The London Resort Development Consent Order

BC080001

Environmental Statement
Volume 2: Appendices

Appendix 13.2 – Marine Ecology and Biodiveristy Baseline Conditions

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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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Contents

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List of Tables

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List of Figures

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Glossary

AA	Annual Average
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
BAP	Biodiversity Action Plan
cAL1	chemical Action Level 1
cAL2	chemical Action Level 2
CITES	Convention on International Trade in Endangered Species
DIN	Dissolved Inorganic Nitrogen
DO	Dissolved Oxygen
EA	Environment Agency
EC	European Council
EQS	Environmental Quality Standards
HMWBs	Heavily Modified Waterbodies
IFCA	Inshore Fisheries and Conservation Authority
INNS	Invasive Non-native Species
JNCC	Joint Nature Conservation Committee
MAC	Maximum Allowable Concentration
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
NERC	Natural Environment and Rural Communities
NNS	Non-native Species
NVC	National Vegetation Classification
PAH	Polycyclic Aromatic Hydrocarbons
PEL	Probable Effect Level
PSA	Particle Size Analysis
SAC	Special Area of Conservation
SPA	Special Protection Area
TBT	Tributyltin
TMMSS	Thames Marine Mammal Sighting Survey
WFD	Water Framework Directive
ZSL	Zoological Society of London

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Chapter One ◆ Water Quality

INTRODUCTION

1.1. The principle water quality data sources that have been used to inform this study are:

- Environment Agency (EA) Water Framework Directive (WFD) classification status and reporting (e.g. EA 2015); and
- EA long-term water quality monitoring data for the tidal Thames.

ENVIRONMENT AGENCY WFD CLASSIFICATION STATUS

1.2. The tidal River Thames is divided into three transitional water bodies as part of the Thames River Basin Management Plan (EA 2015) (Thames Upper [ID GB530603911403], Thames Middle [ID GB53060391140] and Thames Lower [ID GB530603911401]. Each of these waterbodies are classified as heavily modified waterbodies (HMWBs).

1.3. The Thames Estuary at the London Resort Project Site is located within the Thames Middle Transitional water body, which is a heavily modified water body on account of the following designated uses (Cycle 2 2015-2021):

- coastal protection;
- flood protection; and
- navigation.

1.4. The downstream extent of the Thames Middle transitional water body is located approximately 12 km downstream of the Kent Project Site and 8 km downstream of the Essex Project Site near Lower Hope Point. Downstream of this location is the Thames Lower water body which extends to the outer Thames Estuary.

1.5. A summary of the current Thames Middle water body WFD status is presented in Table 1--1, together with those supporting elements that do not currently meet at least Good status and their associated objectives. This table indicates that the Thames Middle HMWB has Moderate ecological potential and is failing for chemical status with an overall water body potential of Moderate. Some of the supporting ecological elements currently at less than Good have water body objectives to improve by 2027 (Table 1-1). Zinc has been included as the objective is to improve status to High and it is reasonable to expect that the background condition for zinc could improve to High over the lifetime of the London Resort Project.

1.6. There is no future improvement planned for Dissolved Inorganic Nitrogen (DIN). The EA's catchment planning data portal states that actions to achieve Good DIN status would involve an 'unfavourable' balance of costs and benefits. The EA objective with respect to TBT is Good (although there are no direct RBMP improvement schemes planned - corresponding objective date of 2015), (EA 2018). The EA have identified several catchment activities contributing to the current TBT classification, i.e. sewage discharges (probable), contaminated sediments (probable), other urban and transport sources (probable), landfill leaching (suspected), contaminated land (suspected) and navigation (suspected). Environmental improvements to these business sectors over time will facilitate indirect improvements to background TBT conditions. A range of other chemicals currently failing had a target of Good by 2015 (Table 1-1).

1.7. Given the limitations on future potential for some elements, however, there is no objective to achieve overall Good WFD Potential for the Thames Middle water body as a whole.

Table 1-1 Summary of recent Thames Middle (Transitional) WFD classification status for physico-chemical quality elements, specific pollutants and priority hazardous substances.

Classification (Cycle 2)	Overall Potential	Ecological	Chemical	Supporting elements at <Good								
				Ecological			Chemical					
				Physico-chemical quality elements		Specific pollutants	Priority hazardous substances					
				DIN	Dissolved oxygen	Zinc	TBT	PBDE	PFOS	Benzo(b)fluoranthene	Benzo(g-h-i)perylene	Mercury and its compounds
2019	MP	M	F	M	G	M	F	F	F	F	F	F
2016	MP	M	F	M	M	M	F	/	/	/	/	G
2015	MP	M	G	M	M	M	/	/	/	/	/	G
Objective (objective date)	MP (2015)	M (2015)	G (2015)	M (2015)	G (2027)	H (2027)	G (2015)	G (2015)	G (2015)	G (2015)	G (2015)	G (2015)

N.B. G=Good, M=Moderate, F=Fail, MP=Moderate Potential, /=not assessed, SP= Specific Pollutant (noting that individual SP classification is either High (H) or Moderate (M) depending on EQS pass/fail), PHS=Priority Hazardous Substance Source: http://environment.data.gov.uk/catchment-planning/

ENVIRONMENT AGENCY LONG-TERM WATER QUALITY MONITORING DATA

1.8. The EA undertakes routine water quality sampling within the tidal Thames and EA water sampling locations and analysis suites were reviewed using the online water quality data archive (EA 2020a).

1.9. Data that cover a long temporal period are of greatest benefit for characterisation of the background water quality environment due to increased associated confidence in statistical characterisations (compared to datasets with fewer numbers of samples across shorter periods of time). Long-term EA water quality monitoring stations are located throughout the tidal Thames at approximately 5 km intervals. These stations generally provide data for WFD monitoring, with samples analysed for a wide range of chemicals at monthly sampling intervals, and the results are used to determine the WFD chemical status of the water body.

1.10. Details of the EA stations closest to London Resort are provided in Table 1-2. EA water quality monitoring data for the last six years from long-term sample stations in the vicinity of the Kent Project Site and Essex Project Site (Greenhithe and Gravesend) were examined and used where relevant to inform assessment.

Table 1-2 Long-term Environment Agency sampling points.

EA station name	Relative location	Sampling point EA ID	NGR	Sampling frequency	Data period analysed
Thames at Erith	~11 km upstream of the Kent Project Site ~ 15 km upstream of Essex Project Site (26.6 km below London Bridge)	TH-PTTR0019	551750 178600	Monthly	Jan 2012 – March 2019
Purfleet AQMS	~4.75 km upstream of the Kent Project Site ~8.75 km upstream of Essex Project Site	Unknown	556755 176806	15 min	Jan 2012-Dec 2019
Thames at Greenhithe	~2.25 km upstream of the Kent Project Site ~ 6.25 km upstream of the Essex Project Site	TH-PTTR0020	558600 175650	Monthly	Specific pollutants: Jan 2010 – June 2012 Other: Jan 2012 to July 2019

EA station name	Relative location	Sampling point EA ID	NGR	Sampling frequency	Data period analysed
Thames at Gravesend	~5k downstream of Kent Project Site ~1 km downstream of the Essex Project Site, on opposite bank	TH-PTTR0021	564900 174600	Monthly	Jan 2012 – Jul 2019
Thames at Ovens Buoy	~7 km downstream of Kent Project Site ~3 km downstream of the Essex Project Site (47.7 km below London Bridge)	TH-PTTR0022	569350 175600	Monthly	Jan 2012 – Aug 2019

RESULTS FOR WATER QUALITY

1.11. Water quality data relevant to the Project Site were collated from the EA water sampling points at Greenhithe (2.25 km upstream from the Kent Project Site and 6.25 km upstream from the Essex Project Site) and Gravesend (5 km downstream from the Kent Project Site and 1 km downstream of the Essex Project Site) which are the closest EA water quality stations to the Kent and Essex Project Sites. At both of these sites sampling takes place on a monthly or two monthly basis. The most recent sampling data available online at the time of writing for the Kent Project Site at Greenhithe is February 2020 and for the Essex Project Site at Gravesend it is October 2019.

1.12. Parameters recorded near the Kent Project Site, at Greenhithe, and the Essex Project Site, at Gravesend, include physiochemical parameters such as water temperature, salinity and a range of determinands, including, nutrients, trace metals, organotins, polycyclic aromatic hydrocarbons (PAHs).

1.13. Water quality concentrations were compared against relevant EQSs. The majority of exceedances recorded were relative to Annual Average (AA) EQS (priority substances) or long-term mean standards (specific pollutants) with only isolated exceedances of short term standards (Maximum Allowable Concentration (MAC) EQS or 95th percentile short term standards). Several of the physico-chemical quality elements, specific pollutants and priority hazardous substances currently do not meet Good status (Table 1-1) and survey results for these pollutants are discussed below.

1.14. Based on values recorded across the last eight years of (monthly) data, Dissolved Oxygen at EA Greenhithe and EA Gravesend has exhibited DO concentrations on the boundary of Moderate and Good status. Recognising that improvements have been realised over recent years, consideration of 2016 to 2020 data in isolation indicates that at Greenhithe the DO conditions have been consistent with High-Good status.

1.15. Data for zinc and TBT for Greenhithe are only available from pre-2010 to June 2012 and mean dissolved zinc concentration was 14.25 µg/l (with all of the 32 results in excess of the long-term mean standard (Annual Average (AA)-EQS as set out in The Water Framework Directive i.e. 6.8 µg/l dissolved plus Ambient Background Concentration; Defra 2015)).

1.16. Mean dissolved zinc concentration recorded at the EA's Gravesend monitoring location (data from Jan 2012 to March 2019) was 9.81 µg/l (with two of the 21 results in excess of the AA-EQS value).

1.17. At Greenhithe TBT concentrations averaged 0.00065 µg/l (sampling since 2010). At Erith, TBT concentrations averaged 0.00061 µg/l (sampling January 2012 to March 2019) and a review of EA data for Gravesend indicated TBT concentrations averaged 0.00075 µg/l (sampling since 2012). The AA-EQS (priority substance) value for TBT is 0.0002 µg/l which was exceeded at all sites. These results reflect the current (2019) WFD status for TBT (Fail) in the Thames Middle water body (Table 1-1).

1.18. At Greenhithe no data have been recorded for PBDEs. At Gravesend they were recorded between February 2015 and September 2017. In all instances PBDE concentrations recorded were <0.00006 µg/l which is considerably less than the Maximum Allowable Concentration (MAC)-EQS of 0.014 µg/l although for the Thames Middle overall these chemicals are indicated to be failing (Table 1-1).

1.19. Mean concentration of perfluorooctylsulphonate anion (i.e. perfluorooctane sulfonate (PFOS)) at Gravesend across seven sample occasions between March 2016 and September 2017 was 0.0059 µg/l. Concentration of perfluorooctylsulphonate anion has not been recorded at Greenhithe since November 2006 when it was recorded as <0.1 µg/l. These background concentrations exceed the AA-EQS for PFOS in transitional waters which is 0.00013 µg/l.

1.20. At Gravesend, between October 2017 and April 2019 mean concentration of benzo(b)fluoranthene was 0.026 µg/l which is greater than the MAC EQS of 0.017 µg/l. No data are available for Greenhithe.

1.21. At Gravesend, between October 2017 and April 2019 mean concentration of benzo(g-h-i)perylene was 0.027 µg/l which is greater than the MAC-EQS of 0.00082 µg/l. No data are available for Greenhithe.

1.22. At Gravesend, between October 2017 and April 2019, mercury concentration has been repeatedly recorded as <0.01 µg/l with one record above this in November 2018 (0.018 µg/l). This is in relation to a MAC-EQS of 0.07 µg/l.

1.23. To support the application a Water Framework Directive assessment has been undertaken to consider the likely effects of the Proposed Development during construction and operation on the waterbodies within the vicinity of the Project Site (Appendix 13.7, document reference 6.2.13.7).

Chapter Two ◆ Plankton

BACKGROUND DATA

2.1 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 (Falkowski *et al*. 1998). Phytoplankton form the basis of marine food webs and are actively consumed by a wide range of herbivorous marine species (Frederiksen *et al*. 2006). Phytoplankton productivity is primarily influenced by variations in depth, temperature, light, water column mixing and availability of nutrients (Graziano *et al*. 1996; Leonardos & Geider 2004).

2.2 Phytoplankton is a biological element contributing to the ecological status of the Thames Middle water body and in 2016 the WFD phytoplankton status for the Thames Middle waterbody was classified as 'Good'.

2.3 Data from London Erith, Gravesend, Oven Buoy and London Mucking sampling stations from the EA presented in the Tilbury2 report (PoTLL 2017) indicates the presence of typical estuarine species within the vicinity of the Essex Project Site and no protected phytoplankton were identified. The groups identified include diatoms, dinoflagellates, silicoflagellates, green algae, Chrysophyceae, Raphidophyceae and blue-green algae. Assemblages of phytoplankton at the Essex Project Site are considered likely to be representative of assemblages at the Kent Project Site.

2.4 EA phytoplankton data are available for approximately every month from 2015 to 2019 for the London Erith, Gravesend, and Oven Buoy EA sampling stations. These data indicate the most abundant and most frequently recorded phytoplankton at each station. The most abundant phytoplankton at all three stations was microflagellates. Microflagellates were also the most frequently recorded phytoplankton group at Gravesend and London Erith, with centric diatoms being the most frequently recorded group at the Oven Buoy station.

2.5 The Thames Estuary has a peak in diatom abundance in March and April, which generally decreases during June through November. Dinoflagellate abundance is greatest in May and June then decreases throughout the summer (Greenwood *et al*. 2019).

2.6 In terms of zooplankton, Gordon *et al*. (1998) studied the mesozooplanktonic fauna at nine sites along the Thames Tideway stretching from Kew to Tilbury. The dominant zooplankton species recorded were calanoid copepods with *Eurytemora affinis* occurring most frequently within this group peaking in late autumn and early spring.

2.7 Ichthyoplankton (fish eggs and larvae) were surveyed in 2007 and 2008 for the Tilbury2 project and 20 taxa were recorded (Table 2-1; from PoTLL 2017). Fish larvae were most abundant during the spring and summer months, corresponding with peak spawning

times (PoTLL 2017). Fish eggs were most abundant in the water column at the Project Site between December and April (PoTLL 2017).

Table 2-1 Species of fish in the ichthyoplankton caught at Tilbury in 2007 and 2008.

Atlantic herring	European sprat
Bass	Flatfish (unable to identify species)
Clupeids (unable to identify species)	Gobies (unable to identify species)
Common goby	Greater sandeel
Crystal goby	Gunnel
Dover sole	Nilsson's pipefish
Dragonet	Pout
Eggs	Reticulated dragonet
European eel	Sand goby
European flounder	Smooth sandeel
European plaice	Transparent goby
European smelt	

Chapter Three ◆ Intertidal Habitats and Species

KENT PROJECT SITE

Background Data

3.1 The Kent Project Site for the London Resort is adjacent to the Swanscombe Marine Conservation Zone (MCZ) (Figure 13.2.1) which was designated in May 2019 (DEFRA 2019). The seabed of the Swanscombe MCZ is primarily composed of shells, pebbles, sands and mud and is designated for the following features:

- tentacled lagoon worm *Alkmaria romijni*; and
- intertidal mud (EUNIS code A2.3).

3.2 The tentacled lagoon worm is a small polychaete worm that is found in both intertidal and subtidal soft sediments. The species is scarce throughout the UK, living within a tube made of mud in sheltered lagoons and estuaries. As a result, it is highly vulnerable to changes to the habitats in which they live (DEFRA 2018). Due to their sensitivity, the worm is listed as a Wildlife and Countryside Act Schedule 5 species (JNCC 2016). Within the vicinity of the Kent Project Site, the NBN Atlas noted four locations where tentacled lagoon worm was recorded (two locations within the Kent Project Site and two locations on the opposite bank near West Thurrock).

3.3 Intertidal mud (A2.3) can support the tentacled lagoon worm feature and is a highly productive ecosystem and important feeding ground for wading and migratory birds (DEFRA 2018).

3.4 An intertidal survey was carried out by Aquatonics Ltd in 2015 for the London Resort (Aquatonics Ltd 2016). During this survey intertidal habitats were mapped across the Kent Project Site. Core samples (with three replicates taken per station) were collected from 11 stations. Sampling was also undertaken at 16 hard substrate stations (a range of natural and artificial habitats including revetments and jetty supports). Seaweed samples were collected from two sites for seaweed washing and sweep net sampling was undertaken at low and high water at three sites (Aquatonics Ltd 2016).

3.5 In total 66 taxa were recorded during the visual survey across all intertidal stations (17 algae (seaweeds) and lichens taxa and 49 invertebrate taxa). Crustaceans were the most numerous taxonomic group (24 taxa), followed by annelids (13 taxa) and then green algae (10 taxa).

3.6 The most commonly recorded species within the core samples was the oligochaete *Baltidrilus costatus*. In total, fourteen taxa were recorded in the core samples including the polychaetes ragworm *Hediste diversicolor*, bristleworm *Pygospio elegans*, *Streblospio shrubsolii*, *Manayunkia aestuarina* and *Capitella capitata*; the oligochaetes *Baltidrilus*

costatus, Tubificoides benedii, Tubificoides heterochaetus, Tubificoides pseudogaster and Enchytraidae; the amphipod *Corophium volutator*; the isopods *Cyathura carinata* and *Sphaeroma rugicauda*; and the mollusc peppery furrow shell *Scrobicularia plana*.

3.7 The 2015 survey identified four habitats which were all variations of oligochaete-dominated intertidal sediment habitats (these habitats were variants of standard descriptions, however, as *H. diversicolor* was often absent and when present was recorded in low numbers):

- *H. diversicolor* and *Limecola balthica* in littoral sandy mud, (EUNIS code: A2.312: previously recorded following JNCC guidance as LS.LMu.MEst.HedLim);
- *H. diversicolor*, *L. balthica* and *S. plana* in littoral sandy mud shores, (A2.313; LS.LMu.MEst.HedLimScr);
- *H. diversicolor* and oligochaetes in littoral mud, (A2.3223; LS.LMu.UEst.Hed.Ol); and
- *H. diversicolor* and *S. shrubsolii* in littoral sandy mud, (A2.3221; LS.LMu.UEst.Hed.Str).

3.8 No tentacled lagoon worms were recorded. The only species of conservation importance was the amphipod crustacean *Apocorophium lacustre* which was recorded at several of the lower shore hard substrate sites and is currently listed as 'Nationally Scarce' by the Joint Nature Conservation Committee (JNCC) (Aquatonics 2016).

3.9 A number of non-native species were recorded as indicated in the *Non-Native Species* section below.

3.10 The intertidal surveys undertaken by Aquatonics Ltd in 2015 recorded the following Habitats of Principal Importance on Section 41 of the NERC Act (previously listed as UK Biodiversity Action Plan (BAP) Priority Habitats):

- Estuarine rocky habitats;
- intertidal mudflats;
- intertidal underboulder communities;
- sheltered muddy gravels;
- peat and clay exposures; and
- coastal saltmarsh.

3.11 None of these areas were considered to be good examples of the habitat types in the report (Aquatonics Ltd 2016) due to the low and variable salinity at the Kent Project Site, high turbidity, the presence of non-native species and the low diversity of native species.

3.12 On the low shore an area of submerged forest with peaty deposits was observed but not sampled.

3.13 Previous data from the Environment Agency for intertidal invertebrate assemblages within the vicinity of the Kent Project Site are also available from an intertidal coring survey conducted in 1992 for the 'Thames Biological Programme'. Samples were collected using a core of 11.28 cm diameter and sieved through a 500 µm mesh. A total of 12 taxa were recorded from three different groups (seven Annelida, three Mollusca and two Crustacea). Samples were largely dominated by *B. costata, C. volutator* and *H. diversicolor* were also recorded in high abundances.

3.14 Most of the western side of the Swanscombe Peninsula was dominated by *H. diversicolor, C. volutator, S. shrubsolii* and *B. costatus*. The intertidal area of the eastern side of Swanscombe Peninsula was much less muddy, and *H. diversicolor* was not found at multiple coring sites. The upper shore parts of the intertidal sediments on the eastern side were mainly mobile sands with a very restricted fauna, similar to A2.222 'Oligochaetes in littoral mobile sand'. The mid and lower shore were similar to A2.323 '*T. benedii* and other oligochaetes in littoral mud'.

Project-specific survey

3.15 An intertidal benthic survey was conducted in August 2020. Intertidal core stations were located in the upper and mid intertidal zone along eight transects, two of which also included stations on the lower intertidal zone (total of 18 stations). The stations were located along Swanscombe Peninsula as shown in Figure 13.2.2. Wall scrape stations were located on White's Jetty and Bell Wharf (total of 5 stations) seen in Figure 13.2.2. Detailed survey data is provided in Appendix 13.4: *Intertidal Benthic Survey Report* (document reference 6.2.13.4).

3.16 Three replicate 0.01 m^2 core samples were collected at each intertidal sampling station for biotic analysis, and at each wall scrape station biotic samples were collected using a 0.01 m^2 sampling device, in accordance with the methodologies described by Worsfold (1998). Further samples were collected at each intertidal core station for Particle Size Analysis (PSA).

3.17 Sediment type within the intertidal zone was found to be fairly homogenous with all except six stations classified as Sandy Mud (the other six stations were classified as Muddy Gravel (two of the stations), with single stations allocated Muddy Sandy Gravel, Mud, Slightly Gravelly Sandy Mud and Sand). All stations expect two were classified as 'Very Poorly' sorted.

3.18 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 biotope '*Hediste diversicolor* and *Streblospio shrubsolii* in littoral sandy mud' (EUNIS A2.3221; JNCC code: LS.LMu.Uest.Hed.Str), (Figure 13.2.3). Either side of White's Jetty and between Transects 7 and 8, 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 the lower shore of Transects 1 and 2, around the base of White's Jetty and around the lower shore artificial boulders around the beacon to the west of Transect 7 large pebbles, 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* (Figure 13.2.3).

3.19 No tentacled lagoon worms were recorded within samples and no other benthic invertebrate species of conservation importance were recorded within any of the samples. Two non-native species were recorded (the barnacle *Austrominius modestus* and the crustacean *Sinelobus vanhaareni*). *Streblospio* sp., Sessilia and Chironomidae were also recorded in samples (at least one species 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*).

3.20 The amphipod *Corophium volutator* was the most abundant taxon across the intertidal core samples and crustaceans were the most abundant taxon group followed by annelids. The non-native crustacean *Sinelobus vanhaareni* was the most abundant taxon across the wall scrape samples. Density of invertebrates was highly variable across stations in the intertidal zone and biomass of intertidal invertebrates was dominated by annelids in the west section of the survey area (west of White's Jetty at Transects 1 to 4) with a greater proportional biomass of crustaceans at stations on Transects 5 to 8.

ESSEX PROJECT SITE

Background Data

3.21 A Phase I habitat survey (Wyn *et al*. 2006) and intertidal core survey was conducted for the Tilbury2 project in June 2017 (PoTLL 2017c). These surveys were located on a stretch of intertidal around 1 km downstream of the Essex Project Site and sediment type is expected to be similar to that at the Essex Project Site. The habitat maps indicated that the lower foreshore was predominantly intertidal mud and sand along the entire length of the survey area backed by either dense saltmarsh, brown algal beds or rock armour. Approximately 500 m east of the Tilbury B power station site was an area of soft cliffs, bare ground and intertidal cobbles and shingle.

3.22 Four transects were sampled from the upper to lower shore with high, mid and low water stations. At each of these sampling stations three replicate 0.01 m^2 core samples were collected for biological analysis and one for Particle Size Analysis (PSA). In addition, single core samples for biological analysis and PSA were collected in between the upper, middle and lower sampling stations. All samples collected from the intertidal stations were found

to be characterised by a variation of muddy sand or sandy mud indicating a high level of homogeneity in sediment composition across the area.

3.23 The intertidal benthic assemblage included typical estuarine species that are characteristic of the Thames Estuary. Across the intertidal samples, a total of 29 benthic invertebrate taxa were identified with 1-17 taxa recorded per station. Invertebrate density across stations varied between 200 and 104,000 individuals per m^2. For each transect the highest number of individuals was recorded in the samples from the upper shore, and the lower shore samples had the lowest number of individuals. The intertidal samples were dominated by the oligochaetes *Tubificoides* spp. and the numbers of the mud shrimp *C. volutator* was greater in the eastern transect samples.

3.24 Previous data for intertidal invertebrate assemblages from the Environment Agency within the vicinity of the Essex Project Site are also 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*.

NOTABLE SPECIES

3.25 During the 2015 intertidal survey of the Kent Project Site, the only notable species recorded was amphipod crustacean *Apocorophium lacustre* along with several non-native species (Aquatonics 2016). No rare species or species of conservation concern were recorded during the 2020 project-specific survey. Details of the non-native species recorded are discussed in the Non-Native Species section below.

3.26 No notable species were recorded at the Essex Project Site.

Chapter Four ◆ Subtidal Habitats and Species

KENT PROJECT SITE

Background Data

4.1 The EA conducts monitoring of subtidal invertebrates in the Thames Estuary and these data form the basis of the WFD status for the 'Invertebrate' biological element for WFD waterbodies. The latest WFD invertebrate status for the Thames Middle waterbody is 'Good', as classified in 2016.

4.2 Monitoring data was obtained from the EA for the Kent and Essex Project Sites, where available.

4.3 In 2016 Ocean Ecology undertook a subtidal survey of Swanscombe Peninsula covering the potential footprint of the London Resort Area (which at the time covered the Kent Project Site area). A total of nine sampling stations were targeted with two of these positioned to specifically characterise the macroinvertebrate community found in the immediate vicinity of the proposed jetty enhancement and floating pontoon works proposed at the time of the surveys (Figure 13.2.4).

4.4 The survey found that annelids were the most abundant taxa across the nine sample stations (one sample for biota analysis taken at each station). Key species included the polychaete *S. shrubsolii*, which was the most abundant species and was found at eight out of the nine sample locations in densities of up to 5,100 individuals per m^2 and other frequently occurring and abundant species included the oligochaetes *Tubificoides benedii* (occurred in all nine samples) and *B. costatus* (recorded in five of the nine samples). Two species of conservation interest were recorded: the tentacled lagoon worm *A. romijni* (recorded in six of the nine samples with the highest density of 2,840 individuals per m^2), and the mud shrimp *A. lacustre* (recorded in three of the nine samples). *A. romijni* and *A. lacustre* are both currently listed as 'Nationally Scarce' by the Joint Nature Conservation Committee (JNCC). *A. romijni* is a Schedule 5 species under the Wildlife and Countryside Act and as indicated above is a designated feature of the Swanscombe MCZ. Both *A. romijni* and *A. lacustre* are considered to be locally abundant in this area of the Thames (Ocean Ecology 2016). No non-native species were identified in the survey area during this study.

4.5 The predominant habitat recorded during the survey was A5.41 'Sublittoral mixed sediment in low or reduced salinity' (stations G01-G05 and G09). Two stations were recorded as A5.12 'Sublittoral coarse sediment in variable salinity (estuaries)' (stations G06 and G07) and one station was recorded as A5.31 'Sublittoral mud in low or reduced salinity' (G08).

4.6 Observations of *A. romijni* have been recorded as far upstream from Swanscombe Peninsula as Purfleet, approximately 3.3 km from the Kent Project Site (DEFRA 2018). There have been no records of the species downstream of the Kent or Essex Project Sites (PoTLL 2017c and EA WFD monitoring data).

4.7 Surveys were conducted at the NuStar jetty redevelopment at Grays in July 2017 as a pre-construction survey and in May 2019 for a post-construction survey (APEM 2019). The site is directly opposite the Kent Project Site. A 0.1 m^2 Day grab was used to successfully obtain sediment samples from seven sampling stations. *A. romijni* was found at two stations in 2017 and one station in 2019.

4.8 Surveys were also conducted at a site between West Thurrock and Grays in October 2007 to determine the distribution of *A. romijni* (Worsfold & Dyer 2007). Twenty-five samples from 0.1 m^2 Day grabs were collected. *A. romijni* was recorded in 11 out of 25 samples.

4.9 Previous data for subtidal invertebrate assemblages within the vicinity of the Kent site are also available from several subtidal surveys conducted by the EA between 1990 and 2015. Surveys utilised both grab and dredging gears to collect benthic invertebrate data.

4.10 Grab surveys were conducted as part of the 'Thames Biological Programme' between 1990 to 1993, the 'Thames Transitional Waters Benthic Survey' in 2007, and the 'Thames Middle Benthic WFD Surveillance Surveys' in 2012 and 2015. Samples were collected using a 0.1 m^2 Day grab and sieved through a 500 µm mesh. A total of 58 taxa were recorded across the subtidal samples from five groups (32 Annelida, 13 Crustacea, eight Mollusca, four Bryozoa and one Nematoda). Samples were largely dominated by the amphipod *C. volutator* and the oligochaete *T. benedii*. The polychaete *S. shrubsolii* was also found in high abundance. *A. romijni* was recorded a total of 13 times throughout these surveys. Three of these individuals were recorded during the 2015 'Thames Middle Benthic WFD Surveillance Survey' north-east of the Swanscombe Peninsula. The remaining 10 individuals were recorded during the 2007 'Thames Transitional Waters WFD Benthic Survey', seven north-west and three south-east of the Swanscombe Peninsula.

4.11 Dredging surveys were conducted quarterly between 1990 and 1991 as part of the Thames Biological Monitoring Programme. Samples were collected using a gulley dredge and sieved through a 500 µm mesh. A total of 13 taxa were recorded from four different groups (six Annelida, three Crustacea, three Mollusca and one Tunicate). Dredge samples were largely dominated by *H. diversicolor*, *H. costata* and *C. volutator* were also recorded in high abundance.

Project-specific survey

4.12 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 surveys were undertaken in August and September 2020. Sampling stations were targeted for the Kent project site located to the western side of Swanscombe peninsula as shown in Figure 13.2.5. A total of 14 grabs were collected for biotic analysis using a 0.1 m^2 Hamon and 0.1 m^2 Day grab. Further samples were collected for particle size analysis (PSA) and

sediment chemistry. Detailed survey data are provided in Appendix 13.5: *Subtidal Benthic Survey Report* (document reference 6.2.13.5).

4.13 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. Most stations were classified as extremely poorly sorted with the exception of four stations.

4.14 Nickel and lead exceeded the chemical Action Level 1 (cAL1) threshold at the majority stations (12 and 11 stations respectively) and concentrations of mercury and zinc exceeded the chemical Action Level 2 (cAL2) at two and one station, respectively. cAL1 and Probable Effect Level (PEL) thresholds for numerous PAHs were exceeded at the majority of sample stations (see Appendix 13.5: *Subtidal Benthic Survey Report* for further details, document reference 6.2.13.5).

4.15 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 '*Aphelochaeta* spp. and *Polydora* spp. in variable salinity infralittoral mixed sediment' (A5.421; SS.SMx.SMxVS.AphPol) (six stations) and *Crepidula fornicata* and *Mediomastus fragilis* in variable salinity infralittoral mixed sediment (A5.422, SS.SMx.SMxVS) (one station adjacent to White's Jetty).

4.16 The tentacled lagoon worm *A. romijni* was recorded at three stations within the Kent project area. Densities of tentacled lagoon worm were relatively low with 20 individuals m^{-2} recorded at Stations 3 and 6 and 40 individuals m^{-2} recorded at Station 22. This species is protected under the Wildlife and Countryside Act 1981 and is a protected feature of the Swanscombe Marine Conservation Zone. A total of four non-native species were recorded within the Kent survey area (*C. caspia, R. philippinarum, E. zostericola* and *M. gigas*).

4.17 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*).

ESSEX PROJECT SITE

Background Data

4.18 Subtidal benthic ecology surveys were conducted for the Tilbury2 project in June 2017, the nearest station to the Project Site was approximately 150 m downstream of the Essex Project Site. Nine subtidal samples were collected using a 0.1 m^2 Day grab for both biological analysis and PSA, with the nearest station around 150 m downstream. Results from the subtidal survey in this area indicated relatively low levels of diversity with 12 to 23 species identified in each sample and a total of 47 subtidal species identified.

Additionally, total numbers of individuals within samples were also relatively low ranging from 3,350 to 16,740 individuals per m^2 (PoTLL 2017b).

4.19 The polychaete *Polydora* spp. was the most abundant species found in most subtidal samples whilst the oligochaete *Tubificoides* spp. was the most abundant in a single sample. Additionally, all subtidal samples were characterised by high numbers of *Tubificoides* spp. and the amphipod *Corophium* spp. (PoTLL 2017). No protected, rare or otherwise notable species were identified in any of the samples.

4.20 Based on PSA analysis and faunal identification, the biotope '*Polydora ciliata* and *C. volutator* in variable salinity infralittoral firm mud or clay' (EUNIS code: A5.321; JNCC code: SS.SMu.SMuVS.PolCvol) was assigned to all samples from the subtidal zone. No rare, protected or otherwise notable species were identified in the Tilbury2 survey.

4.21 Previous data for subtidal invertebrate assemblages within the vicinity of the Essex site are available from several subtidal surveys conducted by the EA between 1990 and 2015. Surveys utilised both grab and dredging gears to collect benthic invertebrate data.

4.22 Grab surveys were conducted as part of the 'Thames Biological Programme' between 1990 to 1993, the 'Thames TW Benthic Survey' in 2007, and the 'Thames Middle Benthic WDF Surveillance Surveys' in 2012 and 2015. Samples were collected using a 0.1 m^2 Day grab and sieved through a 500 µm mesh. A total of 40 taxa were recorded across the subtidal samples from six groups (23 Annelida, 10 Crustacea, three Mollusca, two Cnidaria, one Nematoda and one Tunicate). Samples were largely dominated by *T. benedii*. *C. volutator* and *Corophiidae* were also recorded in high abundance.

4.23 Dredging surveys were conducted quarterly between 1990 and 1991 as part of the Thames Biological Monitoring Programme. Samples were collected using a gulley dredge and sieved through a 500 µm mesh. A total of 22 taxa were recorded from three different groups (13 Annelida, five Crustacea and four Mollusca). Dredge samples were largely dominated by *T. benedii* and *C. volutator. Caulleriella* spp. were also recorded in high abundance.

Project-specific Survey

4.24 To complement the data available from previous subtidal benthic surveys within the wider Thames Estuary and the site-specific data obtained from previous surveys, APEM undertook subtidal benthic ecology surveys in August and September 2020. Sampling stations were targeted for the Essex Project Site located to the east of the Port of Tilbury jetty as shown in Figure 13.2.6. A total of eight grabs were collected for biotic analysis using a 0.1 m^2 Hamon and 0.1 m^2 Day grabs. Further samples were collected for Particle Size Analysis and sediment chemistry. Detailed survey data is provided in Appendix 13.5: *Subtidal Benthic Survey Report* (document reference 6.2.13.5).

4.25 Sediment type within the Essex Project Site was fairly homogenous with four of the eight grab sampling stations classified as Muddy Sand. The remaining stations were classified as

Sandy Mud (two stations) and single stations were classified as Gravelly Muddy Sand and Gravel. All stations except one were classified as Very Poorly Sorted.

4.26 Nickel was the only heavy metal to exceed the cAL1 threshold and this was at a single station. cAL1 and PEL thresholds for numerous PAHs were exceeded at the majority of sample stations (see for further details Appendix 13.5: *Subtidal Benthic Survey Report*, document reference 6.2.13.5).

4.27 The benthic communities samples were assigned to three habitat types: '*Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud' (A5.322; 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 station) and '*Aphelochaeta* spp. and *Polydora* spp. in variable salinity infralittoral mixed sediment' (A5.421; SS.SMx.SMxVS.AphPol) (one station).

4.28 No tentacled lagoon worms *A. romijni* were recorded within samples and no other benthic invertebrate species of conservation importance were recorded within any of the samples within the Essex Project Site. Four non-native species were recorded within the survey area (*M. nitida, P. macrodactylus, E. zostericola* and *M. gigas*).

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

NOTABLE SPECIES

4.30 At the Kent Project Site in 2016 tentacled lagoon worm was the only species of conservation concern recorded. In the surveys conducted between 2007 and 2015 tentacle lagoon worm was the only notable species recorded. In the 2020 survey the only notable species recorded in the site project specific survey was the tentacled lagoon worm and seven non-native species which are further described in the *Non-Native Species* section below.

4.31 No notable species were recorded at the Essex Project Site other than four non-native species: *M. nitida, P. macrodactylus, E. zostericola* and *M. gigas*.

Chapter Five ◆ Non-Native Species

BACKGROUND DATA

5.1 Non-native species (NNS) are defined as species that have been introduced to non-native environments either accidentally or deliberately (DEFRA 2015). It is important to understand, however, that the majority of non-native species are not 'invasive' non-native species (INNS) (i.e. a non-native species that has the ability to spread causing damage to the environment, the economy and our health (GBNNSS 2018)).

5.2 Introduction and transfer of these species primarily occur by the transport and discharge of ballast water, and to a lesser extent transport of fouling organisms on hulls or through aquaculture. The establishment of NNS into marine habitats may cause effects ranging from those which are almost undetectable to the displacement of native communities (where INNS are involved). The introduction of INNS can also cause diseases and may adversely affect a range of interests from commercial use of the marine environment to wildlife conservation (Eno *et al*. 1997).

5.3 Additionally, INNS can occasionally reproduce with native species producing hybrids, causing an irreversible change of the genetic pool. Once a species has fully established itself within the marine environment, it can be impossible to remove (JNCC 2017).

5.4 NNS reported to be present within the tidal River Thames include the following (ZSL 2017; 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*.

KENT PROJECT SITE

5.5 Records from the NBN Atlas from 1965 to 2017 were examined for the Kent Project Site area and indicated the following two records of non-native species (which can be found in intertidal or shallow subtidal environments) 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).

5.6 Records from the Kent and Medway Biological Records Centre from 1971 to 2018 indicate the following three non-native species 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).

5.7 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 non-native species 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*.

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

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

5.10 During the saltmarsh fish survey by Colclough and Coates in 2015 (Colclough & Coates 2015) there was isolated evidence at multiple sites of burrowing by *E. sinensis*.

5.11 Project-specific intertidal and subtidal surveys were conducted in 2020 to map habitats and characterise taxa across the Kent Project Site (see the Site Acquisition Surveys in Data Acquisition Methodology section above). Four non-native species were recorded during the intertidal Phase I survey (the Chinese mitten crab *Eriocheir 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*)(see for further details Appendix 13.4: *Intertidal Benthic Survey Report*, document reference 6.2.13.4).

5.12 Five non-native species 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*)(see for further details Appendix 13.5: *Subtidal Benthic Survey Report*, document reference 6.2.13.5).

5.13 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).

ESSEX PROJECT SITE

5.14 Between 1965 and 2017 the NBN Atlas indicated 11 records of non-native species 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 non-native species (which can be found in intertidal or shallow subtidal environments):

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

- *P. pholadiformis* (1 record).

5.15 APEM undertook subtidal benthic ecology surveys in August and September 2020. A total of eight sampling stations were targeted at the Essex Project Site consisting of eight successful mini-Hamon grabs and one successful Day grab (Figure 13.2.6). The following non-native species 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*.

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

Chapter Six ◆ Saltmarsh

INTRODUCTION

6.1 Saltmarsh is an intertidal habitat that is defined as flat, poorly drained areas of land that are subject to periodic or occasional flooding by saltwater and are predominately covered by grassy halophytic plants (Bates & Jackson 1980). The formation of saltmarsh occurs when sediment is deposited on existing mudflats and pioneer plant species colonise the substrate and allow further accretion of sediments and other material. This causes further elevation of the marshes and succession of communities as the tidal influence decreases with increase distance landward (Williams *et al*. 1994; Boorman 2003).

6.2 The Thames Estuary has an extensive area of saltmarsh on both the north and south shores. The EA water body status summary for the tidal Thames indicates that there is approximately 557 ha of saltmarsh habitat in the tidal Thames, with 130.06 ha within the Thames Middle water body. Large areas of maritime saltmarsh are present along the foreshore of the Thames Estuary in the vicinity of Swanscombe.

6.3 The EA and Natural England were contacted to determine if they held any relevant data and this was incorporated into the baseline.

KENT PROJECT SITE

Background Data

6.4 Limited saltmarsh data were recorded during a specific intertidal survey conducted for the London Resort (relating to the Kent Project Site) in 2015 by Aquatonics Ltd (Aquatonics Ltd 2016). Two female specimens of the rare spider *Baryphyma duffeyi* were found in a net sample near an extensive strandline area away from the saltmarsh (Aquatonics Ltd 2016). This is a saltmarsh specialist species restricted to the Thames Estuary and a few other locations on the Essex and Suffolk coasts. Currently it is listed as a species 'of principal importance' under Section 41 (England) of the NERC Act (2006) and was designated 'Rare RDB3' in 1991 (Bratton 1991).

6.5 In 2015 a survey of fish communities associated with saltmarsh habitats around Swanscombe Peninsula was undertaken (Colclough & Coates 2015). The fish species recorded are indicated below in the fish baseline section and the following saltmarsh plant species were noted during the surveys:

- Mudflats – *Spartina* spp. colonising areas below saltmarsh at sites 1, 2 and at mouth of creek. *Salicornia* spp. were also noted in small stands at sites 1 and 2;

- Low marsh – *Pucinellia maritima, Triglochin maritima, Aster tripolium, Spergularia* spp.;
- Upper marsh – *Atriplex portulacoides, Limonium vulgare, Atriplex hastata*; and
- Above High Water – *Elytrigia atherica, Phragmites australis, Beta vulgaris*.

6.6 Colclough & Coates (2015) indicate there were low numbers of mysids, moderate numbers of Talitrid amphipods, *C. volutator, Gammarus* spp. and several *Carcinas maenas* identified among and adjacent to, the saltmarsh plants. Several mysids were recorded at locations in front of the marsh. There was some isolated evidence of burrowing by Chinese mitten crabs *Eriochier sinensis* at two of the sites.

Project-specific Survey

6.7 In August 2020, BSG, on behalf of APEM conducted a National Vegetation Classification (NVC) survey of the salt-marsh habitat around the Swanscombe Peninsula at the Kent Project Site. The aim of the survey was to identify, describe and map the saltmarsh vegetation communities present. The survey consisted of an initial walkover survey to map homogenous stands of vegetation and make a provisional identification of NVC plant communities; and subsequent quadrat sampling of stands of vegetation to identify all vascular plants and an estimation of percentage cover. A minimum of five quadrats were sampled for the main saltmarsh communities, whilst communities occupying small and difficult to access areas were sampled less (see for further details Appendix 13.3: *Saltmarsh Survey Report*, document reference 6.2.13.3).

6.8 The survey found that saltmarsh vegetation is present along the majority of the shore. The only exception to this was towards the western end of the Peninsula due to the presence of a piled deck and deeper water. Saltmarsh varied from approximately 7 m to 70 m in width. Wider areas of saltmarsh were present on the western side of the Peninsula whilst narrower sections were present on the eastern side of the Peninsula.

6.9 The lower saltmarsh is generally limited in its width and zonation is restricted to narrow bands due to the presence of a coastal defence embankment which runs the entire length of the survey area. S21 *Scripus maritima* swamp dominated the lower saltmarsh in a west facing creek towards the centre of the survey area. SM6 *Spartina anglica* saltmarsh is also supported.

6.10 The mid-level saltmarsh was heavily dominated by SM13 *Puccinellia maritima* saltmarsh community. In some areas, the seaward edge of the community forms a sheer face of clay in which there is little to no vegetation below. The only exception to this is the occasional presence of SM6 saltmarsh.

6.11 The upper saltmarsh was heavily dominated by S24 *Elymus pycnathus* community with the dominant species, sea couch *Elytrigia atherica* extending out to the sea embankment and inland towards the grassland habitats. Lower areas of the upper saltmarsh supported the SM23 *Spergularia maritima-Puccinella distans* saltmarsh community.

6.12 Results from the condition assessment found that the majority of saltmarsh within the survey area was considered to be in 'Fairly Good' condition based on Natural England Criteria (Natural England 2020). Despite the significant presence of the embankment and abundant wood and plastic rubbish observed in the shallow bay near the western limit of the survey area 'zonation of vegetation is present but may have gaps or be incomplete' and 'processes appear to be functioning and not compromised by artificial structures' (Natural England 2020).

6.13 Of the notable plant communities in the survey area, SM13 saltmarsh and SM23 saltmarsh are EU Annex I habitats (corresponding to 1330 Atlantic salt meadows and inland salt meadows' respectively (European Commission 2013). Golden samphire *Inula crithmoides* (a nationally scarce species) was occasionally observed on the seaward edge of the low lay cliffs along the eastern third of the survey area. Based on the JNCC Handbook for Phase 1 habitat survey (JNCC 2010), the Phase 1 habitat 'saltmarsh' includes the following communities that were present in the survey area:

- SM6 *Spartina anglica* saltmarsh community;
- SM13 *Puccinellia maritima* saltmarsh community;
- SM16 *Festuca rubra* saltmarsh community;
- SM23 *Spergularia marinia-Puccinellia distans* saltmarsh community; and
- SM24 *Elymus pycnanthus* saltmarsh community.

6.14 Additionally, 'Coastal Saltmarsh' is a Habitat of Principle Importance in England). The results of the survey found that this is likely to include all vegetation seaward of the sea defence embankment in the survey area.

ESSEX PROJECT SITE

6.15 In 2017 an intertidal habitat survey was conducted for Tilbury2 which identified saltmarsh within the Tilbury2 area further upstream and downstream of the site (PoTLL 2017a) Within the vicinity of the Essex Project Site it was identified in a small (187 m^2) patch of dense saltmarsh at the west end of the survey area (around 180 m east of the Essex Project Site). The following five species were present: sea aster *Aster tripolium*, cord-grass *Spartina* sp., *A. portulacoides*, English scurvy grass *Cochlearia anglica* and sea plantain *Plantago maritima*. *A. tripolium* and *Spartina* sp. were abundant, *A. portulacoides* occasional, and *C. anglica* and *P. maritima* frequent. The saltmarsh type and habitat mosaic are expected to be similar along the high shore closer to the Essex Project Site.

Chapter Seven ◆ Fish

BACKGROUND DATA

7.1 The Thames Estuary provides both spawning and nursery grounds for a number of marine species. In particular, the EA, Kent and Essex Inshore Fisheries and Conservation Authority (IFCA) and Marine Management Organisation (MMO) have highlighted the importance of the use of the lower Thames Estuary as a spawning and nursery ground for Dover sole *Solea solea* and Atlantic herring *Clupea harengus* and a nursery ground for European seabass *Dicentrarchus labrax* (PINS 2017). Lemon sole *Microstomus kitt* also utilises the Estuary for both spawning and as a nursery ground.

7.2 The Thames Estuary also provides nursery habitats for European flounder *Platichthys flesus*, European plaice *Pleuronectes platessa*, whiting *Merlangius merlangus*, European sprat *Sprattus sprattus* and Atlantic mackerel *Scomber scombrus* (Coull *et al*. 1998, Ellis *et al*. 2012, ABPmer 2013, Jacobs 2014). The adjacent marine areas also support spawning and/or nursery grounds for sandeels *Ammodytes* spp., Atlantic cod *Gadus morhua* and thornback ray *Raja clavata*.

7.3 Approximately 125 fish species have been recorded within the Thames Estuary including species of commercial and conservation interest. The species identified range from freshwater species with no estuarine requirement, to marine species with an estuarine requirement. Euryhaline species (those that can live in both fresh water and salt water) migrate through the estuary to spend different parts of their life-cycle in fresh or salt water. These species include seabass, eel, and flounder. In addition, there are many marine species such as Dover sole, mullet and sea trout that use the estuary as a nursery area or seasonally as adults (PoTLL 2017).

7.4 A primary source of information is EA survey data (available in the National Fish Population Database) including approximately 9,900 records of species counts obtained from >1,000 monitoring surveys undertaken between 1989 and 2019 throughout the estuary. Four of the sample stations are located within 10 km of the London Resort Project Site.

7.5 EA monitoring programmes in the Thames estuary produced data collected from stations between Greenhithe (West Thurrock and Gravesend intermediary stations) and Denton Wharf. A variety of sampling methods were implemented and were used to ensure the greatest variety of fish were captured to allow the data to be as comprehensive as possible (PoTLL 2017).

7.6 Beam trawling was undertaken at, Denton Wharf (2011-2018), Gravesend (1996), West Thurrock (1995-2018) and Greenhithe (1993). Dip and kick netting were used at West Thurrock twice annually from (2000-2018) and Denton Wharf (2011-2018) carrying out surveys in either spring or autumn. Otter trawling was conducted annually in autumn at Gravesend (1997-1998), West Thurrock (1997, 1999, 2002, 2004-2009), and Greenhithe

(2000). Seine netting was carried out biannually in spring and autumn at low tide at Denton Warf (2011-2018), West Thurrock (1995-2018), Greenhithe (1992-1994).

7.7 Between 1974 and 2019 during the EA sampling of the Thames Estuary 101 species of fish were caught. The highest numbers of fish consisted of flounder *Platichthys flesus*, European eel *Anguilla anguilla*, Dover sole *Solea solea*, *Dicentrarchus labrax*, smelt *Osmerus eperlanus*, sprat *Sprattus sprattus*, and sand gobies *Pomatoschistus minutus*.

7.8 Many fish species demonstrate seasonal patterns of use of the Thames Estuary and sensitive periods for different species are provided in Table 7-1.

Table 7-1 Seasonal use of the Thames Estuary by selected fish species. Green cells indicate migration, blue cells indicate spawning and orange cells indicate use of the Thames Estuary as a nursery ground or for residency/feeding

Receptor	Life Stage	Residence and/or Transit Times											
		J	F	M	A	M	J	J	A	S	O	N	D
European eel	Glass eel migration												
	Yellow eel resident												
	Silver eel migration												
European smelt	Larval / juvenile migration												
	Juvenile resident												
	Adult migration												
Atlantic salmon	Smolt migration												
	Adult migration												
Sea trout	Smolt migration												
	Adult resident												
	Adult migration												
River lamprey	Transformer migration												
	Adult resident												
	Adult migration												
Sea lamprey	Transformer migration												
	Adults migration												
Twaite shad	Juvenile migration												
	Adult migration												
Allis shad	Juvenile migration												
	Adult migration												
Dover sole	Adult spawning												
	Juvenile nursery												
European seabass	Juvenile nursery												

Receptor	Life Stage	Residence and/or Transit Times											
		J	F	M	A	M	J	J	A	S	O	N	D
Atlantic herring	Adult spawning												
	Juvenile nursery												
Lemon sole	Adult spawning												
	Juvenile nursery												
European flounder	Juvenile nursery												
European plaice	Juvenile nursery												
Whiting	Juvenile nursery												
European sprat	Juvenile nursery												
Atlantic mackerel	Juvenile nursery												
Sandeels	Juvenile nursery (individuals buried during winter)												
Atlantic cod	Juvenile nursery												
Thornback ray	Juvenile nursery												

7.9 Fish sampling was conducted for the Tilbury B power station project in 2007 to 2012 using a combination of push and fyke netting for intertidal area and trawling in subtidal areas. Push netting was conducted on foot by pushing along a transect parallel to the shore in water approximately 0.5 - 1 m deep, approximately 2.2 km downstream from the Essex Project Site (6.2 km downstream from Kent Project Site). Single fyke nets, approximately 1 km downstream from the Essex Project Site (5 km downstream from Kent Project Site) with varying mesh grades (6.5, 8, and 10 mm) were set perpendicular to the shore within marginal vegetation and staked off just above the high waterline. Nets were retrieved immediately after high tide to prevent drying out. Intertidal sampling was carried out quarterly summer 2007 to summer 2008, then additionally in autumn 2009, winter 2010, autumn 2011 and winter 2012. Otter and beam trawls were used to target demersal and pelagic species and were conducted quarterly from summer 2007 to spring 2008, then additionally in autumn 2009, winter 2010, autumn 2011 and winter 2012 (PoTLL 2017).

7.10 In 2015 a survey of fish communities associated with saltmarsh habitats around Swanscombe Peninsula was undertaken by Colclough & Coates for the London Resort Project (Colclough & Coates 2015). Seven sites along the frontage of the Peninsula were selected for fish sampling after a thorough site walk over. Over 100 individuals were caught on 3rd July 2015 (Sites 1 - 7) and comprised of three fish species including sand gobies, sand smelt *Atherina presbyter* and European seabass. On 4th July only Site 2 was sampled, 74 individuals were caught and included the following European eel, sand smelt, European seabass and European sprat.

7.11 Through the monitoring and surveys mentioned above, it was determined that a number of fish species, utilise the area within the study site at varying life-stages. The species identified in the collective monitoring programmes mentioned above from 1974 and 2019 indicate that at least 98 fish species could potentially be present in the vicinity of the study site. The species are identified within Table 7-2 below (taken from PoTLL 2017).

KENT PROJECT SITE

7.12 To complement the data available from previous fish surveys within the wider Thames Estuary and the site-specific data obtained from previous surveys, project specific surveys were undertaken in June and September of 2020 and included an intertidal fish survey of the intertidal area surrounding White's Jetty, west of Swanscombe Peninsula within the Kent Project Site. The purpose of this survey was to provide a finer resolution and up-to date understanding of the local fish populations in the area. The survey was conducted in June and September 2020 using fyke and seine netting (see for further details Appendix 13.6: *Intertidal Fish Survey Report*, document reference 6.2.13.6).

7.13 The sampling array for the June survey included four fyke net stations (F01 to F04) and five seine net stations (S01 to S05) and the sampling array for the September survey included two fyke net stations (F05 and F06) and eight seine net stations (S06 to S13). Seine and fyke nets were deployed in the intertidal area of White's Jetty.

7.14 During the June survey a total of 159 fish were recorded, representing nine species. A total of 57 fish representing four species were caught during fyke netting in June and 102 fish representing eight species were caught during seine netting. During the September survey 88 fish were recorded representing eight taxa. A total of 47 fish representing four species were caught during the September fyke netting and 41 fish representing six taxa were caught during seine netting.

7.15 The fish species recorded in the highest numbers during the June and September intertidal surveys was European seabass (80 individuals representing 32.1% of the total catch), followed by Atlantic herring (79 individuals representing 31.7% of the total catch). The catch at fyke net stations were dominated by seabass with a total of 57 individuals caught. The second most abundant fish species at fyke net stations was European flounder (26 individuals recorded.) The catch at seine net stations were dominated by herring with a total of 77 individuals caught and the second most abundant fish species at seine net stations was seabass (23 individuals recorded).

7.16 The only non-native species to be recorded throughout the entire intertidal survey was the highly invasive Chinese mitten crab *E. sinensis*. Two individuals were captured during fyke netting at station F04. Other notable species recorded within the intertidal fish survey were sprat, herring, seabass and eel. The legal and conservation status of these species is indicated below Table 7-2.

Table 7-2 Fish Species caught near Swanscombe Peninsula through screening monitoring of Tilbury Power Station, EA sampling programmes and Tilbury B fish surveys.

Species Caught		
10-spined stickleback (*Pungitius pungitius*)	Garfish (*Ablennes hians*)	Roach (*Rutilus rutilus*)
15-spined stickleback (*Spinachia spinachia*)	Golden Goby (*Gobius auratus*)	Rock Goby (*Gobius paganellus*)
3-bearded rockling (*Gaidropsarus vulgaris*)	Golden Grey mullet (*Chelon auratus*)	Rudd (*Scardinius erythrophthalmus*)
3-spined stickleback (*Gasterosteus aculeatus*)	Goldsinny wrasse (*Ctenolabrus rupestris*)	Sand goby (*P. minutus*)
4-bearded rockling (*Enchelyopus cimbrius*)	Grater pipefish (*Syngnathus acus*)	Sand smelt (*A. presbyter*)
5-bearded rockling (*Ciliata mustela*)	Greater sandeel (*Hyperoplus lanceolatus*)	Scad/ Horse mackerel (*Trachurus lathami*)
Allis shad (*Alosa alosa*)	Greater weever (*Trachinus draco*)	Scaldfish (*Arnoglossus laterna*)
Anchovy (*Engraulis encrasicolus*)	Grey gurnard (*Eutrigla gurnardus*)	Sea bass (*D. labrax*)
Angler fish (*Lophius piscatorius*)	Haddock (*Melanogrammus aeglefinus*)	Sea lamprey (*Petromyzon marinus*)
Atlantic horse mackerel (*Trachurus trachurus*)	Herring (*C. harengus*)	Sea trout (*Salmo trutta*)
Atlantic salmon (*Salmo salar*)	John dory (*Zeus faber*)	Sea-snail (*Liparis liparis*)
Ballan wrasse (*Labrus bergylta*)	Lemon sole (*Microstomus kitt*)	Short-snouted seahorse (*Hippocampus hippocampus*)
Black goby (*Gobius niger*)	Lesser (Nillson's) pipefish (*Syngnathus rostellatus*)	Short spined sea scorpion (*Myoxocephalus scorpius*)
Blue whiting (*Micromesistius poutassou*)	Lesser sandeel (*Ammodytes tobianus*)	Smelt (*O. eperlanus*)
Brill (*Scophthalmus rhombus*)	Lesser weever (*Echiichthys vipera*)	Smooth sand eel (*Gymnammodytes semisquamatus*)
Brown / sea trout (*S. trutta*)	Lozano's goby (*Pomatoschistus lozanoi*)	Snake pipefish (*Entelurus aequoreus*)
Bullhead (*Cotus gobio*)	Mackerel (*Scomber scombrus*)	Solenette (*Buglossidium luteum*)
Bull-rout / Short-spined sea scorpion (*Myoxocephalus scorpius*)	Montagu's seasnail (*Liparis montagui*)	Sprat (*S. sprattus*)
Butterfish (*Pholis gunnellus*)	Northern rockling (*Ciliata septentrionalis*)	Sting ray (*Dasyatis pastinaca*)

Species Caught		
Cod (*Gadus morhua*)	Norway bullhead (*Micrenophrys lilljeborgii*)	Straight-nosed pipefish (*Nerophis ophidion*)
Common bream (*Abramis brama*)	Painted goby (*Pomatoschistus pictus*)	Tadpole-fish (*Raniceps raninus*)
Common dragonet (*Callionymus lyra*)	Perch (*Perca fluviatilis*)	Tench varieties (*Tinca tinca*)
Common Goby (*Pomatoschistus microps*)	Pilchard (*Sardina pilchardus*)	Thick lipped grey mullet (*Chelon labrosus*)
Conger (*Conger conger*)	Plaice (*Pleuronectes platessa*)	Thin lipped grey mullet (*Chelon ramada*)
Crockwing wrasse (*Symphodus melops*)	Pogge (*Agonus cataphractus*)	Thornback ray / Roker (*Raja clavata*)
Crystal goby (*Crystallogobius linearis*)	Pollack (*Pollachius pollachius*)	Tompot blenny (*Parablennius gattorugine*)
Dab (*Limanda limanda*)	Poor cod (*Trisopterus minutus*)	Transparent goby (*Aphia minuta*)
Dace (*Leuciscus leuciscus*)	Pouting / Bib (*Trisopterus luscus*)	Tub gurnard (*Chelidonichthys lucerna*)
Deep-snouted [Broad-nosed] pipefish (*Syngnathus typhle*)	Raitt's snadeel (*Ammodytes marinus*)	Turbot (*Scophthalmus maximus*)
Dover sole (*S. solea*)	Red gurnard (*Aspitrigla cuculus*)	Twaite shad (*Alosa fallax*)
European eel (*A. anguilla*)	Red mullet (*Mullus surmuletus*)	Whiting (*Merlangius merlangus*)
European smelt (*O. eperlanus*)	Reticulated dragonet (*Callionymus reticulatus*)	Worm pipefish (*Nerophis lumbriciformis*)
Flounder (*P. flesus*)	River lamprey (*Lampetra fluviatilis*)	

NOTABLE FISH SPECIES

7.17 Numerous species of conservation and commercial importance protected by a range of legislation utilise the River Thames/Thames Estuary as outlined in Table 7-3 below. Of particular note is an important population of European smelt. The European smelt is a priority species on the Section 41 list of the NERC Act.

7.18 In addition, the diadromous species European eel *A. anguilla* is known to migrate through the Thames Estuary and utilise the estuary whilst maturing (Naismith & Knights 1988). The European eel is protected under European Council (EC) Regulation No 1100/2007, which establishes measures for the recovery of the stock of European eel. This is implemented in UK legislation by the Eels (England and Wales) Regulations 2009.

7.19 European smelt and European eel are frequently recorded diadromous species in the Thames Estuary. Other diadromous migrants also present which are Annex II species under the EC Habitats Directive are Atlantic salmon *Salmo salar*, sea trout *Salmo trutta*, river lamprey *Lampetra fluviatilis*, sea lamprey *Petromyzon marinus*, twaite shad *Alosa fallax* and allis shad *Alosa alosa*) (ZSL 2016). A number of other species present within the Thames Estuary are on the Section 41 List under the NERC Act (previously UK BAP species) and/or covered by protective international legislation, including the Bern Convention and CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). A number of species are also on the OSPAR list of threatened species and/or the IUCN Red List (see Table 7-3).

Table 7-3 Fish species of conservation importance potentially present at the Kent and Essex Project Sites. Identified from review of historic and contemporary Thames Estuary survey data and research.

Receptor Species	Commercial status	Legal status	Conservation status	Value
Lampreys (Petromyzontidae)				
River lamprey (*Lampetra fluviatilis*)	Low	Appendix III Bern Convention, Annex II and V (Habitats Directive), NERC S41 list (previously UKBAP Priority Species)	IUCN Red List Least Concern, indicator species status in UK (WFD)	Very High
Sea lamprey (*Petromyzon marinus*)	Low	Appendix III Bern Convention, Annex II (Habitats Directive), NERC S41 list (previously UKBAP Priority Species)	IUCN Red List Least Concern, indicator species status in UK (WFD), OSPAR species	Very High
Salmonids (Salmonidae)				
Atlantic salmon (*Salmo salar*)	Recreational fishery	Appendix III Bern Convention, Annex II and V (Habitats Directive), NERC S41 list (previously UKBAP Priority Species), Salmon and Freshwater Fisheries Act	IUCN Red List Least Concern, indicator species status in UK (WFD), OSPAR species	Very High
Sea trout (*Salmo trutta*)	Recreational fishery	NERC S41 list (previously UKBAP Priority Species), Salmon and Freshwater Fisheries Act	IUCN Red List Least Concern	High
Eels (Anguillidae)				
European eel (*Anguilla anguilla*)	Recreational fishery	NERC S41 list (previously UKBAP Priority Species), Eels (England and Wales) Regulations 2009.	IUCN Red List Critically Endangered, indicator species status in UK (WFD), OSPAR species	Very High
Conger eel (*Conger conger*)	Recreational fishery	None	IUCN Red List Least Concern	Low

Receptor Species	Commercial status	Legal status	Conservation status	Value
Shads and herrings (Clupeiformes)				
Twaite shad (*Alosa fallax*)	Low	Appendix III Bern Convention, Annex II and V (Habitats Directive), Wildlife and Countryside Act 1981 – Schedule 5, NERC S41 list (previously UKBAP Priority Species).	IUCN Red List Least Concern, indicator species status in UK (WFD)	Very High
Allis shad (*Alosa alosa*)	Low	Appendix III Bern Convention, Annex II and V (Habitats Directive), Wildlife and Countryside Act 1981 – Schedule 5, NERC S41 list (previously UKBAP Priority Species)	IUCN Red List Least Concern, indicator species status in UK (WFD), OSPAR species	Very High
European sprat (Sprattus sprattus)	Commercial fishery	None	Not assessed by IUCN Red List. Important prey item for other fish	Medium
Atlantic herring (*Clupea harengus*)	Commercial fishery	NERC S41 list (previously UKBAP Priority Species)	IUCN Red List Least Concern. Important prey item for other fish and marine mammals.	High
European anchovy (*Engraulis encrasicolus*)	Commercial fishery	None	IUCN Red List Least Concern.	Medium
European pilchard (*Sardina pilchardus*)	Commercial fishery	None	IUCN Red List Least Concern.	Medium
Bass (Serranidae)				
European seabass (*Dicentrarchus labrax)*	Commercial and recreational fishery	None	IUCN Red List Least Concern	Medium

Receptor Species	Commercial status	Legal status	Conservation status	Value
Perciformes				
Ballan wrasse (*Labrus bergylta*)	Low	None	IUCN Red List Least Concern	Low
Corkwing wrasse (*Symphodus melops*)	Low	None	IUCN Red List Least Concern	Low
Perch (*Perca fluviatilis*)	Recreational fishery	None	IUCN Red List Least Concern	Medium
Butterfish (*Pholis gunnellus*)	Low	None	Not assessed by IUCN Red List	Low
Common dragonet (*Callionymus lyra*)	Low	None	IUCN Red List Least Concern	Low
Atlantic horse mackerel (*Trachurus trachurus*)	Low	NERC S41 list (previously UKBAP Priority Species)	IUCN Red List Vulnerable	High
Lesser sand eel (*Ammodytes tobianus*)	Low	None	IUCN Red List data deficient	Low
Greater sandeel (*Hyperoplus lanceolatus*)	Low	None	Not assessed by IUCN Red List	Low
Raitt's sand eel (*Ammodytes marinus*)	Low	NERC S41 list (previously UKBAP Priority Species)	IUCN Red List data deficient	High
Smooth sand eel (*Gymnammodytes semisquamatus*)	Low	None	IUCN Red List Least Concern	Low

Receptor Species	Commercial status	Legal status	Conservation status	Value
Lesser weever (*Echiichthys vipera)*	Low	None	Not assessed by IUCN Red List	Low
Greater weever (*Trachinus draco*)	Low	None	IUCN Red List Least Concern	Low
Tompot blenny (*Parablennius gattorugine*)	Low	None	Not assessed by IUCN Red List	Low
Gadoids (Gadidae)				
Atlantic cod (*Gadus morhua*)	Commercial fishery	NERC species of Principal importance; NERC S41 list (previously UKBAP Priority Species)	IUCN Red List Vulnerable, OSPA| species	High
Blue whiting (*Micromesistius poutassou*)	Commercial fishery	NERC S41 list (previously UKBAP Priority Species)	Not assessed by IUCN Red List	High
Five-bearded rockling (*Ciliata mustela*)	Low	None	IUCN Red List Least Concern	Low
Three-bearded rockling (*Gaidropsarus vulgaris*)	Low	None	Not assessed by IUCN Red List	Low
Bib/Pouting (*Trisopterus luscus*)	Low	None	Not assessed by IUCN Red List	Low
Whiting (*Merlangius merlangus*)	Commercial fishery	NERC S41 list (previously UKBAP Priority Species)	IUCN Red List Least Concern	High
Poor cod (*Trisopterus minutus*)	Commercial fishery	None	IUCN Red List Least Concern	Medium

Receptor Species	Commercial status	Legal status	Conservation status	Value
Tadpole fish (*Raniceps raninus*)	Low	None	IUCN Red List Least Concern	Low
Cyprinids (Cyprinidae)				
Roach (*Rutilus rutilus*)	Recreational fishery	None	IUCN Red List Least Concern	Medium
Common bream (*Abramis brama*)	Recreational fishery	None	IUCN Red List Least Concern	Medium
Dace (*Leuciscus leuciscus*)	Recreational fishery	None	IUCN Red List Least Concern	Medium
Gobies (Gobiidae)				
Common goby (*Pomatoschistus microps*)	Low	Bern Convention Protected Fauna Appendix III	IUCN Red List Least Concern	Medium
Black goby (*Gobius niger*)	Low	None	IUCN Red List Least Concern	Low
Painted goby (*Pomatoschistus pictus*)	Low	None	Not assessed by IUCN Red List	Low
Rock goby (*Gobius paganellus*)	Low	None	Not assessed by IUCN Red List	Low
Sand goby (*Pomatoschistus minutus*)	Low	Bern Convention Protected Fauna Appendix III	Not assessed by IUCN Red List	Medium
Transparent goby (*Aphia minuta*)	Low	None	Not assessed by IUCN Red List	Low

Receptor Species	Commercial status	Legal status	Conservation status	Value
Crystal goby (*Crystallogobius linearis*)	Low	None	IUCN Red List Least Concern	Low
Lozano's goby (*Pomatoschistus lozanoi*)	Low	None	IUCN Red List Least Concern	Low
Flatfish (Pleuronectiformes)				
Common dab (*Limanda limanda*)	Commercial fishery	None	IUCN Red List Least Concern	Medium
Brill (*Scophthalmus rhombus*)	Commercial fishery	None	Not assessed by IUCN Red List	Medium
Dover sole (*Solea solea*)	Commercial fishery	NERC S41 list (previously UKBAP Priority Species)	IUCN Red List Data deficient	High
European plaice (*Pleuronectes platessa*)	Commercial fishery	NERC S41 list (previously UKBAP Priority Species)	IUCN Red List Least Concern	High
European flounder (*Platichthys flesus*)	Commercial fishery	None	IUCN Red List Least Concern	Medium
Lemon sole (*Microstomus kitt*)	Commercial fishery	None	Not assessed by IUCN Red List	Medium
Turbot (*Scophthalmus maximus*)	Commercial fishery	None	Not assessed by IUCN Red List	Medium
Solenette (*Buglossidium luteum*)	Low	None	IUCN Red List Least Concern	Low
Scorpaeniformes				

Receptor Species	Commercial status	Legal status	Conservation status	Value
Tub gurnard (*Chelidonichthys lucerna*)	Low	None	Not assessed by IUCN Red List	Low
Grey gurnard (*Eutrigla gurnardus*)	Low	None	Not assessed by IUCN Red List	Low
Red gurnard (*Aspitrigla cuculus*)	Low	None	Not assessed by IUCN Red List	Low
Pogge (*Agonus cataphractus*)	Low	None	IUCN Red List Least Concern	Low
Short spined sea scorpion (*Myoxocephalus scorpius)*	Low	None	IUCN Red List Least Concern	Low
Common sea snail (*Liparis liparis*)	Low	None	IUCN Red List Least Concern	Low
Bullhead (*Cottus gobio*)	Low	Bern Convention Protected Fauna Annex II	IUCN Red List Least Concern	Low
Seahorses (Syngnathidae)				
Greater pipefish (*Syngnathus acus*)	Low	None	IUCN Red List Least Concern	Low
Lesser/ Nilsson's pipefish (*Syngnathus rostellatus*)	Low	None	Not assessed by IUCN Red List	Low
Snake pipefish (*Entelurus aequoreus*)	Low	None	Not assessed by IUCN Red List	Low
Short snouted seahorse	Low	Wildlife and Countryside Act - Schedule 5; NERC S41 list (previously UKBAP	IUCN Red List Data deficient	Very High

Receptor Species	Commercial status	Legal status	Conservation status	Value
(*Hippocampus hippocampus*)		Priority Species); Bern Convention Protected Fauna Annex II; MCZ Species Features of Conservation Importance		
Smelt (Osmeridae)				
European smelt (*Osmerus eperlanus*)	Commercial fishery	NERC S41 list (previously UKBAP Priority Species); London BAP Priority Species; UK BAP Priority Species; Wildlife and Countryside Act 1981– Schedule 5	IUCN Red List Least Concern	High
Silversides (Atherinidae)				
Sand smelt (*Atherina presbyter*)	Commercial fishery	None	Not assessed by IUCN Red List	Low
Mullet (Mullidae)				
Thick lipped grey mullet (*Chelon labrosus*)	Commercial fishery	None	IUCN Red List Least Concern	Medium
Thin lipped grey mullet (*Chelon ramada*)	Commercial fishery	None	Not assessed by IUCN Red List	Medium
Red mullet (*Mullus surmuletus*)	Commercial fishery	None	Not assessed by IUCN Red List	Medium
Rays (Rajidae)				
Thornback ray (*Raja clavata*)	Commercial fishery	None	IUCN Red List Least Concern, OSPAR species	Medium
Sticklebacks (Gasterosteidae)				

Receptor Species	Commercial status	Legal status	Conservation status	Value
Three-spined stickleback (*Gasterosteus aculeatus*)	Low	None	IUCN Red List Least Concern	Low
Scombriformes				
Atlantic mackerel (*Scomber scombrus*)	Commercial fishery	NERC S41 list (previously UKBAP Priority Species)	IUCN Red List Least Concern	High
Angler (Lophiiformes)				
Angler fish (*Lophius piscatorius)*	Low	NERC S41 list (previously UKBAP Priority Species),	IUCN Red List Least Concern	High

Chapter Eight ◆ Marine Mammals

BACKGROUND DATA

8.1 Compared to other areas within the UK, the presence of marine mammals in the Thames estuary is low (SCOS 2016) especially upstream of Mucking (Evans & Anderwald 2007). The Thames Estuary, however, is frequented by seals and transient cetaceans (whales, dolphins and porpoises). Two cetaceans and two seal species are frequently recorded in the estuary, these being:

- Harbour porpoise *Phocoena phocoena*;
- Bottlenose dolphin *Tursiops truncatus*;
- Harbour (common) seal *Phoca vitulina*; and
- Grey seal *Halichoerus grypus*.

8.2 Another less frequently recorded species is the white-beaked dolphin *Lagenorhynchus albirostris* and the northern bottlenose whale *Hyperoodon ampullatus*.

8.3 Marine mammals that are present within the Thames Estuary may pass both the Kent Project site and Essex Project site as they transient up and down the estuary. Additionally, the first comprehensive count of seal pups born in the Thames, conducted by the Zoological Society for London (ZSL), has found evidence that harbour seals are breeding within the Thames Estuary (ZSL 2019). There is no evidence of grey seal breeding in the Thames, with no reports of large groups in the autumn when this species is known to breed (PoTLL 2017).

8.4 ZSL has also collated opportunistic sightings of marine mammals within the Thames and Thames Estuary which are provided by members of the public, tour boat operators, and organisations such as the PLA, EA, Thames River Police, Port of London Health Authority and the Kent Mammal Group. The project is known as the Thames Marine Mammal Sightings Survey (TMMSS) and has been running since 2004 to provide a long-term dataset of marine mammals in the Thames.

8.5 Between 2004 and 2014, 1,317 marine mammal sightings were submitted to the TMMSS (ZSL 2015), of which, 1,281 were considered to be valid by ZSL. Pinniped sightings were the most common (79.86% of sightings), followed by cetacean sightings (19.98% of sightings) and sightings of otters (0.16% of sightings). A similar trend was observed for number of animals, where pinnipeds accounted for 81.84% of the total animals encountered, while cetaceans accounted for 18.05%, and European otters accounted for just 0.11% of animals sighted (ZSL 2015). As otter is primarily a terrestrial species, effects on otter are not considered further in this chapter and are covered in ES Chapter 12:

Terrestrial and freshwater ecology and biodiversity (document reference 6.1.12). The results from the report are summarised in Table 8-1.

8.6 The distribution of marine mammal sightings recorded on the TMMSS during 2004-2014 is shown in Figure 13.2.7. The peak time of year for marine mammal sightings is August.

8.7 Frequent sightings of pinnipeds occurred as far upstream as Hampton Court palace and were most frequently sighted near Greenwich, Crossness (upstream of Kent Project sites) and Foulness Island (downstream of Essex Project site) at the mouth of the Estuary (ZSL 2015). Harbour seals are the most frequently sighted and abundant species in the Thames. They have been sighted as far upstream from Swanscombe as Richmond, hauled-out on the riverbanks at low tide (Kowalik *et al*. 2005). They are also known to haul out on sand banks in the outer Thames Estuary, but show individual preference and site fidelity for particular sand banks and haul out sites (Barker *et al*. 2014). Grey seals are normally sighted as solitary animals.

8.8 Sightings of cetaceans have occurred as far upstream as Teddington Lock, whilst the largest group sightings have been reported near Clacton-on-Sea and the Isle of Sheppey (pilot whales), and Southend on Sea and Canvey Island (harbour porpoise). Of the two most common cetacean species (harbour porpoise and bottlenose dolphin), harbour porpoise is the most frequent visitor to the Thames estuary with peak sightings occurring between April and August (Evans & Baines 2010; Evans *et al*. 2011). Bottlenose dolphin is the only other frequently sighted cetacean in the Thames.

8.9 Data of aquatic protected, and designated species obtained from the Essex Wildlife Trust recorded two marine mammal species within 1 km upstream and downstream of the port of Tilbury in the past 15 years. Two *H. ampullatus* individuals were observed in the field in January 2016 and one dead *P. phocoena* individual was reported stranded at Coalhouse fort in May 2005 (Essex Wildlife Trust Biological Records Centre 2020).

Table 8-1 Complete marine mammal sightings from 2004-2014 submitted to TMMSS. Source ZSL 2015.

	Total Sightings	**Total Animals**
Pinnipeds		
Unknown seal	466	823
Harbour seal	307	1,080
Grey seal	250	333
Total Pinnipeds	**1,023**	**2,236**
Cetaceans		
Harbour porpoise	226	398
Dolphin	26	46
Whale	4	49
Total Cetaceans	**256**	**493**
Other marine mammals		
Otter	2	3
Totals	**1,281**	**2,732**

8.10 Of the two most common cetacean species (harbour porpoise and bottlenose dolphin), harbour porpoise is the most frequent visitor to the Thames Estuary. Evans *et al*. 2011 reported over 75% of total cetacean sightings on the Sea Watch Foundation database for the Thames Estuary area were harbour porpoise.

8.11 In the estuary there have been highly infrequent sightings of whales (historical sightings/strandings of minke whale, humpback whale and pilot whale). This is most likely due to animals being sick or injured and they are not considered to be representative of the usual distribution of these species, although minke whale are more frequent visitors to the northern North Sea than other whale species (Reid *et al*. 2003).

8.12 Between September 2015 and January 2016 several marine mammal surveys along the Thames frontage of Swanscombe were undertaken for the London Resort Project by Chris Blandford Associates (CBA 2016). Four viewpoints were selected for marine mammal observation surveys along the Thames frontage of Swanscombe Peninsula. Surveys took place twice a month, one at high tide and one a low tide (except for September in which only one survey at hightide occurred). A total of 40 sightings were made throughout the entire survey period for three marine mammal species: harbour porpoise, grey seal and harbour seal. Of these sightings, 22 were classed as confirmed, four were probable and 14 were possible. Grey seal was observed the most (22 total sightings), followed by harbour porpoise (10 total sightings) and finally harbour seal (eight total sightings). Sightings were observed in every month however; most species were observed in the Autumn (October and November) compared to Winter (December and January). Additionally, most species were observed at high tide compared to low tide.

8.13 Distribution of sightings showed no clear pattern. However, it was noted that most observations of harbour seal were made along the eastern side of Swanscombe Peninsula, whilst harbour porpoise were mostly to the west of the peninsula. Grey seal sightings were evenly distributed to both sides of the peninsula. Observations of behaviour found that marine mammals that were seen in the deeper channel of the Thames were not disturbed by boat activity, whilst those closer to shore and hauled out exhibited evasive behaviour to human presence.

8.14 Some further general information on the key species potentially present is provided below.

SEALS

8.15 There are two species of seal which live and breed in UK waters: grey seals and harbour seals. UK seas supports 95% of the European population for grey seals and 5% of the global population for harbour seals (SCOS 2016).

Harbour seal

8.16 The harbour seal is widespread around the shores of the UK, but population density varies between regions, with low numbers at many sites. Harbour seal are found from Northern Ireland and the southern Firth of Clyde clockwise round the coast to the Thames Estuary.

8.17 ZSL data, based on the targeted population survey carried out in the August 2015 moult period (Barker & Obregon 2015) estimated the harbour seal population for the Greater Thames Estuary to be 626 individuals. This 2015 Thames population count represented nearly 10% of the English and Welsh harbour seal minimum population estimate (SCOS 2016).

8.18 Harbour seals consume a wide range of prey items from the surface, mid-water and benthic habitats depending on season and regional availability. Key prey species are sandeels, whitefish, herring, sprat, flatfish, crustaceans, octopus and squid (e.g. SCOS 2016). Foraging usually occurs within 40 to 50 km of their haul-outs and individuals may travel longer distances in relation to change in foraging sites (SMRU 2011).

Grey seal

8.19 Grey seals are common around the British Isles coastline, although their distribution is centred on the north of Scotland (Smart Wind 2015). However, in recent years grey seal breeding colonies have rapidly expanded along the east coast of England in Berwickshire, Lincolnshire, Norfolk and Suffolk (SOCS 2016).

8.20 In December 2014, ZSL completed a grey seal breeding survey in the Thames region during the peak grey seal breeding season to identify whether any grey seal breeding colonies were located in the Greater Thames Estuary. Neither grey seals nor grey pups were found during the survey, suggesting that grey seals do not breed in the region and might be seasonal visitors of the Greater Thames Estuary (Barker & Obregon 2015), which is consistent with the SCOS 2016 findings.

8.21 Main prey items are sandeel, whitefish and flatfish (particularly Dover sole) with sandeel generally making up around 50% of their diet (Hammond *et al*. 2013). Local variations in prey choice can occur depending on prey availability and benthic substrate type. Foraging trips from haul-out sites to offshore areas occur over distances of up to 145 km with much longer distances covered between haul-out sites (Smart Wind 2015).

CETACEANS

Harbour porpoise

8.22 The harbour porpoise is the UK's most common and widely distributed cetacean species (Evans & Prior 2012). This species is found in the North Sea, Irish Sea, seas west of Ireland and Scotland and northwards to Orkney and Shetland (JNCC 2017b). Since the 1990s it has become much less common around the Northern Isles, but it appears to be returning to the English Channel and southern North Sea, where it was infrequent in the late 1980s (JNCC 2017b).

8.23 Reproductive behaviour is strongly seasonal with mating occurring between June and August and gestation lasting 10-11 months giving a peak in birthing from June to July in UK waters. This seasonal reproductive pattern is often reflected in sightings data which tend to peak in June and July (Smart Wind 2015).

8.24 Harbour porpoise have a higher metabolic rate than dolphins and therefore need to feed more frequently and consume more prey per unit body weight to maintain their body temperature and other energy needs. The diet of the harbour porpoise predominantly comprises small fish from both demersal and pelagic including small gadoids (e.g. cod, haddock, whiting, pollock), herring and sandeels and gobies may be important at certain times or locations (Reid *et al*. 2003). Harbour porpoise are also known to take squid *Loligo* spp. and crustaceans such as brown shrimp *C. crangon* (IAMMWG 2015).

Bottlenose Dolphin

8.25 There are two main areas of UK territorial waters where there are semi-resident groups of bottlenose dolphin which are Cardigan Bay and the Moray Firth (JNCC 2017b). Away from these two areas, there are smaller groups off south Dorset, around Cornwall and in the Sound of Barra, Outer Hebrides. Dolphins from all of these areas may range some distance from their apparent core range.

8.26 Transient groups are not infrequent around the British coast and the total population in UK inshore waters is probably less than 300 individuals (JNCC 2017b). Sightings data for the River Thames suggests transient bottlenose dolphin activity with at least annual frequency of occurrence.

8.27 Bottlenose dolphin prey on a wide variety of benthic and pelagic fish (both solitary and schooling species) such as haddock, saithe, cod, hake, blue whiting, mullet, European eel, salmon, trout, seabass, sprat and sandeels (Reid *et al*. 2003). Octopus, other cephalopods and crustaceans have also been recorded in the diet of this species (Reid *et al*. 2003).

CONSERVATION IMPORTANCE

8.28 Marine mammal species found within the study area are afforded both national and international protection under a range of legislation, plans and protection lists.

8.29 All cetacean species are protected by The Wildlife and Countryside Act 1981 (as amended), The Bonn Convention, 1983 (Appendix II of CMS Agreement on the Conservation of Migratory Species of Wild Animals), and specifically the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) which obliges signatories to apply a range of research and management measures aimed at their conservation.

8.30 Harbour porpoise, bottlenose dolphin, grey seal and harbour seal are listed as EC Habitats Directive Annex II species (with grey and harbour seal also listed under Annex V), however, there are no Special Areas of Conservation (SACs) with marine mammal related designations or qualifying interests associated with the Thames Estuary.

8.31 Both the grey and harbour seal are protected by the Conservation for Seals Act 1970 and

they are listed as protected species under Annex II and Annex V of the EC Habitats Directive. Further protection is afforded to both grey and harbour seals on the east and south-east coast of England (from Berwick to Newhaven) under the Conservation of Seals (England) Order 1999.

8.32 In addition, harbour seal, harbour porpoise and bottlenose dolphin are listed as a priority species under Section 41 (of the 2006 Natural Environment and Rural Communities (NERC) Act and harbour porpoise is also listed on the OSPAR List of Threatened and/or Declining Species.

Chapter Nine ◆ Designated Sites

BACKGROUND DATA

9.1 Sites of international conservation importance within the vicinity of the Project Site are the Thames Estuary and Marshes Special Protection Area (SPA), and the Thames Estuary and Marshes Ramsar Site.

9.2 Sites of national conservation importance within the vicinity of the Project Site include the Swanscombe Marine Conservation Zone (MCZ) and the Inner Thames Marshes, West Thurrock Lagoon and Marshes, South Thames Estuary and Marshes, and Mucking Flats and Marshes Sites of Special Scientific Importance (SSSIs).

9.3 Figure 13.2.1 details the location of designated sites within the vicinity of the Project Site.

Statutory designations

9.4 A 10 km buffer was adopted for the consideration of designated sites in relation to marine ecology as it is considered effects of the Proposed Development are unlikely to extend beyond this distance (Table 9-1).

Table 9-1 Designated sites, protected features and distance from the Project Site.

Designated sites	Distance to the Kent Project Site (km)	Distance to the Essex Project Site (km)	Protected features
Swanscombe MCZ	0 km	4 km	Intertidal mud Tentacled lagoon-worm *Alkmaria romijni*
Thames Estuary and Marshes SPA	8 km	4.6 km	Eight bird species Waterbird assemblage Supporting habitat: Coastal lagoons Coastal reedbeds Freshwater and coastal grazing marsh Salicornia and other annuals colonising mud and sand Spartina swards Intertidal seagrass beds Intertidal mixed sediments Intertidal mud Intertidal sand and muddy sand Water column

Designated sites	Distance to the Kent Project Site (km)	Distance to the Essex Project Site (km)	Protected features
Thames Estuary and Marshes Ramsar	3 km	4.6 km	Ramsar criterion 2 The site supports more than 20 British Red Data Book invertebrates and populations of the GB Red Book endangered least lettuce (*Lactuca saligna*), as well as the vulnerable slender hare's-ear (*Bupleurum tenuissimum*), divided sedge (*Carex divisa*), sea barley (*Hordeum marinum*), Borrer's saltmarsh-grass (*Puccinellia fasciculata*), and dwarf eelgrass (*Zostera noltei*). Ramsar criterion 5: Assemblages of international importance: Species with peak counts in winter: 45,118 waterfowl (5 year peak mean 1998/99-2002/2003) Ramsar criterion 6: Species/populations occurring at levels of international importance. Qualifying Species/populations (as identified at designation): Species with peak counts in spring/autumn: Black-tailed godwit *Limosa limosa islandica* Species with peak counts in winter: Dunlin *Caldris alpina* Red knot *Caldris canutus islandica*
Inner Thames Marshes SSSI	5.7 km	9.7 km	Aggregations of non-breeding birds – Teal, *Anas crecca* Assemblages of breeding birds – Lowland damp grasslands Invertebrate assemblage Vascular plant assemblage

Designated sites	Distance to the Kent Project Site (km)	Distance to the Essex Project Site (km)	Protected features
West Thurrock Lagoon & Marshes SSSI	1 km	5 km	Aggregations of non-breeding birds – Dunlin, *Calidris alpina* Aggregations of non-breeding birds – Redshank, *Tringa tetanus*
South Thames Estuary and Marshes SSSI	7.1 km	3.1 km	Aggregations of three species of breeding birds, 16 species of non-breeding birds Assemblages of breeding birds – Lowland damp grasslands Assemblages of breeding birds – Lowland open waters and their margins Assemblages of breeding birds – Sand-dunes and saltmarshes Invertebrate assemblage Lowland ditch systems SD1 – *Rumex crispus* – *Glaucium flavum* shingle community SM1 – *Zostera* communities SM10 – Transitional low marsh vegetation with *Puccinellia maritima*, annual *Salicornia* species and *Suaeda maritima* SM12 – Rayed *Aster tripolium* on saltmarsh SM13a – *Puccinellia maritima* saltmarsh, *Puccinellia maritima* dominant sub-community SM14 – *Atriplex portulacoides* saltmarsh SM26 – *Inula crithmoides* stands SM6 – *Spartina anglica* saltmarsh SM7 – *Sarcocornia perennis* SM8 – Annual *Salicornia* saltmarsh SM9 – *Suaeda maritima* saltmarsh Vascular plant assemblage
Mucking Flats and Marshes SSSI	8.4 km	4.4 km	Aggregations of 6 species of non-breeding birds Invertebrate assemblage

9.5 The Thames Estuary and Marshes SPA and Ramsar site has marine components and covers an area of 48 km^2. The SPA primarily supports eight species of birds and a waterbird assemblage. However, it also establishes protection for their foraging habitats. The saltmarsh and grazing marsh are internationally important for their diverse range of wetland invertebrates and wetland plants. Saltmarshes are listed as A2.5 by the EUNIS habitat classification and are protected under the Berne Convention (EEA 2019). The habitats also support internationally important wintering waterfowl. The site performs

important hydrological functions, including shoreline stabilization, sediment trapping, flood water storage and desynchronization of flood peaks, and maintenance of water quality by removal of nutrients (JNCC 2000).

9.6 The Swanscombe MCZ covers an area of approximately 3 km^2 and was designated for tentacled lagoon worm *A. romijni* and intertidal mud which is a supporting habitat for this species. These protected features are maintained in a favourable condition, this is done by regulating activity in the area, introducing voluntary measures, and using existing planning and licensing framework, specific byelaws and orders (DEFRA 2019).

9.7 The mudflats within the Inner Thames Marshes SSSI site support important invertebrate communities which are an important food resource for birds. This site has a mixed classification throughout the site by Natural England as unfavourable declining and unfavourable recovering through to favourable condition.

9.8 The West Thurrock Lagoon and Marshes SSSI protects multiple aggregations of non-breeding birds (Dunlin and Redshank) and encompasses mudflats and saline lagoons. The habitats at this site are described as unfavourable by Natural England due to coastal erosion and human disturbance.

9.9 The South Thames Estuary and Marshes SSSI protects multiple aggregations of breeding birds in addition to an invertebrate assemblage, lowland ditch systems, multiple saltmarsh species and a vascular plant assemblage. The SSSI has been designated largely for its importance as an estuarine habitat and is considered to be almost entirely in favourable condition.

9.10 The saltmarsh within Mucking Flats and Marshes SSSI has a high invertebrate interest, which includes the rare spider *B. duffeyi*, as noted near the Kent Project Site, as well as many notable and local species.

Non-statutory designations

9.11 In 2012 the Natural England Designation Strategy report listed the Thames Estuary stretching from the middle of London to the mouth of the Thames River at Westcliff-on-Sea at a proposed National Important Area (NIA). NIAs are a local assessment of opportunities for restoring and connecting nature on a significant scale. Designations are set within the context of wider initiatives (Natural England 2012), however, this portion of the Thames River has not yet been designated as an NIA.

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Appendices

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Appendix 1.0 Figures

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Figure 13.2.1. Designated sites within the vicinity of the Project Site.

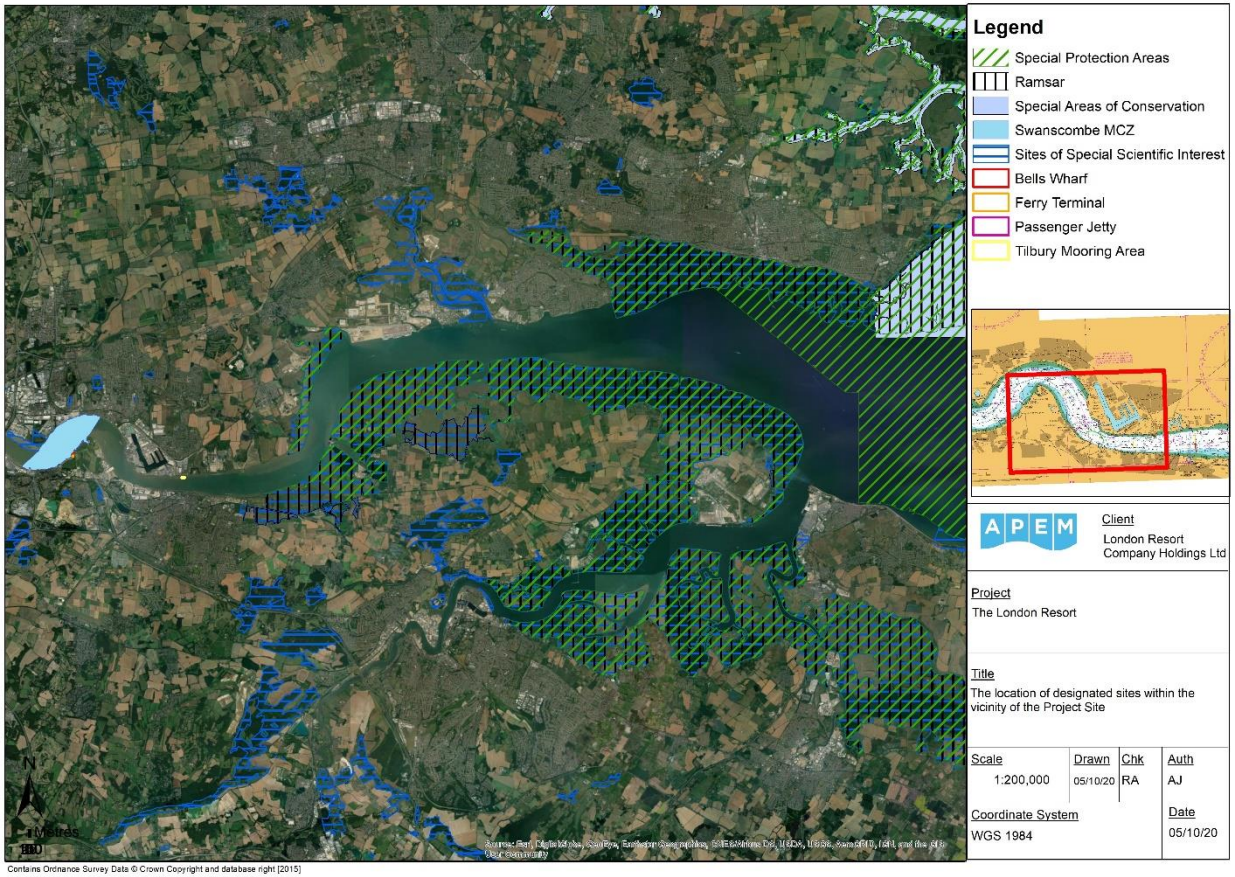

Figure 13.2.2. Intertidal transect and wall scrape sampling locations.

Figure 13.2.3. EUNIS habitat map for the Swanscombe Peninsula from project-specific survey conducted in August 2020.

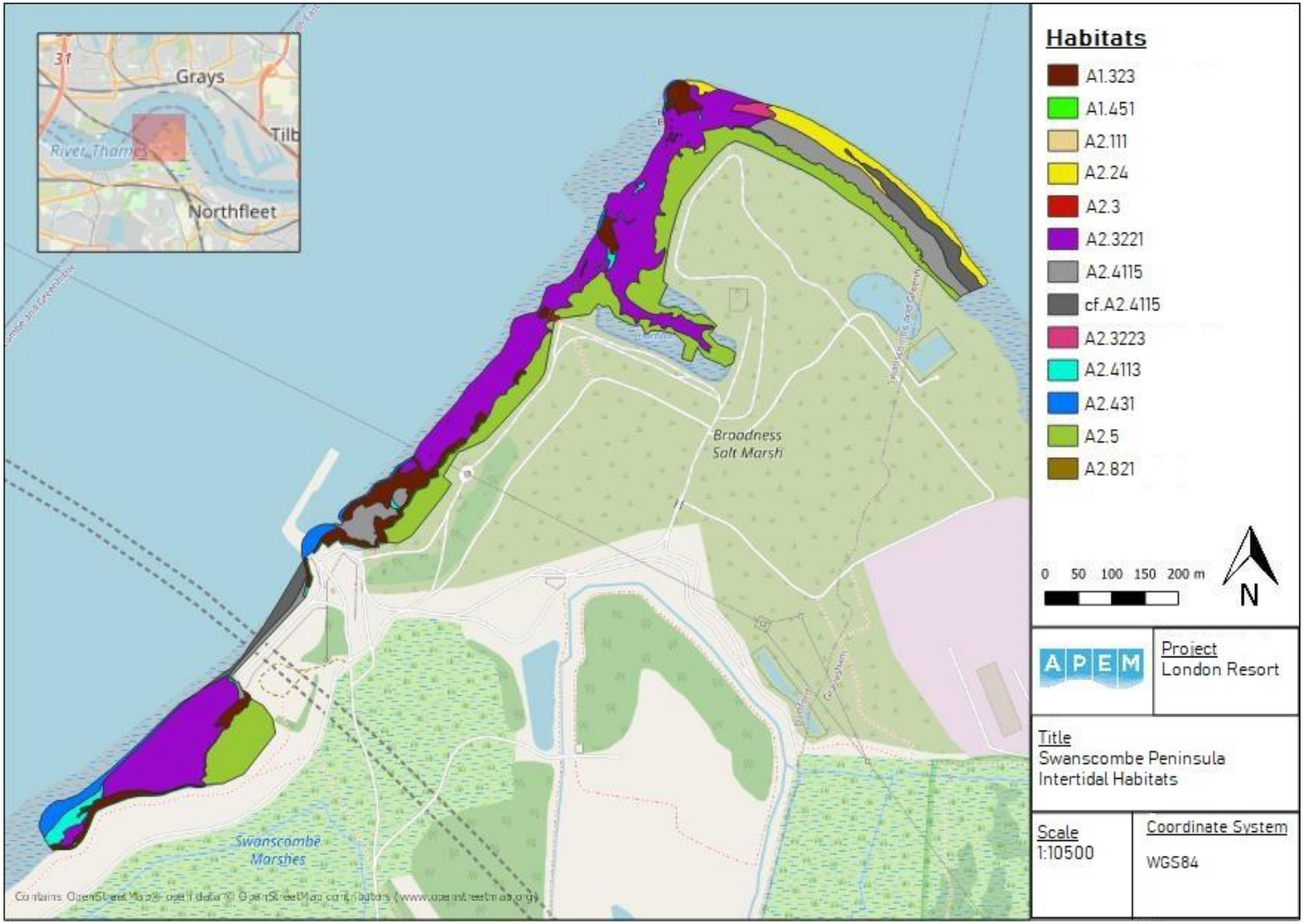

Figure 13.2.4. Subtidal grab sampling locations for the survey undertaken by Ocean Ecology in 2016.

Figure 13.2.5. Subtidal grab sampling locations for the survey undertaken by APEM at the Kent project site in 2020.

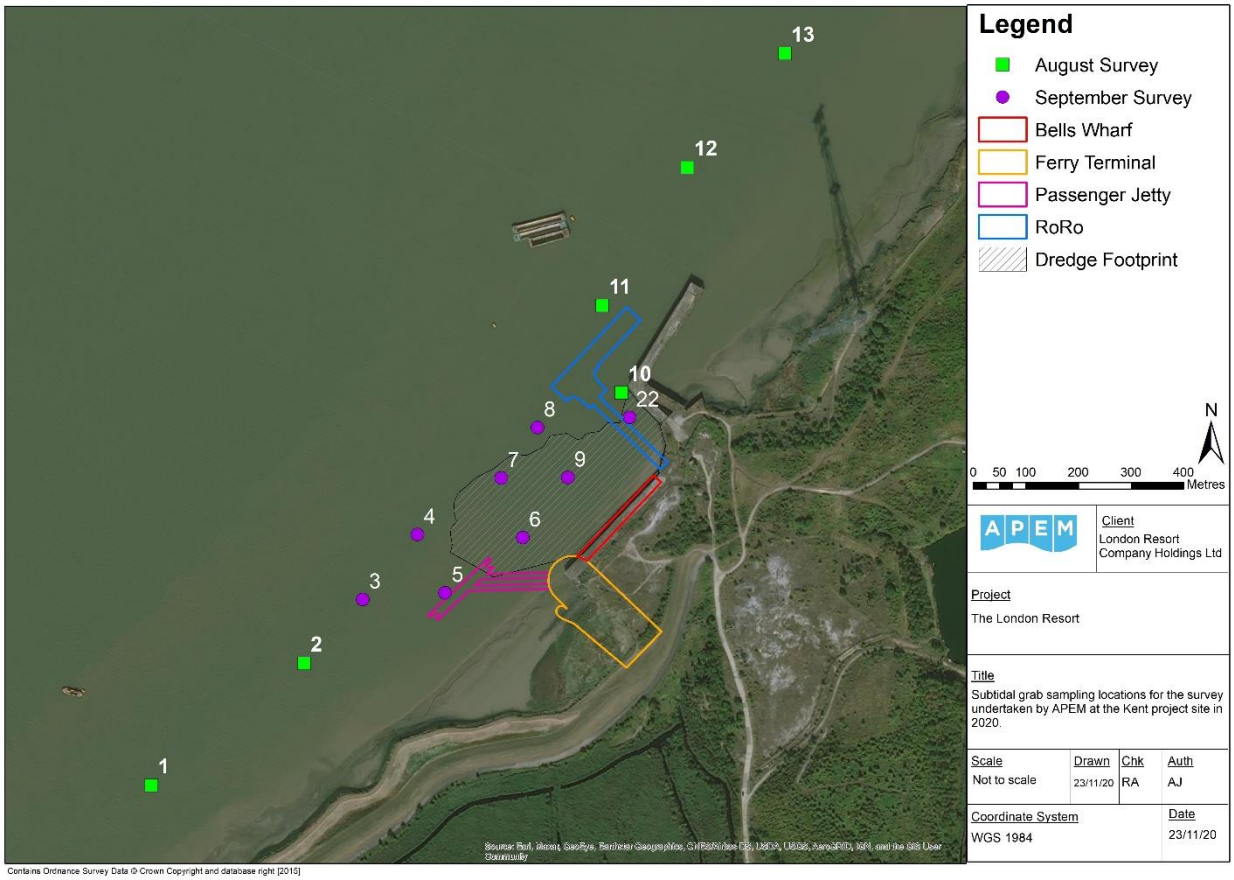

Figure 13.2.6. Subtidal grab sampling locations for the survey undertaken by APEM at the Essex project site in 2020.

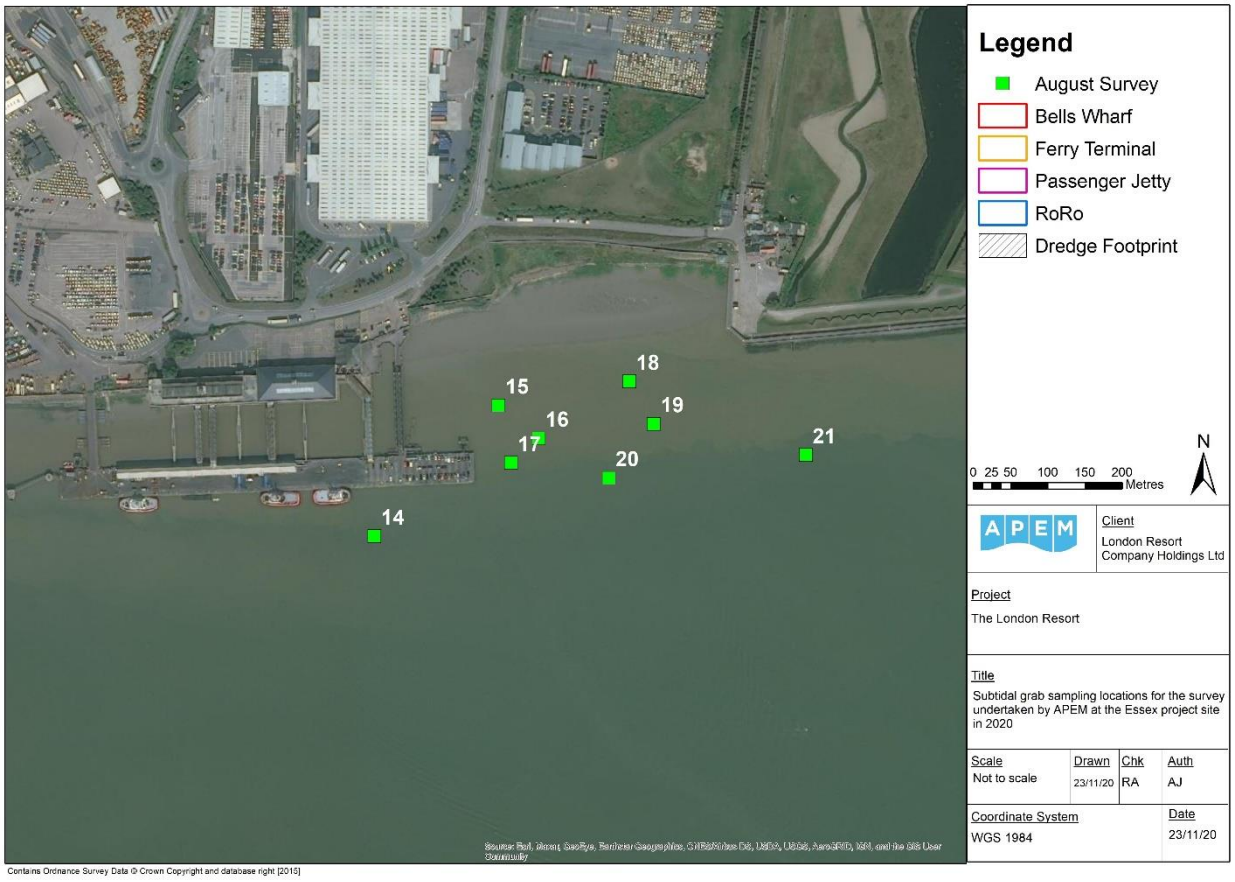

Figure 13.2.7. Sightings of pinnipeds and cetaceans in the Greater Thames Estuary (2004-2014), (points scaled by number of animals per sighting).