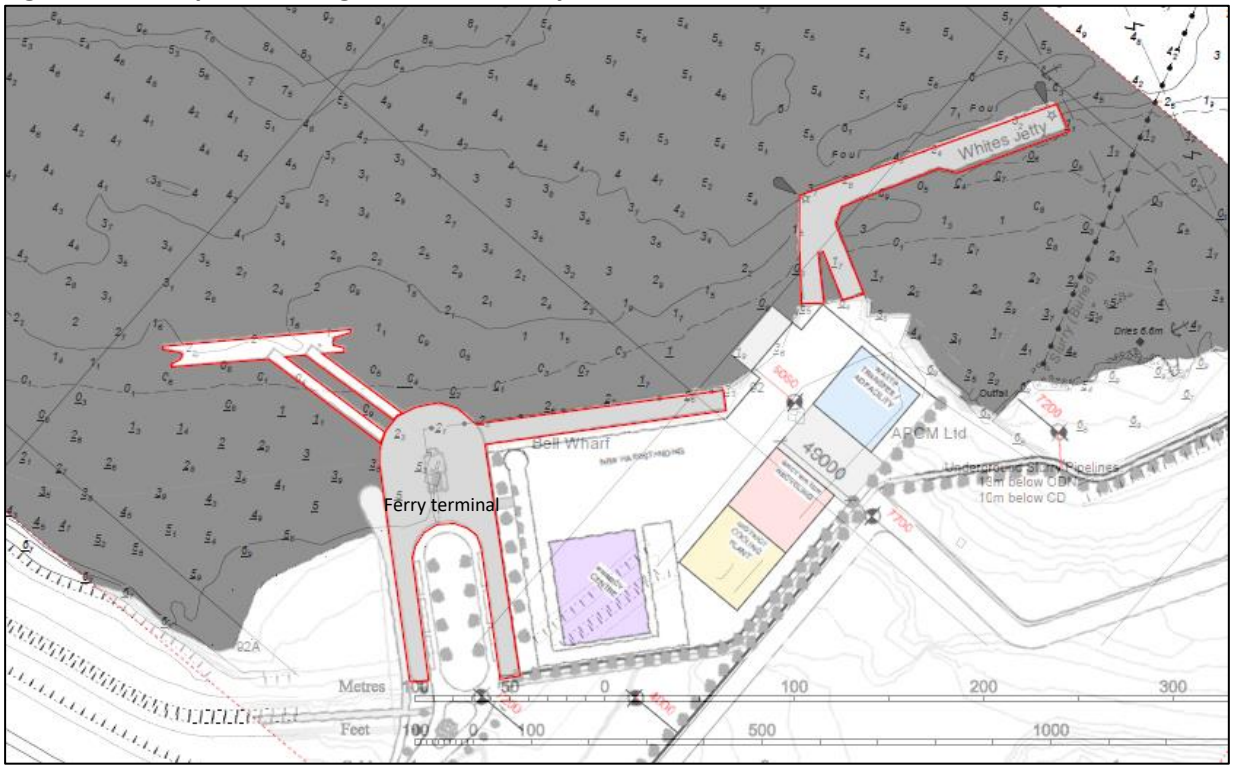


Figure 13.9.3: Option C design at the Kent Project Site.

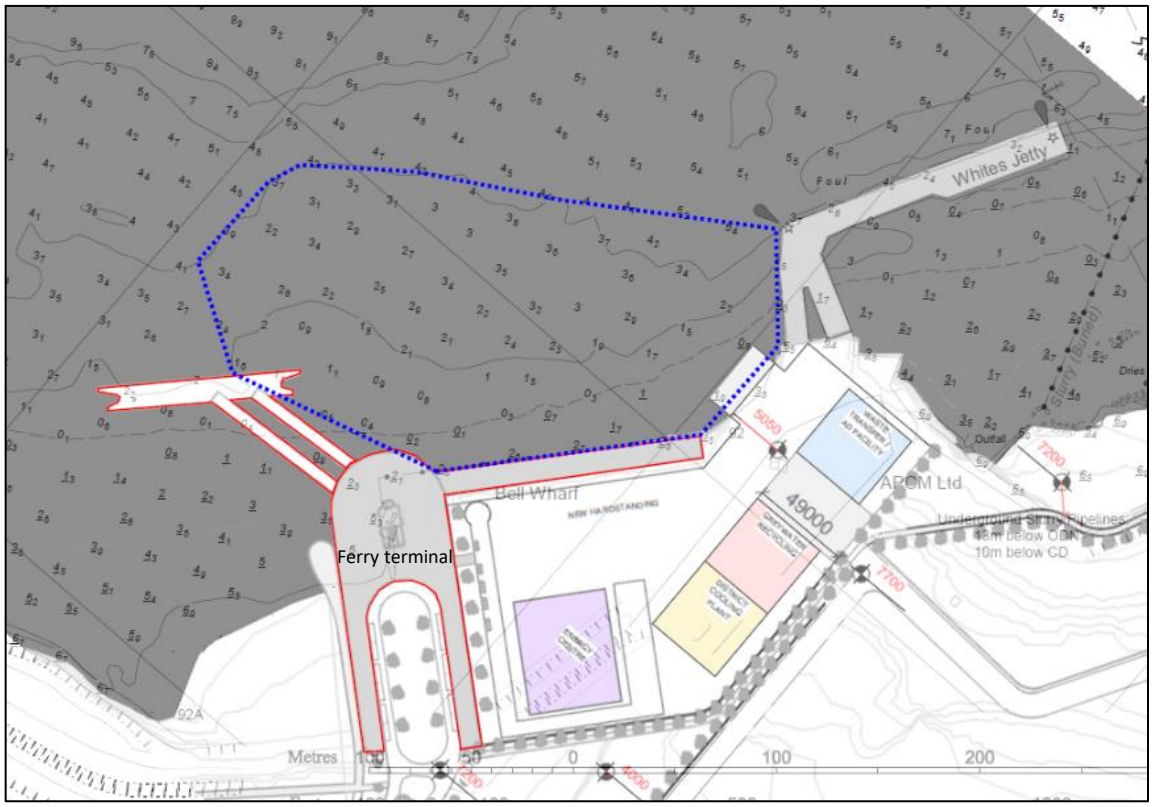


Figure 13.9.4: Design of proposed ferry pontoon at the Essex Project Site.

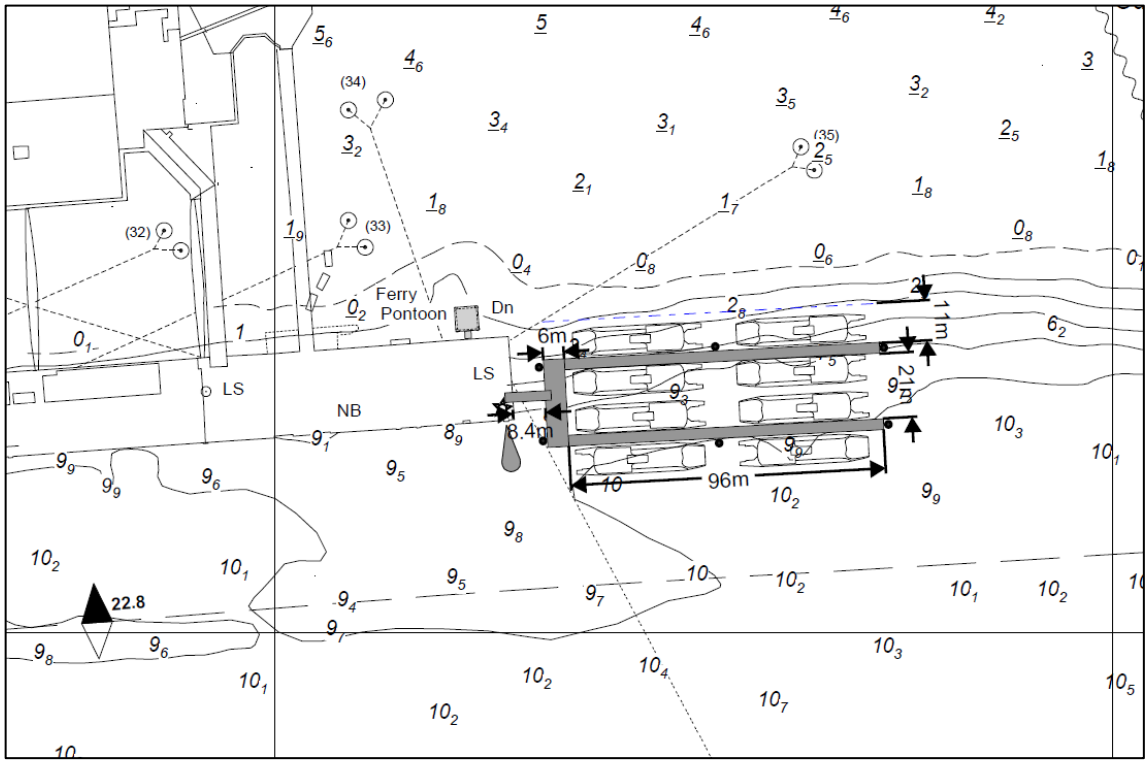
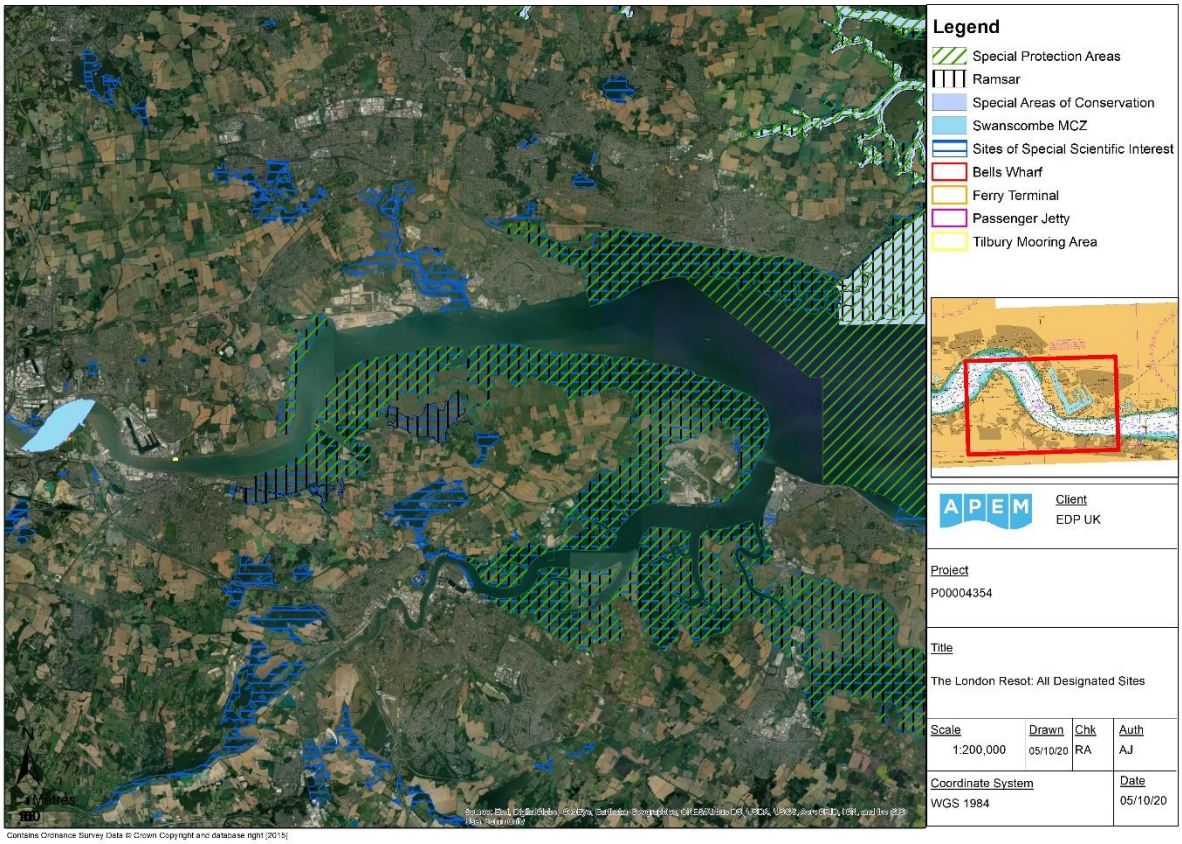


Figure 13.9.5. Designated sites including the SACs, SPAs, SSSIs and Ramsar Sites within and surrounding the Kent and Essex Project Sites.



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Appendix 2.0 Criteria for visual assessment for biofouling

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Criteria for visual assessment of the extent of biofouling (Cook *et al*. 2015)

Rank	Description	Visual estimate of biofouling cover
0	No visible fouling. Hull entirely clean, no biofilm on visible submerged parts of the hull.	Nil
1	Slime fouling only. Submerged hull areas partially or entirely covered in biofilm, but the absence of any plants or animals.	Nil
2	Light fouling. Hull covered in biofilm and one to two very small patches of one type of plant or animal.	1–5 % of visible submerged surfaces
3	Considerable fouling. Presence of biofilm, and fouling still patchy, but clearly visible and comprised of either one or more types of plant and/or animal.	6–15 % of visible submerged surfaces
4	Extensive fouling. Presence of biofilm and abundant fouling assemblages consisting of more than one type of plant or animal.	16–40 % of visible submerged surfaces
5	Very heavy fouling. Many different types of plant and / or animal covering most of visible hull surfaces.	41–100 % of visible submerged surfaces