

TKRE Cable Tunnel Replacement Project

Environmental Screening Report

nationalgrid

National Grid Electricity Transmission

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1 Introduction

1.1 Introduction

1.1.1 This Environmental Screening Report (ESR) (hereafter “this report”) accompanies four individual Environmental Impact Assessment (EIA) screening opinion requests to the relevant authorities with respect to the elements of the TKRE Cable Tunnel Replacement Project which fall within their jurisdiction. The relevant authorities comprise of:

- **Thurrock Council**; EIA Screening under the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 for one new shaft headhouse and one new cable sealing end compound;
- **Gravesham Borough Council**, EIA Screening under the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 for one new shaft headhouse and one new cable sealing end compound;
- **Marine Management Organisation (MMO)**; EIA Screening under The Marine Works (Environmental Impact Assessment) Regulations 2007 for the new bored tunnel; and
- **Department for Energy Security and Net Zero (DESNZ)**; EIA Screening under The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017 for the overhead line modification works.

1.2 Background

Project Need

- 1.2.1 National Grid Electricity Transmission (hereafter referred to as ‘National Grid’) owns and operates the national high-voltage electricity transmission system throughout England and Wales. The key role of the transmission system is to connect the electricity generators’ power stations with the local distribution networks of the regional electricity companies. National Grid holds the Transmission Licence for England and Wales and is thus obligated to develop and maintain an efficient, co-ordinated and economical system of electricity transmission and to facilitate competition in the generation and supply of electricity, as set out in the Electricity Act 1989.
- 1.2.2 The Proposed Development is part of the Ofgem’s new accelerated strategic transmission investment (ASTI) framework (published December 2022). National Grid is responsible for delivering the extensive onshore transmission system enhancements that are required to achieve the government’s 2030 power sector decarbonisation target.
- 1.2.3 National Grid’s operations are dictated by the latest Future Energy Scenarios (FES) and Electricity Ten Year Station (ETYS) reports. In recent years, these reports have begun forecasting a large amount of renewable and low carbon energy generation, connecting into the transmission network in the east coast of England, together with three interconnectors from the continent. Through these forecasts, National Grid Electricity System Operator (ESO) has identified that the Tilbury to Grain and Tilbury to Kingsnorth (TKRE) 400 kilovolt (kV) circuits will be significantly overloaded in their current capacity and require upgrading.
- 1.2.4 Each year, the ESO undertakes an assessment of the options National Grid has available for meeting forecasted energy demands (the Network Options Assessment, NOA). This assessment comprises economic analysis to understand the balance between managing power flows across network boundaries. In the most recent NOA (2021/22), the ESO has recommended investment in upgrading the TKRE 400 kV circuits giving the project a ‘proceed’ signal with an Earliest in Service Date (EISD) of 2028. This was reconfirmed in the NOA refresh published July 2022.

- 1.2.5 The TKRE 400 kV circuits are currently predominantly overhead line, with a section installed within a deep tunnel beneath the River Thames. As the Transmission Licence Holder with responsibility for the TKRE circuits, National Grid are required to upgrade the existing circuits.

Options Appraisal

- 1.2.6 In 2022, National Grid undertook a Strategic Options Appraisal to inform the selection of a preferred option for the upgrade of the TKRE circuits. Three options were initially identified:
- the installation of new cables within the existing tunnel;
 - the installation of new cables within the new tunnel; and
 - the installation of a new overhead line across the River Thames.
- 1.2.7 The installation of new cables within the existing tunnel is not feasible due to the health and safety risks. The installation of a new overhead line across the River Thames, given its location and scale, would have had greater permanent environmental impacts. On balance, it was considered that the installation of new cables within a new tunnel was the most viable preferable option overall.
- 1.2.8 It should be noted the use of Horizontal Directional Drilling (HDD) as a construction method for the tunnel has been initially reviewed. The ground profile contains a gravel layer which would present a significant challenge with horizontal penetration for any appreciable distance. The number and length of bores required would be significant resulting in larger launch and reception pits to accommodate. HDD is therefore considered high risk and without significant benefits when compared to the option for a new tunnel.

1.3 Overview of the TKRE Cable Tunnel Replacement Project

- 1.3.1 The TKRE Cable Tunnel Replacement Project (hereafter referred to as 'the Proposed Development') relates to the replacement of the section beneath the River Thames of the TKRE 400 kV circuits only. It is proposed that a new bored tunnel under the River Thames is constructed to house new cross linked polyethylene (XLPE) cables. In addition, associated new infrastructure is proposed either side of the River Thames in Tilbury and Gravesend comprising:
- Two new headhouses;
 - Two Sealing End Compounds (SECs); and
 - Overhead line re-stringing to connect the existing overhead lines to each of the new SECs.
- 1.3.2 Each required headhouse and SEC would fall within Thurrock Council and Gravesham Borough Council's jurisdiction.
- 1.3.3 Figure 1 in Appendix A – Figures provides a site location plan.

1.4 Planning Context

Permitted Development

- 1.4.1 National Grid has permitted development rights under Schedule 2, Part 15, Class B electricity undertakings of the Town and Country Planning (General Permitted Development) (England) Order 2015 (GPDO).
- 1.4.2 The following elements of the Proposed Development would be covered by the GPDO, subject to conditions being met and the Proposed Development not being determined to be EIA development:
- Construction of the shafts and tunnel and installation of the electric cables by virtue of Schedule 2, Part 15, Class B(a);
 - Headhouses and SECs by virtue of Schedule 2, Part 15, Class B(e); and

- Any required temporary construction sites by virtue of Schedule 2, Part 4, Class A.

1.4.3 As the required headhouse and SECs at Tilbury cannot be located on operational land, permitted development rights are not available and thus a planning application is required, under the Town and Country Planning Act 1990 (as amended), to Thurrock Council.

1.4.4 The required headhouse and SECs at Gravesend is located on operational land and would be covered by the GPDO, subject to the Proposed Development not being determined to be EIA development.

Requirement for EIA

The Town and Country Planning (Environmental Impact Assessment) Regulations 2017

1.4.5 EIA Development is defined in The Town and Country Planning (Environmental Impact Assessment) Regulations 2017 as either:

- Schedule 1 development for which EIA is mandatory; or
- Schedule 2 development for which EIA may be required taking account factors such as the Proposed Development's nature, size or location.

1.4.6 The Proposed Development does not fall within the definition of Schedule 1 development.

1.4.7 Schedule 2 development is defined by the EIA Regulations as:

"Development of a description mentioned in Column 1 of the table in Schedule 2¹ where:

- any part of that development is to be carried out in a sensitive area²; or*
- any applicable threshold or criterion in the corresponding part of Column 2 of that table is respectively exceeded or met."*

1.4.8 The closest description for the Proposed Development within Schedule 2 is Category 10(b) 'urban development', which the relevant corresponding threshold reads are as follows:

"In the case of Urban Development Projects,

- the development includes more than 1 hectare of development which is not dwelling house development; or*
- the development includes more than 150 dwellinghouses; or*
- the area of the development exceeds 5 hectares."*

1.4.9 The Proposed Development would exceed the threshold set at 10(b)(i) because it would consist of more than 1 hectare of development (at approximately 1.1 hectares (ha)) which is not dwellinghouse development. Therefore, an EIA Screening Opinion is being sought from Thurrock Council and Gravesham Borough Council in order to determine whether the development is likely to give rise to likely significant environmental effects on its own or cumulatively with other developments.

The Marine Works (Environmental Impact Assessment) Regulations 2007

1.4.10 Of interest to the MMO will be the proposed boring of new tunnel. The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) set out the procedure that must be followed before approval is granted for a range of plans and projects. These require an EIA to be carried out in support of an application for consent for categories of project listed in Schedule A1 and Schedule A2 of the Regulations. The boring of a new tunnel does not fall under Schedule A1 or Schedule A2 of the EIA Regulations. However National Grid is requesting an EIA Screening opinion to confirm if the MMO consider a statutory EIA is required.

1.4.11 Activities associated with the construction or operation of a bored tunnel that are carried out wholly under the seabed do not need a Marine Licence so long as the construction of the tunnel does not

¹ <https://www.legislation.gov.uk/ukxi/2017/571/schedule/2/made>

² A Sensitive Area is defined as land designated as a National Park, Site of Special Scientific Interest (SSSI), Area of Outstanding Natural Beauty (AONB), UNESCO World Heritage Site (WHS), Scheduled Monument or European Protected Site.

significantly adversely affect the environment of the UK marine area or the living resources that support it.

Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017

1.4.12 Development requiring EIA is defined in Schedule 1 of The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017 as:

“1. Development to provide any of the following—

(a) a nuclear generating station;

(b) a thermal generating station with a heat output of 300 megawatts or more;

(c) an electric line installed above ground with—

(i) a voltage of 220 kilovolts or more; and

(ii) a length of more than 15 kilometres.

1.4.13 The Proposed Development falls within the definition of Schedule 1 (c)(i), as would at a voltage of 400kV. However, the overhead line modifications associated with the Proposed Development but does not meet the length threshold of 15 km. Therefore, an EIA Screening Opinion is being sought from the Department for Energy Security and Net Zero (DESNZ) in order to determine whether the development is likely to give rise to likely significant environmental effects on its own or cumulatively with other developments.

1.5 Purpose of this Environmental Screening Report

1.5.1 The purpose of this report is two-fold. Firstly, it has been prepared to accompany the requests for EIA Screening Opinions from the following four authorities:

- Thurrock Council (under the Town and Country Planning EIA Regulations 2017);
- Gravesham Borough Council (under the Town and Country Planning EIA Regulations 2017);
- MMO (under The Marine Works (Environmental Impact Assessment) Regulations 2007; and
- DESNZ (under the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017.

1.5.2 The information presented in this report to support EIA Screening covers the Proposed Development in its entirety, noting its geographical spread covering all the aforementioned jurisdictions.

1.5.3 Secondly, as National Grid propose to prepare a Non-Statutory Environmental Appraisal Report (EAR) to accompany the relevant consent applications for the Proposed Development, this report sets out the proposed scope of that EAR. The EAR would cover all elements of the Proposed Development commensurate with that of a formal Environmental Statement (ES) demonstrating how National Grid intends to meet its environmental responsibilities.

1.6 Structure of this Environmental Screening Report

1.6.1 The structure of this report is structured as follows:

- **Chapter 1: Introduction:** This section provides background to, and an overview of the Proposed Development, its planning context and the purpose and structure of this report;
- **Chapter 2: The Proposed Development:** This provides a comprehensive description of the Proposed Development's design;
- **Chapter 3: Information to Support EIA Screening:** This section describes the known baseline conditions, and identifies the key receptors associated with each environmental topic, provides a summary of the potential construction and operational effects associated with the proposed development and a suite of standard and good practice mitigation measures. From this is it determined, after the implementation of the mitigation, whether there would be any likely significant residual effects.

- **Chapter 4: Information to Support Planning Applications.** This section describes the information that will be provided to support the planning applications, including the scope of the environmental appraisal.
- **Chapter 5: Summary.** This section conclusions this report and summarised the next steps for the proposed development.

2 Project Description

2.1 Overview

- 2.1.1 For the purposes of EIA screening, an EIA Screening Boundary has been defined for the Proposed Development as illustrated in Figure 2 (Appendix A – Figures). The EIA Screening Boundary illustrates the current extent of the Proposed Development. The design of the Proposed Development within the EIA Screening Boundary will be refined following further engineering surveys, engagement with stakeholders and the findings of the environmental assessment.
- 2.1.2 The Proposed Development comprises the following components:
- **Two new tunnel headhouses:** one either side of the new tunnel, onshore, which would cover the shaft into the tunnel. During construction, the shaft is used to lower the Tunnel Boring Machine (TBM). Once operational, the shaft is the access point to the tunnel for maintenance work once the tunnel is built and operational. The headhouses also contain ventilation equipment (fans) which regulate the temperature inside the tunnels, keeping the cables cool. These fans would be of a similar size and design to those in the existing headhouses;
 - **Two new cable sealing end compounds:** one either side of the tunnel, onshore, which house the connection between the overhead line and underground cable. These would be a similar size and design to the existing cable sealing end compounds; and
 - **Overhead line modifications to the existing overhead lines:** The new sealing end compounds would be connected to the existing TKRE 400 kV circuits overhead lines either side of the tunnel.

2.2 The Proposed Development

Bored Cable Tunnel

- 2.2.1 The new cable tunnel will be approximately 2.14km long (from headhouse to headhouse), 4m in diameter and its indicative route is illustrated on Figure 2 (Appendix A – Figures).

Table 2-1: New Bored Cable Tunnel - Summary of Key Characteristics

New Bored Cable Tunnel - Summary of Key Characteristics	
Length of tunnel	Approximately 2.14km (headhouse to headhouse)
Width of tunnel	4m
Depth of tunnel	Approximately 50m
Design life	120 years

Plate 2-1: XLPE Cables installed in a deep bored tunnel



Tunnel Headhouses and Cable Sealing End Compounds

- 2.2.2 Two new headhouses and SECs are required as part of the Proposed Development either side of the River Thames.
- 2.2.3 The purpose of the tunnel headhouse is to allow controlled safe and secure access into the shafts, provides enclosure for ventilation fans and equipment to regulate the temperature in the tunnel, to locate mechanical and electrical equipment and to house control equipment for the cable circuits.
- 2.2.4 The new headhouses will accommodate:
- Ventilation plant for the tunnel and shafts (Tilbury), and dedicated access staircase (Tilbury and Gravesend);
 - Accommodation for operational services; including a main control room at Tilbury, and a small Portable Relay Room (PRR) at Gravesend;
 - Conductor transition structures for both Tilbury and Gravesend headhouses and shafts;
 - Shaft access;
 - Uninterrupted Power Supplies (UPS)³; and
 - Limited welfare facilities, such as a small Water Closet (WC) and wash hand basin.
- 2.2.5 The details of the ventilation equipment have not yet been finalised, however the headhouse would be acoustically insulated (where required) in line with BS8233:20147 to ensure operational noise levels are acceptable.
- 2.2.6 The two new SECs would be located adjacent to the new headhouses. The purpose of the SEC is to connect the overhead line to underground cables within the tunnel. The SEC will accommodate:
- The support structures for the cable terminations/sealing ends;

³ Uninterruptible power supplies provide backup power, protecting equipment from damage in the event of grid power failure.

- Post insulators;
- Earth switches; and
- A terminal pylon.

2.2.7 The exterior of the headhouses and layout of the SECs would be developed at the detailed design stage. Plate 2-2 and Plate 2-3 present the existing headhouse at Tilbury and SEC Gravesend as an example of the design of the proposed headhouses and layout of the SECs.

Plate 2-2: Indicative Tunnel Headhouse



Plate 2-3: Indicative Sealing End Compound



Tilbury Tunnel Headhouse and SEC

- 2.2.8 The proposed new Tilbury Tunnel Headhouse and SEC is on an area of existing hardstanding in Tilbury, Thurrock, approximate grid reference TQ 66317 75873 on land owned on all sides by the Port of Tilbury, London.
- 2.2.9 Subject to final detailed design, the Tilbury Tunnel Headhouse and SEC will occupy an area of up to 6500m² / 0.65ha (based on an indicative footprint of 160 m by 80 m). During construction, a larger area of approximately 30, 000m² / 3ha will be required during installation to accommodate construction equipment and storage areas.
- 2.2.10 The Tilbury Tunnel Headhouse and SEC would be surrounded by a 2.4m mesh or palisade security fence topped with an electric pulse fence to a height of 3.4m.

Access

- 2.2.11 The proposed Tilbury Tunnel Headhouse and SEC is accessible from an existing private road belonging to Port of Tilbury, which connects first to local road, Fort Road, and then the A1089 Ferry Road and the wider Strategic Road Network (SRN).
- 2.2.12 No new access roads would be required to facilitate the construction of the Tilbury Tunnel Headhouse and SEC, however an existing access road would need to be re-routed approximately 70m westwards. After construction of the Tilbury headhouse and SEC there are two options for access under consideration:
- the existing road may be reinstated and the temporary reinstated to former use, or
 - the re-routed road may be made into a permanent access road for Port of Tilbury and the public; with the existing access road made adopted by National Grid for access in to the new headhouse and SEC.

Gravesend Tunnel Headhouse and SEC

- 2.2.13 The proposed Gravesend Tunnel Headhouse and SEC is located within a vegetated area which is part of the Canal and Grazing Marsh, Higham Local Wildlife Site (LWS), designated for its grassland habitats and on land owned by National Grid at approximately TQ 67455 74158. To the north of the Proposed Development is the existing cable tunnel and associated headhouse and SEC. The land immediately east is owned by the RSPB and is partially leased and used as a Police Training Centre for rifle shooting. The land immediately west comprises of the Thameside Campus (National Maritime Training Centre), Metropolitan Police Specialist Training Centre (MPSTC) and Thames and the Medway Canal Association.
- 2.2.14 Subject to final design, the Gravesend Tunnel Headhouse will occupy an area of up to 5000m² / 0.5ha (based on an indicative footprint of 160 m by 80 m), however a larger area of 49, 230m² / 4.9ha will be requiring during installation to accommodate construction equipment and storage areas.
- 2.2.15 The Gravesend Tunnel Headhouse and SEC will be surrounded by a 2.4m mesh or palisade security fence topped with an electric pulse fence to a height of 3.4 m.

Access

- 2.2.16 The proposed Gravesend Tunnel Headhouse and SEC is accessible from an existing private road belonging to National Grid, which connects to a public road, Wharf Road, alongside the Thames and Medway Canal. Wharf Road connects first to Norfolk Road, which then connects to Prospect Grove, then the A226 Milton Road and the wider SRN. The new headhouse and SEC compound will require access onto the existing private road.
- 2.2.17 A summary of the key characteristics of the Tunnel Headhouses and SECs is outlined in Table 2-2.

Table 2-2: Tunnel Headhouses and SECs – Summary of Key Characteristics

Factor	Tunnel Headhouses	Sealing End Compound
Tilbury		
Permanent footprint	6000 m² /0.6 ha	
Temporary footprint	49, 230m² / 4.9 ha	
Max. height of buildings	Approximately 10m	Approximately 12 m (compound gantry)
Technology	• Ventilation fans for Tunnel and for stairwell pressurisation system; and • Tunnel shaft including stairwell and access hatches, control room with equipment, mechanical and electrical supplies, welfare room and domestic supplies.	• 12 new XLPE cables; • 12 new cable terminations (polymeric); • 12 new cable support steel structures with buried concrete foundations; • Concrete surface troughs for new cables; • 6 Surge Arrester for protection of underground cables; and • 6 earth switches.
Exterior lighting	External lighting is considered within the compound area for ease of access and maintenance at night. The lighting system can be provided with sensors to operate based on day light availability.	
Access	During construction, this would be via a temporarily re-routed access road which may either be reinstated or become a permanent access road for Port of Tilbury and the public. The existing access road may be adopted by National Grid for access in to the new headhouse and SEC during operation.	
Gravesend		
Permanent footprint	5000m² / 0.5 ha	
Temporary footprint	36, 520m² / 4.652 ha	
Max. height of buildings	Approximately 10m	Approximately 12m (compound gantry)
Technology	• Ventilation fans for stairwell pressurisation system; and • Tunnel shaft including stairwell and access hatches, control room with equipment, mechanical and electrical supplies, welfare room and domestic supplies.	• 12 new XLPE cables; • 12 new cable terminations (polymeric); • 12 new cable support steel structures with buried concrete foundations; • Concrete surface troughs for new cables; • 6 Surge Arrester for protection of underground cables; and • 6 Earth switch.
Exterior lighting	External lighting is being considered within the compound area for ease of access and maintenance at night. The lighting system can be provided with sensors to operate based on day light availability.	
Access	Via new access to an existing private road belonging to National Grid, which connects to a public road alongside the Thames and Medway Canal.	

Overhead line modifications

2.2.19 The new SECs require connection in to the wider TKRE 400 kV circuits overhead line.

Tilbury

2.2.20 At Tilbury, a new terminal pylon will be constructed which will form the new commencement of the 400kV overhead line (OHL). Approximately 260m of new double span overhead line will be installed.

2.2.21 Approximately 600m of single span overhead line will be permanently diverted from the existing terminal pylon (4VG045B) and existing pylons 4VG043, 4VG044 removed. Pylon 4VG045A may be removed or refurbished or replaced.

- 2.2.22 It should be noted that there would be no permanent development within the proposed Site of Special Scientific Interest (SSSI) boundary. It will be limited to the construction phase restringing of pylons and removal or refurbishment or replacement of existing equipment.

Gravesend

- 2.2.23 At Gravesend, a new terminal pylon will be constructed which will form the new commencement of the 400kV OHL. Approximately 350m of new double span overline will be installed.
- 2.2.24 Approximately 400m of single span overhead line will be permanently diverted from between pylons 4VG041 and 4VG042 as well as existing pylon 4VG042.

2.3 Construction Phase

Bored Cable Tunnel Construction

Tilbury

- 2.3.1 The tunnel construction will commence from the Tilbury side and drive south underneath the River Thames. A main compound would be required at Tilbury to facilitate the construction of the drive shaft for the TBM. A smaller, satellite compound would be required at Gravesend to facilitate the receiving and removal of the TBM.
- 2.3.2 The required sizes of the shafts and compound areas are described below.

Main Compound

- 2.3.3 The Main Compound at Tilbury would require an area of approximately 6000m² and comprise of:
- Project offices;
 - Welfare facilities;
 - Spoil storage areas for both shaft sinking and tunnelling operations;
 - Shaft ring and tunnel ring storage areas;
 - Workshop to maintain tunnelling equipment; and
 - Parking facilities.

Drive Shaft Construction -Temporary Works

- 2.3.4 The depth of the shaft is expected to be approximately 50m. A total of 450 m² working area is required for the construction of the shaft. This is made up of:
- the finished internal diameter (15m);
 - the diameter of the working area for the shaft, including required construction plant and material delivery (45m); and
 - storage of segments and spoil (400m²).

Tunnel Construction – Temporary Works

- 2.3.5 Once the shaft construction is complete, the tunnelling phase would commence. Staff numbers would increase for this phase and tunnelling would continue 24 hours a day until complete. Storage of the tunnel segments would require an area of 1500 m².
- 2.3.6 The tunnelling method cannot be confirmed until the appointment of the main contractor however based on the information obtained to date it is likely that construction using a TBM would be used to cut a channel through the ground. The tunnel would then be constructed with precast concrete segments behind the TBM.

- 2.3.7 For the spoil handling, the required area is based on the type of TBM selected. For an Earth Pressure Balance machine (EPB) the spoil typically surfaces as a paste and can be stockpiled prior to removal from site. Some treatment of the chalk may be required to meet the requirements of the end location of the spoil, before it leaves site.
- 2.3.8 If a slurry machine is used, a processing plant is required to separate the arisings from the bentonite and then the processed material stored in the same way as the EPB machine prior to removal from site. If this method is used, the separation plant would be required with a footprint of 4000m².
- 2.3.9 During the tunnelling operations cranes will be required to sit adjacent to the shaft to lift plant and materials. This may be a crawler crane located next to the shaft or a gantry crane with legs either side of the shaft. An area of 100m² is required.
- 2.3.10 Additional areas either side of the shaft site are required for the assembly of the TBM and for siting the crane to lift the TBM into the shaft. Due to the significant loading required to lift the TBM, some ground improvement work may also be required.

Spoil

- 2.3.11 The excavated material from construction of the tunnel would be approximately 49,100m³. The excavated material from the construction of each shaft would be approximately 10,250m³ per shaft. This results in a total of approximately 69,600m³ of spoil which will need to be removed from site. The composition of the spoil is currently being investigated which will determine its suitability for reuse. However, a review of existing local data suggests tunnel arisings are likely to be chalk.
- 2.3.12 National Grid have a zero waste to landfill target by 2026, which will come into force during the construction phase of the Proposed Development. Numerous promising local opportunities are being explored for the reuse of the spoil materials to meet National Grid's commitment to avoid landfill. These include:
- the infill and restoration of saline lagoon at RSPB Cliffe Pools providing benefits to aquatic invertebrates and located approximately 5.5km east of the Proposed Development on the south side of the River Thames (National Grid's preferred choice);
 - the infill of similar lagoons on neighbouring land owned by commercial operator, Brett Aggregates;
 - use as construction material for the various other large developments up and coming in the Tilbury area; and
 - to support other habitat restoration and wetland projects in the Tilbury area.

Gravesend

Reception Shaft Site – Temporary Works

- 2.3.13 The reception shaft would be located on the Gravesend side and spoil storage for the shaft construction would be at a similar area to that of the Tilbury side. The reception shaft would be the same diameter as the drive shaft.

Tunnel Construction – Temporary Works

- 2.3.14 The reception shaft is only required for the removal of the TBM, once the drive has been completed. For this, a crane and fleet of lorries will be required. Their size is dependent on the TBM chosen and the size of the parts following disassembly. Typically, a TBM can be split in to three parts.
- 2.3.15 Due to the weight of the TBM, it is possible that foundations or potential ground improvements are required to support the crane track.

Reception Shaft Compound – Gravesend

- 2.3.16 The Reception Shaft Compound would serve as a satellite compound to the main site and so would be smaller, at approximately 400m² and comprise of:
- Welfare facilities for the contractor on site;
 - Small office areas; and
 - Spoil handling for shaft construction works.
- 2.3.17 The size of the project offices and welfare would be smaller here compared to the Tilbury side, however the spoil storage for the shaft construction would be similar.

Sealing End Compound and Terminal Pylon

- 2.3.18 An SEC is required either side of the River Thames to enable the transition from an OHL to an underground connection. The new SECs have been sited as close to the existing OHL as possible to prevent the requirement for any new extent of OHL. Two new terminal pylons will be required either side; this forms the commencement of the 400kV OHL.
- 2.3.19 Pylon erection will be by either a Mobile Hydraulic Crane, or with a derrick to erect the pylon in small sections. Pylon erection will require a large laydown and assembly area of approximately 50m x 50m for laying out and assembling the steelwork into the lifting sections. Steelwork will be delivered to site on trucks and assembled in sections around the pylon base. A tractor with a light crane or tele-handler may assist in the moving of and erecting steelwork on the ground. The first panel will be lifted by the crane and manoeuvred into position over the foundation stubs and fixed into place by locating the connecting bolts.

Plate 2-4: Pylon Erection at Base Level



- 2.3.20 Once in place the panel will be stayed to hold its position. Subsequent sections will be assembled using a controlled lift and staying sequence with each panel or boxed section bolted in turn to the previous erected panel until the pylon is complete and secured.

Plate 2-5: Pylon Erection at Upper Levels



Removing of Existing Infrastructure

- 2.3.22 Existing pylons 4VG043, 4VG044 & 4VG045A at Tilbury will require removal. These pylons are shown on Figure 2 (Appendix A – Figures).
- 2.3.23 Pylon dismantling and removal can be carried out using a variety of methods depending on the pylon type, location and accessibility. Potential methods include:
- **Crane:** Pylons can be dismantled using a large mobile hydraulic crane which is positioned on a crane pad at the pylon location. The crane pad will be approximately 20m x 10m (subject to crane size/site constraints) constructed from plastic or metal panelling. It will take approximately one day to dismantle a pylon using a crane (following advanced site preparation i.e. installation of the crane pad and progressing of advanced works on the pylon prior to commencement of works with the crane). The sections of the pylon will be broken up as they are lowered to the ground using a steelwork breaker/ mechanical shears fitted to an excavator. The cut sections of the pylon are then placed into waste skips (which could be located within the crane pad or on temporary track way joining the crane platform) and removed from site for reuse wherever possible or recycling where not possible.
 - **Felling:** This method avoids the need to use a mobile hydraulic crane but can only be used where there is sufficient room to pull over the pylon without damaging roads, utility services, and fixed boundary features such as hedges. A wire bond will first be taken and fitted to the top of the pylon. A winch tractor will be positioned approximately 1.5 to 2 times the pylon height away from the pylon. The base of the pylon (the two back legs of the pylon are cut) is then partially cut through (or use controlled explosives) and the winch tractor used to pull over the pylon using the attached bond. The sections of the pylon will then be broken up using a steelwork breaker/ mechanical shears, loaded into skips and removed from site for reuse or recycling. This method is not suitable for all pylons especially those which are wide.
 - **Winch and Derrick:** This method requires a small mobile winch and a derrick (lifting device) will be taken to the site. The derrick will be raised up to the top of the pylon such that approximately one third of the derrick is above the top of the pylon. Four stay wires will be required (for support) at right angles from the top of the derrick down to backstays which are positioned at least one and a half times the maximum height of the derrick away. The pylon will

act as a scaffold and dismantled from the inside in small sections which will be individually lowered to the ground using the winch and derrick.

- 2.3.24 As the pylon is dismantled and laid down in sections, gas torches or a hydraulic shearer mounted on a 360-degree excavator will be used to break up the pylon into small sections and load into skips for reuse or recycling.

Plate 2-6: Hydraulic Shearer Mounted on an Excavator Boom



Sealing End Compounds – Temporary Works

- 2.3.25 The temporary storage areas required for the SECs are similar to those for the shaft and tunnel phases. Craneage is required to lift equipment and cabling into place.

Table 2-3: Temporary Working Areas - Summary of Key Characteristics

Factor	Temporary Working Areas
Tilbury	
Main Compound	6000 m ² / 75 x 80m
Drive Shaft Construction Area	46, 000 m ²
Gravesend	
Satellite Compound	400m ²
Reception Shaft Construction Area	46, 000m ²

Reinstatement

- 2.3.26 The land used temporarily to support the construction of the Proposed Development will be reinstated to its former, or better than former condition.

Working Hours

- 2.3.27 Once the shaft construction is complete, the tunnelling phase will commence and is expected to take eight months. For this phase, the tunnelling will continue 24 hours a day until complete.
- 2.3.28 The core working hours for the rest of the construction activities will be between 8:00 – 18:00 (Monday to Friday) and 8:00 - 13:00 (Saturday). A period of up to one hour before and one hour after core working hours is envisaged for start-up and close down activities. These activities will not include the use of plant or machinery likely to cause disturbance to neighbouring residents/businesses but may include movement to place of work, maintenance and general preparation works.

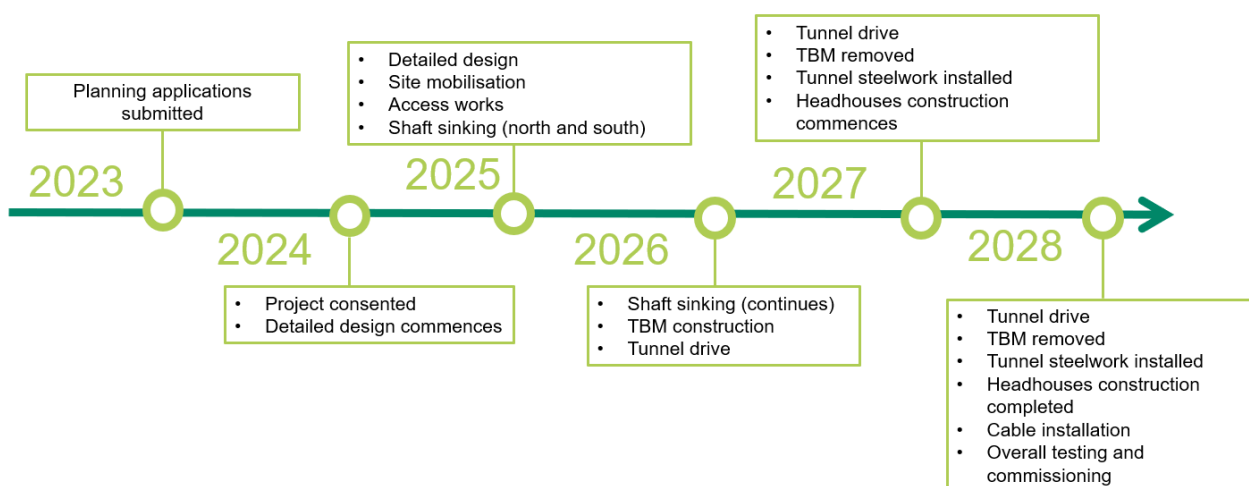
Construction Environmental Management

- 2.3.29 An important measure to avoid significant effects is effective management during design and construction, details of which would be included in a Construction Environmental Management Plan (CEMP). Adherence to the requirements of the CEMP will be undertaken by National Grid during the detailed design and construction phase. National Grid will undertake assurance audits and inspections throughout the construction phase to ensure that the Contractor is in compliance with the CEMP and other applicable requirements.

Construction Programme

- 2.3.30 Construction at the site would take place from 2025, when the site is mobilised, and run until 2028, when the Proposed Development is commissioned. The indicative construction programme is shown in Plate 2-7.

Plate 2-7: Indicative Construction Programme



Site Access and Routes

- 2.3.31 Vehicle movements would be mainly light vehicles and HGVs including the delivery of the crane. Abnormal indivisible Loads (AIL) may be required to deliver the TBM depending on its configuration.

Traffic Movements

Tunnel and shaft excavation traffic movements

- 2.3.32 National Grid's preference is use river barges to remove the tunnel spoil from the construction site at Tilbury to and from *existing* jetty structures only. Heavy Goods Vehicles (HGVs) would be required to move the spoil from the construction compound at Tilbury, to the existing jetty.
- 2.3.33 The peak construction activity in terms of traffic generation is expected to relate to the excavation of aggregate during tunnelling. If the local highway network were to be used, initial forecasts indicate that there will be in the order of 8198 two-way HGV movements required in total across the eight-month tunnel construction period. Tunnelling works, including construction and removal of the TBM are expected to take place for approximately 11 months.
- 2.3.34 The total number of HGV movements based on both the estimated volumes of excavated material and tunnel lining segments is included below in Table 2-4. The table presents the estimated two-way movements of HGVs. One two-way movement is defined as a vehicle arriving at and then leaving the site.

Headhouse construction traffic movements

- 2.3.35 The average number of two-way HGV movements during the construction of the headhouses would be approximately three per week, per site (Tilbury and Gravesend) for 12 months.

Sealing End Compound Construction Traffic Movements

- 2.3.36 The average number of two-way HGV movements during the construction of the SECs would be approximately three per day, per site (Tilbury and Gravesend) for 26 weeks.

Overhead Line Diversions Construction Traffic Movements

- 2.3.37 The average number of two-way HGV movements during the construction phase the Overhead Line Diversions would be approximately 20 per day in Tilbury, 15 per day in Gravesend for 32 weeks.

Table 2-4: Provisional Construction HGV Movements - Tilbury

Construction Phase	Total HGV Movements (in and out of site)	Average Two-way movements per day	Peak Two-way movements per day	Programme
Shaft Construction	2124	7	7	4 months
Tunnel Construction	8198	25	25	8 months
Tunnel lining segments delivery	4600	40	40	23 weeks
Shaft lining segments delivery	208	1	3	44 weeks
Abnormal Indivisible Loads (AILs) - TBM	10	2	6	1 week
Abnormal Indivisible Loads (AILs) Cable Drums	72 (36 x 2)	2	3	~4 weeks
Shaft fit out and head house construction	64x2	3 per week	Not Applicable	12 months
Sealing End compound construction	780 (390 x 2)	3	10	26 weeks
400kv overhead line diversions	1300 (650x2)	8	20	32 weeks

Table 2-5: Provisional Construction HGV Movements - Gravesend

Construction Phase	Total HGV Movements (in and out of site)	Average Two-way movements per day	Peak Two-way movements per day	Programme
Shaft Construction	2124	7	7	8 months
Shaft lining segments delivery	208	1	3	8 months
Abnormal Indivisible Loads (AILs) TBM	10	2	6	1 weeks
Shaft fit out and head house construction	64x2	3 per week	Not Applicable	12 months
Sealing End compound construction	780 (390 x 2)	3	10	26 weeks
400kv overhead line diversions	110 (550x2)	7	15	32 weeks

Decommissioning of existing assets

- 2.3.38 Decommissioning of the existing tunnel and associated infrastructure does not form part of this project. However, it is expected that the existing cables and cable joints within the existing tunnel will be purged of their oil and sent for recycling. Further tunnel inspection work will be needed.

- 2.3.39 The cable terminations and steel structures within the existing headhouses and SEC's will be recycled, or reconditioned for reuse, or repurposed.

2.4 Electric and Magnetic Fields

- 2.4.1 All equipment that generates, distributes or uses electricity produces Electric and Magnetic Fields (EMFs). Exposure limits for EMFs in the UK are set by the Government on advice from Public Health England, and the electricity industry strictly adheres to these limits. The exposure limits for both Direct Current (DC) and Alternating Current (AC) cables originate from the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines, published in 1994 and 1998 respectively and recently updated in March 2020. The Proposed Development will be designed to comply with the guidelines for exposure to EMFs.

2.5 Operational Phase

- 2.5.1 Once the Proposed Development is commissioned and in operation, it is expected that operational activity would mirror that of the existing headhouses and SECs. Operational activity of the Proposed Development may include:
- Two to three occasional visits annually with a light van or car for inspection or minor maintenance of electrical and ventilation equipment; and
 - Maintenance work on electrical/ventilation equipment or buildings involving five to ten light good vehicles visits once every two to five years.

2.6 Decommissioning

- 2.6.1 The overall design life of the new tunnel, headhouses and sealing end compounds is approximately 120 years. During that time, the cables are likely to be replaced more than once.
- 2.6.2 If the Proposed Development is to be decommissioned in the future, its constituent parts would be decommissioning in accordance with the relevant legislation and removed or disposed or used in an appropriate manner.

3 Information to Support EIA Screening

3.1 Introduction

- 3.1.1 The following sections set out whether or not the construction and operation of the TKRE Cable Tunnel Replacement Project is considered likely to result in significant effects on the environment.
- 3.1.2 The assessment within the following sections also takes account of reasonable and easily achievable mitigation measures which the Proposed Development will adopt to avoid or prevent significant effects on the environment.
- 3.1.3 These sections should be read in conjunction with Figures 1 to Figure 6 in Appendix A – Figures which illustrate the environmental constraints identified in the surrounding area.

3.2 Ecology

- 3.2.1 The ecology baseline has been informed by a Preliminary Ecological Appraisal (PEA) incorporating a desk study and extended Phase 1 Habitat survey which was undertaken in 2022, and discussions with Natural England. The PEA is appended to this report, see Appendix C – Preliminary Ecological Appraisal. It should be noted that the PEA covers a larger area than the area considered in this report.
- 3.2.2 In addition, the understanding of the current baseline draws upon feedback from Port of Tilbury and Natural England regarding further surveys that are understood to have been undertaken on habitats in the vicinity of the Tilbury site.

Baseline Environment

Tilbury

- 3.2.3 The proposed headhouse location and associated working areas at Tilbury are located approximately 2km from the Thames Estuary & Marshes Ramsar Site and Special Protection Area (SPA), which is designated based on its internationally important bird populations and associated wetland habitats.
- 3.2.4 Tilbury Marshes LWS is approximately 500m to the west of the Tilbury site but is separated from the site by the Port of Tilbury.
- 3.2.5 Land adjoining the southern and eastern boundaries of the SEC, headhouses and associated working area forms part of the “Tilbury Power Station” LWS. Limited works are proposed within this area to enable the removal of an existing overhead line and one pylon base. This area is designated on the basis of remnant floodplain grazing marsh habitats, areas of open mosaic habitat and importance for invertebrates and reptiles. These areas and others in the wider local area have been proposed for statutory designation as a Site of Special Scientific Interest (SSSI) based on botanical interest and terrestrial invertebrate populations.
- 3.2.6 Refer to Figure 3a in Appendix A – Figures for statutory and non-statutory designations in context of the EIA Screening Boundary.
- 3.2.7 The proposed headhouse and SEC location and associated working areas at Tilbury consist predominately of existing hardstanding, containing smaller vegetated areas containing rough grassland, dense scrub and tall ruderals. Those areas of terrestrial habitat at Tilbury that would be directly impacted are isolated, frequently disturbed and are considered to be of negligible ecological value. However, the land adjoining the Tilbury site to the east is known to be of ecological value for a range of habitats and species including foraging bats, common reptiles (common lizard, slow worm, grass snake and adder), notable invertebrate populations associated with brownfield habitats, and water vole associated with the ditch network.

- 3.2.8 In addition, the grassland and scrub habitats in close proximity to the Tilbury site are suitable to support a range of breeding and wintering birds. At its closest point the Tilbury site is approximately 200m from the foreshore habitats adjoining the River Thames. These areas of foreshore habitat are considered to be of value in supporting bird populations associated with the nearby Thames Estuary and Marshes Ramsar/SPA.
- 3.2.9 Two active subsidiary badger (*Meles meles*) setts are known to be present within the Tilbury Power Station LWS, and, pending further survey to clarify their presence/absence, the site is considered potentially suitable to support great crested newt (*Triturus cristatus*), foraging bats, hedgehogs, (*Erinaceus europaeus*), otter (*Lutra lutra*) and European eel (*Anguilla anguilla*).

Gravesend

- 3.2.10 The Thames Estuary & Marshes Ramsar Site and SPA is located in close proximity to both the south and east of the site. At its closest point it is approximately 50m from an existing pylon where restringing will occur. The headhouse and main works area is approximately 100m from the Ramsar/SPA. The foreshore areas adjoining the River Thames to the north of the Gravesend site are also considered to be suitable to support the species for which the Ramsar/SPA are designated.
- 3.2.11 The Gravesend site is located within the Canal and Grazing Marsh, Higham Local Wildlife Site LWS, a non-statutory designated site for nature conservation. The site is designated on the basis of remnant grazing marsh habitat which has been found to support a range of notable plant species.
- 3.2.12 Other designated sites nearby include South Thames Estuary and Marshes SSSI, approximately 500m south, Mucking Flats and Marshes SSSI, approximately 2km north-east and Tilbury Marshes LWS approximately 2km north-west.
- 3.2.13 Refer to Figure 3a in Appendix A – Figures for statutory and non-statutory designations in context of the EIA Screening Boundary.
- 3.2.14 The majority of the site consists of horse grazed semi-improved grassland with occasional scattered scrub and trees. In addition, a wet ditch directly adjoins the eastern and southern boundaries of the site. These habitats are potentially suitable to support notable plant species such as those listed on Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006, as amended).
- 3.2.15 The habitats at the Gravesend site have suitability to support several protected species. The grassland and scrub have suitability to support foraging bats, widespread species of reptile, notable bird species, badgers, hedgehogs, eels and notable invertebrates. The ditches are potentially suitable to support great crested newt, water vole and otter.
- 3.2.16 A single tree in close proximity to the proposed SEC was identified as having high suitability for roosting bats due to the multiple bark fissures, woodpecker holes and callous rolls in its trunk. There are invasive non-native plant species on site.

River Thames

- 3.2.17 The area of the Thames which the cable tunnel will pass beneath is approximately 7km from the Swanscombe Marine Conservation Zone (MCZ) which is designated for the conservation of intertidal mud and tentacled lagoon worm (*Alkmaria rominini*).
- 3.2.18 The foreshore adjoining both the Tilbury and Gravesend sites are identified in the MAGIC database (Ref 1) as supporting areas of intertidal soft sediment and saltmarsh which are both habitats highlighted in the Water Framework Directive (WFD) as being sensitive (based on their resistance to, and recovery rate) to human pressures within the Middle Thames WFD Waterbody (GB530603911402) (Ref 2).
- 3.2.19 The Thames catchment is known to support several nationally and internationally protected migratory fish species as well as those known to be dependent on the estuary at certain life stages or for their entire life cycle.
- 3.2.20 A study carried out by the Zoological Society of London (ZSL) identified 24 protected and common species in the Tidal Thames. Of these, 17 are considered likely to be present in the Thames Middle

water body within the vicinity of the proposed works. Some of these species are protected nationally under Annex I of the Habitats Directive 2017 (e.g., Atlantic salmon).

- 3.2.21 A range of marine mammals are known to utilise the River Thames. The most recent report from ZSL between 2004 and 2014 (Ref 3) concluded that on average, 113 sightings were reported each year, with 80 % of sightings being of pinnipeds (seals). The greatest density of sightings was around Canary Wharf where 138 sightings per km² were recorded between 2004 and 2014 (although this could be due to increased observation effort in this area). The location of the proposed activities, had between 1 and 5 sightings per km² during the 10-year period between 2004 and 2014; the majority of these were pinnipeds.

Key Receptors

- 3.2.22 The key ecological receptors (i.e. Important Ecological Features) at Tilbury and Gravesend are outlined in Table 3-1. In accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland (Ref 4) a geographic scale of reference is given for each receptor based on current understanding of the baseline. Further surveys are required to confirm the baseline.

Table 3-1: Key Ecological Receptors

Receptor	Tilbury Site	Gravesend Site	Geographical Scale of Biodiversity Importance
Thames Estuary & Marshes Ramsar Site and Special Protection Area	✓ Located 2km to the south with potential for functionally linked habitat within 200m.	✓ Located 50m to the south	International
Tilbury Power Station LWS/proposed SSSI	✓ Existing pylon and overhead within LWS to be removed/refurbished/replaced. Adjacent to main compound.	x	Up to National
Canal and Grazing Marsh, Higham LWS	x	✓ Main works compound within the LWS.	County
Habitats	The semi-natural grassland, watercourse and lake are Habitats of Principal Importance supporting protected species. The foreshore contains sensitive intertidal habitats highlighted as sensitive within the WFD.	The semi-natural grassland is a Habitats of Principal Importance supporting protected species. The foreshore contains sensitive intertidal habitats highlighted as sensitive within the WFD.	Tilbury – Local Gravesend – Up to County River Thames – up to Regional
Notable invertebrates	✓ Adjacent brownfield habitat site is of known value for brownfield invertebrates and is being designated by Natural England as a SSSI for its invertebrate communities.	✓ Habitats within the works area and adjacent suitable for notable invertebrates.	Up to National

Receptor	Tilbury Site	Gravesend Site	Geographical Scale of Biodiversity Importance
Wintering and wading birds	✓ The nearby foreshore habitat is potentially suitable to support the species for which the Thames Estuary and Marshes Ramsar and SPA are designated. Grassland habitat adjacent to the site provides suitable habitat for notable overwintering bird species.	✓ The nearby foreshore habitat is potentially suitable to support the species for which the Thames Estuary and Marshes Ramsar and SPA are designated. Grassland habitat adjacent to the site provides suitable habitat for notable overwintering bird species.	Up to National
Breeding birds	✓ The scrub and grassland habitats have moderate suitability for breeding birds.	✓ The scrub and grassland habitats have suitability for breeding birds.	Up to County
Widespread species of reptile	✓ Populations of four species present on site.	✓ Scrub and grassland suitable to support reptiles. Presence/absence to be confirmed.	Up to County
Water vole	✓ Known population within ditches to south of the site and suitable habitat adjoining site.	✓ Suitable habitat adjoining main works area.	District
Otter	✓ Further survey needed to confirm presence/absence in ditches adjacent to site.	✓ Further survey needed to confirm presence/absence in ditches adjacent to site.	Local
Great crested newt	✓ Ditches adjoining site likely unsuitable but further survey needed to confirm presence/absence.	✓ Ditches adjoining site likely unsuitable but further survey needed to confirm presence/absence.	Up to District
Roosting bats (trees)	✗ Negligible roosting suitability.	✓ One tree with High suitability for roosting bats.	Up to Local
Foraging and commuting bats	✓ Suitable foraging habitat. Further survey needed to confirm level of use.	✓ Suitable foraging habitat. Further survey needed to confirm level of use.	Up to District
Marine mammals	Thames and its banks and suitable for cetaceans and pinnipeds. The location of the proposed activities, had between 1 and 5 sightings per km ² during the 10-year period between 2004 and 2014.		Up to Regional.

Summary of Potential Effects

Potential Construction Effects

3.2.23 Based on the current understanding of the baseline, prior to mitigation the Proposed Development has the potential to result in the following key impacts on receptors during construction, which in turn could generate significant adverse effects:

- **Direct habitat loss** – the Proposed Development will result in a permanent loss of habitat at both the Gravesend and Tilbury sites, and temporary habitat loss of a larger area during construction to provide space for compounds and spoil storage. At Gravesend this will include permanent loss of notable habitat from within the Canal and Grazing March Higham LWS at Gravesend, which could impact the structure/function of this non-statutory designated site. In addition, at both sites direct loss of habitat has the potential to adversely affect the associated species populations, in particular notable invertebrates, birds and reptiles;
- **Habitat degradation** – direct or indirect impacts resulting in the reduction in the condition of retained habitats within or adjoining the Proposed Development, and its suitability for some or all of the species it supports. For example, changes in water quality may impact water vole populations utilising ditches adjoining the site; potential changes in marine and foreshore habitats as a consequence of increased use of existing jetty structures leading to potential to mobilise sediment and increase suspended sediment concentrations (SSC);
- **Species mortality** – direct impacts on species populations due to potential for killing/injury during site clearance operations. For example, impacts on notable reptile population known to occur at Tilbury and potential impacts on nesting bird, notable invertebrate populations and badger setts;
- **Species disturbance/displacement** – for example visual, noise or vibration-related disturbance from tunnel boring, additional barge movements for deliveries/spoil disposal. This may include potential for visual disturbance of marine mammals and underwater sound disturbance effects to marine mammals and fish. In addition, potential disturbance of birds and bats from lighting during construction. In particular there is a risk of disturbance of foreshore habitats adjoining the Thames, and resultant displacement of any birds utilising these habitats which are associated with the Thames Estuary and Marshes Ramsar Site and SPA as a consequence of increased boat movements;
- **Fragmentation of populations or habitats** – indirect impacts by dividing a habitat, group of related habitats, site or ecological network, or the creation of partial or complete barriers to the movement of species, with a consequent impairment of ecological function (reptiles, roosting bats, badgers, great crested newt).

Potential Operational Effects

3.2.24 The following additional operational impacts and associated effects may occur:

- **Habitat degradation/disturbance** – potential for indirect impacts associated with operational lighting which may reduce the suitability of adjoining habitats for bat and bird populations. In addition, permanent increases in human activity associated with ongoing operation of the headhouses and SECs could reduce the suitability of adjacent habitat for use by nesting and foraging birds.

Potential Cumulative Effects

3.2.25 There are a range of recently consented schemes at Tilbury within a 1km radius. Those schemes which have already obtained consent will be considered as part of the future baseline in the Non-Statutory Environmental Appraisal (See Appendix B – Cumulative Developments). Other schemes with developed proposals but that are not yet committed development (e.g. Lower Thames Crossing) will be considered in relation to potential cumulative impacts and effects. However, no project alone or in combination is expected to generate a likely significant effect assuming each scheme continues to ensure that all specified mitigation measures are implemented.

Mitigation

3.2.26 The following avoidance and mitigation measures are currently proposed. These proposals will be refined based on the outcomes of further survey work:

- **Canal and Grazing Marsh Higham LWS:** Areas of temporary habitat loss will be minimised, with the majority of spoil extraction and storage undertaken at Tilbury. A site specific habitat reinstatement plan will be produced to cover restoration and enhancement of those areas within the LWS required during construction only. This will include specifications for soil reinstatement, seeding and/or natural recolonisation (where appropriate);
- **Water Framework Directive Scoping Assessment:** even though the proposed barge movements are temporary in nature, they have the potential to mobilise sediment and impact benthic communities. The effects of this impact pathway are largely dependent on understanding the scale and duration of the activities. Therefore, this impact will be assessed further when a higher level of detail is provided regarding the works. This should include a WFD Scoping assessment to understand the effects on WFD sensitive habitats and water quality;
- **Overwintering birds:** due to the proximity to habitat potentially functionally linked to the Thames Estuary and Marshes Ramsar Site and SPA the results of further survey may identify a need for specific mitigation to reduce the risk of disturbance of birds utilising the foreshore habitats. The requirement for further mitigation will be informed by the results of further survey work and discussion with Natural England. Where appropriate hoarding and/or acoustic barriers will be incorporated at the works locations to avoid significant effects;
- **On-site habitat creation:** following construction the Tilbury site will be appropriately landscaped, with a particular emphasis on ensuring integration into the surrounding landscape and reducing potential for disturbance of adjoining retained habitats. Opportunities to incorporate biodiverse roofs to the headhouse structures will also be explored;
- **Off-site habitat creation:** the tunnel will generate a large volume of spoil material. There are several examples in the wider Thames Estuary of such material being utilised for large scale habitat creation. A suitable nearby partner organisation (e.g. RSPB at Cliffe Pools) will be sought to utilise spoil from the tunnel. In order to minimise potential for impacts on marine receptors and the nearby SPA/Ramsar this will utilise existing jetty facilities by agreement, potential options are presented in section 2.3.11;
- **Restraining/removal/reconfiguration/refurbishment of existing OHL equipment:** these works will seek to avoid vegetation clearance and will be programmed to minimise impacts on species. Where pylons are to be removed at Tilbury, bases will be broken out where access allows to increase the extent of semi-natural habitat, or where not practical covered with additional spoil to enhance the habitat;
- **Sensitive timing of works:** key stages of works such as vegetation clearance will be sensitively timed in order to limit the potential impacts on species such as birds and reptiles. If any vegetation removal is required during the bird nesting season (March to September) an Ecological Clerk of Works (ECOW) will check the vegetation for the presence of any active bird nests before it is cleared under supervision. Any active bird nests will have to remain in-situ until the young have fledged and an exclusion zone will be implemented around the nest which will be determined by the ECOW so that there is no further disturbance to the nest from site activities;
- **Habitat degradation/species translocation:** species specific mitigation strategies will be developed for reptiles and invertebrates (and bats, badger, great crested newt and water vole if necessary) to reduce impacts of vegetation clearance on these species. This will include strategies for phased vegetation clearance to encourage displacement into adjoining areas of retained habitat. Where appropriate this may also include habitat creation and/or enhancement to compensate for habitat lost as a consequence of the Proposed Development. Appropriate mitigation licences will be obtained wherever it is determined these are required;
- **Water vole and otter:** there will be no permanent removal of water vole habitat at either Gravesend or Tilbury. Any temporary works will be moved 10m away from the toe of the ditch

to prevent damage to burrows and no spoil, fuel or other materials should be stored or set down within this buffer zone, unless on hardstanding. The design will ensure no degradation of habitat quality within the existing ditches;

- **Badgers:** If works occur within 30m of a badger sett, a Natural England mitigation licence to close a badger sett is required in Tilbury. Any temporary excavations will be covered at night and hazardous chemicals stored in a lock-up to prevent harm to badgers. Semi-natural grassland and scrub will be established post-construction to provide suitable badger habitat;
- **CEMP:** standard construction controls will be secured via a CEMP. This will include controls to limit potential for dust deposition (e.g. wetting down of haul roads), avoid pollution incidents and ensure sensitive construction lighting (e.g. directing away from adjoining sensitive receptors). In addition it will include measures to prevent spread of invasive non-native species, including within the marine habitats;
- **Underwater sound disturbance effects to marine mammals and fish:** based on information available at this stage it is considered unlikely that proposed activities will generate sufficient underwater sound to exceed ambient levels. However, as a precaution once the full design details are available the impact pathway will be subject to further assessment to confirm that this is the case.

Summary

- 3.2.27 Existing baseline information shows that both the Tilbury and Gravesend site are located in ecologically sensitive locations, either within or adjoining designated sites for nature conservation. Direct impacts will include land take from non-statutory designated sites, with the design avoiding any permanent physical footprint within the existing or proposed statutory designations.
- 3.2.28 Further baseline surveys are being undertaken in both locations to clarify the scale of these constraints and inform ongoing design and mitigation requirements.
- 3.2.29 At this stage of data collection and design development it is not currently possible to rule out the potential for likely significant effects on ecological receptors prior to mitigation. However, based on implementation of the avoidance and mitigation measures proposed (including design assumptions set out in Section 2) it is considered likely that significant adverse residual effects will not occur.
- 3.2.30 The ecological baseline will be fully established through the surveys presented in Table 4-1 in Chapter 4 of this report. An ecological appraisal will be undertaken, proportionate to that of a full EIA, to support the planning application(s). As required, Mitigation by Design and Project Specific Mitigation will be tailored, in discussions with Natural England, with Project Specific Mitigation detailed in an Outline CEMP.
- 3.2.31 Further information on the proposed scope of the ecological appraisal can be found in section 4.2.3.

3.3 Landscape and Visual

Baseline Environment

Study Area

- 3.3.1 For landscape and visual effects, the study area may be determined either by specific development type guidance or by professional judgment based on the anticipated Zone of Theoretical Visibility (ZTV), informed by digital terrain modelling. Guidelines for Landscape and Visual Impact Assessment Third Edition (Ref 1) suggests that the study area should be proportionate to the proposed development itself and may include refinement by professional judgement. In the case of the proposed development, the study area has been defined by a combination of the ZTV and professional judgement. The combination of these factors has resulted in a study area which encompasses land within a 1.5km radius of each of the sites (Tilbury and Gravesend) (see Figure 5, Appendix A – Figures). Beyond this distance it is anticipated that the proposed development will be unlikely to give rise to important or likely significant landscape or visual effects.

Landscape Character Overview

- 3.3.2 Landscape character is a composite of physical, cultural, perceptual and aesthetic elements. Landform, hydrology, vegetation, land cover, land use pattern, cultural and historic features and associations combine to create a common 'sense of place' and identity which can be used to categorise the landscape into definable types and areas. The level of detail and size of the types and areas can be varied to reflect the scale of definition required. It can be applied at a national, regional, and local level.
- 3.3.3 The sites are not subject to any locally, nationally or internationally important landscape designations. The Proposed Development would be designed to respect the character of the landscape as far as practicable.

Landform and Hydrology

- 3.3.4 The landform of both sites (Tilbury to the north of the River Thames, and Gravesend to the south of the River Thames) are flat and low-lying at 0-10m Above Ordnance Datum (AOD).
- 3.3.5 The landform of the Tilbury study area is flat with no notable change in elevation. The landform of the Gravesend study area is also predominantly flat however the terrain rises up gradually to the west to approximately 15m AOD in the direction of Windmill Hill, and to the south to approximately 30m AOD in the direction of Harts Hill and Shorne Hill.
- 3.3.6 The River Thames passes from west to east through both the Tilbury and Gravesend study areas and is the dominant hydrological feature within the area. There are also a series of linear field drains within the marshland of the Tilbury study area as well as the moat surrounding Tilbury Fort which is a notable water feature. The Gravesend area also comprises marshland and the field drains within this study area are more intricate and extensive.

Settlement and Vegetation Patterns

- 3.3.7 The Tilbury site is located to the southeast of Tilbury with residential properties alongside the northwestern side of the railway line lying approximately 1.3km from the site at the closest point. Large infrastructure is particularly prevalent to the west of the study area. This includes the existing OHL infrastructure to the north of the site, Tilbury Sewage Treatment Works to the west along with the extensive area occupied by Tilbury Docks. Tilbury Fort is a recreational site to the west of the site. The remainder of the study area is rural with scattered farmsteads and isolated properties to the northeast at Buckland.
- 3.3.8 The Gravesend site is located to the east of Gravesend on an area known as the East Court Marshes. The site is adjacent to an industrial area that forms a narrow strip between the River Thames and the Thames and Medway Canal. The nearest residential properties in the settlements

of Denton and Chalk are approximately 750m to the south and west of the site. The remainder of the study area is rural with scattered farmsteads and isolated properties to the southeast.

- 3.3.9 There is a marked contrast between the industrial areas of the Tilbury study area and the residential areas of the Gravesend study area with the low-lying marshland landscape that makes up the remainder of each study area. The flat, open marshland landscape largely comprises grazing pasture and riparian vegetation lining the drainage ditches with very few trees.

Public Rights of Way and Access

- 3.3.10 There are no Public Rights of Way (PRoW) across the Tilbury site. The nearest PRoW (Footpath 146) is located approximately 30m to the south of the site. Much of this footpath also comprises part of the England Coast Path promoted recreational route and the National Cycle Network (NCN) Route 13 from Tower Bridge to Dereham at approximately 200m to the south of the site. Footpath 144 and Byway 98 to the west of the site, and Footpath 200 to the northeast of the site are the only other PRoWs in the study area (see Figure 4c in Appendix A – Figures).
- 3.3.11 West Tilbury Commons located approximately 700m north of the site, The Green, Hall Hill Common, Fort Road Common, Par Thurrock approximately 900m to the west of the site are areas of accessible Countryside and Rights of Way (CRoW) Act land in the study area.
- 3.3.12 There are no PRoWs across the Gravesend site. The nearest PRoW (Footpath 0328/NG1/1) is located approximately 150m to the north of the site and comprises part of the England Coast Path and Saxon Shore Way promoted recreational routes. A public footpath that runs alongside the Thames and Medway Canal (0328/NG2/2) is located approximately 150m to the south of the site and also forms part of NCN Route 1 from Dover up to the Highlands of Scotland. There are several other PRoWs that run perpendicular to this route (0328/NG3/1 and 0328/NG4/1) to the south of the site and bridleway 0229/NS318/1 to the east of the site. In addition, there are several smaller PRoWs to the edge of the study area, particularly in the vicinity of Chalk and Denton (see Figure 4c in Appendix A – Figures). There are no areas of Registered Common Land or accessible CRoW Act land in the study area.

National Landscape Character

- 3.3.13 Both sites lie within the National Character Area (NCA) 81(Ref 7) (see Figure 4a in Appendix A – Figures). Greater Thames Estuary and both the Tilbury and Gravesend study areas exhibit some of the key characteristics of the NCA:
- Predominantly flat, low-lying coastal landscape;
 - Extensive open spaces ...dominated by the sky;
 - The pervasive presence of water;
 - Open grazing pastures patterned by a network of ancient and modern reed-fringed drainage ditches; and
 - Highly urbanised areas ... on marsh edges subject to chaotic activity of various major developments.
- 3.3.14 A small part of the northern extents of the Tilbury study area also lie within NCA 111 Northern Thames Basin (Ref 8) with “*mixed farming, with arable land*” typical of the NCA.
- 3.3.15 A small part of the southern extents of the Gravesend study area also lie within NCA 113 North Kent Plain (Ref 9) with the area exhibiting the “*open, low and gently undulating*” areas of “*productive arable land*” characteristic of the NCA.
- 3.3.16 Both sites also lie within the Marine Character Area (MCA) 18: Thames and Medway Estuaries defined in the Seascape Character Assessment for the South East Inshore marine plan area (Ref 10) and both the Tilbury and Gravesend study areas exhibit some of the key characteristics of the MCA:
- Marked contrast of industrial ports and urban area with the wild and remote isolated low-lying marshy coastal landscape;

- Entrance to the River Thames heavily used by commercial shipping traffic; and
- A busy industrial environment with dense residential and large scale industrial developments.

Local Landscape Character

- 3.3.17 At the Unitary authority level, the Tilbury site and study area incorporates Landscape Character Areas (LCA) C5 Tilbury Marshes, and E5 Tilbury and Docks Urban Area. A smaller part of the outer extents of the study area also lies at the transitional edge of the D6 Chadwell Escarpment Urban Fringe and D7 West Tilbury Urban Fringe defined in the Thurrock Landscape Capacity Study 2005 (Ref 11). These are shown on Figure 4b in Appendix A – Figures.
- 3.3.18 LCA C5 Tilbury Marshes is characterised by:
- Low lying, level landscape;
 - Horizontal landform;
 - Large scale landscape;
 - Network of linear ditches;
 - Southern skyline of dock cranes, chimneys, pylons and power lines; and
 - Close proximity of residential areas.
- 3.3.19 E5 Tilbury and Docks Urban Area is characterised by:
- Tilbury nucleated settlement, predominantly post-war with some tower blocks and flat-roofed housing;
 - The docks, part of the Port of London, containing large commercial warehouses and distinctive vertical cranes;
 - A large industrial and commercial area of large warehouses; and
 - Several areas of publicly accessible greenspace distributed within housing areas.
- 3.3.20 D6 Chadwell Escarpment Urban Fringe Area is characterised by:
- Irregular fields of rough grassland and pasture.
- 3.3.21 D7 West Tilbury Urban Fringe Area is characterised by:
- Large, open fields; and
 - Absence of hedgerows and woodland cover.
- 3.3.22 At the county level, the Gravesend site and study area incorporates the Eastern Thames Marshes LCA and Hoo Peninsula LCA defined in the Landscape Assessment of Kent landscape character assessment (2004) (Ref 12). These are shown on Figure 4b in Appendix A – Figures.
- 3.3.23 Eastern Thames Marshes LCA is characterised by:
- Remote, wild, remote and quiet. Influence of sea and sky;
 - Creeks, dykes, marsh and patches of scrub, extensive areas of cultivated marsh, a simple landscape;
 - Overhead power lines; and
 - Wild birds and grazing animals.
- 3.3.24 Hoo Peninsula LCA is characterised by:
- Prominent hills and low-lying alluvial marshes; and
 - Flat/undulating farmland.

- 3.3.25 At the local level, the Gravesend site and study area incorporates the Shorne and Higham Marshes LCA defined in the Gravesham Landscape Character Assessment (Ref 13). This is characterised by:
- Flat grazing marsh with a lack of vegetation; and
 - Network of ditches and meandering waterways divide the marshes in an irregular pattern leaving parcels of land of a medium scale.
- 3.3.26 The study area also incorporates the Higham Arable Farmland LCA. This is characterised by:
- Very gently undulating topography;
 - Open arable farmland; and
 - Views out to the marshes and the River Thames in the north.
- 3.3.27 The study area also incorporates the Gravesend Townscape Area. This is further defined by Urban Character Areas at the local level.
- 3.3.28 The study area includes the Urban Character Areas (UCA) of Inter/Post War Suburbs UCA, the Victorian/Edwardian Suburbs UCA, the Modern Suburbs UCA, and the Industrial Hinterland UCA defined in the Gravesend Townscape Appraisal (Ref 14).
- 3.3.29 The Inter/Post War Suburbs UCA is characterised by:
- Largely residential land use with naturally undulating topography; and
 - The close proximity of the neighbouring Green Belt all combine to create some extensive views of the surrounding landscape.
- 3.3.30 The Victorian/Edwardian Suburbs UCA is characterised by:
- Some of the most extensive views of Gravesend, including the industrial estates adjacent to the River Thames and large areas of the surrounding landscape.
- 3.3.31 The Modern Suburbia UCA is characterised by:
- The nearby heavy industrial estates and the associated chimney stacks form a noticeable backdrop to this residential area.
- 3.3.32 The Industrial Hinterland UCA is characterised by:
- Heavy industrial land use dominating the space both physically and visually; and
 - Views through the area restricted by the numerous large scale buildings.

Landscape Designations

- 3.3.33 Neither the Tilbury or the Gravesend sites or respective study area are covered by any statutory landscape designations. The nearest Area of Outstanding National Beauty (AONB) is the Kent Downs located 5km and 3.2km south of the Tilbury and Gravesend sites respectively. Neither site or their respective study areas are within a National Park and there are no Registered Parks or Gardens within either study area.
- 3.3.34 Whilst there are no landscape designations, there are a number of ecological and cultural heritage designations within the study area and these can inform landscape value and are of importance in terms of visitor destinations and visual amenity for the area. These include the Scheduled Monument of Tilbury Fort within the Tilbury study area, and listed buildings within both the Tilbury and Gravesend study areas. In addition to these cultural heritage designations, there are ecological designations including the South Thames Estuary and Marshes SSSI, Ramsar site, and SPA approximately 200m south, and 700m to the west of the Gravesend site.
- 3.3.35 Both sites and their respective study areas sit within the London Area Green Belt (LAGB) with the Tilbury site lying within the Thurrock B LAGB and the Gravesend site within the Gravesham District B LAGB. The radius of both study areas also encompasses both LAGBs. This indicates landscape value as a result of openness, rather than intrinsic quality.

Visual Resource

- 3.3.36 Visual impacts are defined in GLVIA3 (Ref 1) (Para 2.21) as “*specific views and on the general visual amenity experienced by people*”. This means people with the potential for views of either the construction or operation of the Proposed Development.
- 3.3.37 The identification of visual receptors is a two-staged process, beginning with interrogation of baseline mapping and the preliminary ZTVs and then moving onto fieldwork to refine and ascertain the actual inter-visibility between the Proposed Development and potential visual receptors.

ZTV Analysis

- 3.3.38 The study area has been established by initial analysis of topographic maps and terrain analysis and precedent work undertaken by AECOM landscape architects for similar schemes in the vicinity including site visits to the area. This indicated that, for most points of the compass, beyond the extent of the 1.5km study area the Proposed Development would be unlikely to give rise to any visual effects although due to the flat topography of the area, there is theoretical visibility from higher land to both the south-east and south of the 1.5km boundary.
- 3.3.39 A computer generated ZTV was run for the Proposed Development generated using 5m DTM from OS MasterMap incorporating screening from vegetation based on woodland from the National Forestry Inventory (NFI) using an assumed height of 10m and screening from existing buildings from OS Open Map Local with an assumed height of 7.5m. The ZTV is based upon a series of points around the sealing end compound terminal pylons with a height of 12 m, a grid of points 2 m apart within the headhouse building at a height of 10 m, and an observer eye height of 1.6 m. All heights are above ground level. Individual ZTVs have been generated for both the Tilbury and Gravesend study areas.
- 3.3.40 The ZTV indicates areas from where it may be possible to view part of or the entire Proposed Development, however, the use of the ZTV needs to be qualified by the following considerations:
- The ZTV is limited by the detail of the digital terrain model data used and does not take account of local topographic variations;
 - Some areas of theoretical visibility may comprise woodland (not accounted for in the NFI) or agricultural land, where there is effectively no public access and the likelihood of views being experienced is consequently low; and
 - The ZTV does not take account of the likely orientation of a viewer, such as the direction of travel and there is no allowance for reduction of visibility with distance, weather, or light.
- 3.3.41 These limitations mean that the ZTV tends to overestimate the extent of visibility, both in terms of the areas from which the Proposed Development is visible and the extent of the particular site which is visible. Consequently, the ZTV should be considered as a tool to identify areas of potential visibility for further targeted survey and assessment, and not a measure of the visual effect.
- 3.3.42 The receptors identified have been selected on the basis that they fall within the ZTV (Figure 5 in Appendix A – Figures). As illustrated by the ZTV, the pattern of theoretical visibility is mostly concentrated around the undeveloped marshland around both the Tilbury and Gravesend sites where the riverine topography is flat. There are pockets of potential more distant visibility to the south and southeast of both the Tilbury and Gravesend study areas where the landform starts to rise. Visibility from the urban areas of Tilbury and Gravesend are limited to the settlement edge.
- 3.3.43 The ZTV locations and types of visual receptors within the defined study areas include, but are not limited to, the following: settlements and residential receptors; users of National Cycle Routes and promoted recreational routes; and those using local rights of way; people using major transport routes (major roads and rail); and people using the local road network.

Key Receptors

- 3.3.44 The types of visual receptor and receptor groups within each study area who have the potential to experience views of the Proposed Development at Tilbury and Gravesend are listed below and grouped into the following categories:

- Views from residential settlements;
- Views from recreational routes and places of interest;
- Views from roads and rail;
- Views from places of work; and
- Views for those engaged in outdoor sport or recreation.

Tilbury

Views from residential settlements

- 3.3.45 Residential settlement within the Tilbury study area is limited to the eastern settlement edge of Tilbury approximately 1.3km northwest. Views of the proposed Tilbury site would be screened by the intervening railway line and the industrial area including the cement works and the maritime container storage and transportation site. Any resulting change in views would be barely perceptible.
- 3.3.46 There are several scattered farmsteads and isolated properties approximately 1.4km to the northeast at Buckland, and approximately 1.5km north northeast on the outskirts of Low Street. Whilst views across the intervening marshland are flat with sparse vegetation, the proposed development will be perceived as part of, and an extension to, the existing industrial landscape. The isolated properties at Low Street also have the line of existing overhead power lines receding into the distance.

Views from recreational routes and places of interest

- 3.3.47 Recreational routes are shown on Figure 4c in Appendix A – Figures. The English Coast Path promoted recreational route and NCN Route 13 pass to the south of the site. Whilst the proposed development will be noticeable within the view it will be perceived as part of, and an extension to, the existing industrial landscape. The local part of PRoW 146 passes closest to the site and the Proposed Development would therefore become a dominant part of the view localised in this area. Views to the Proposed Development at Gravesend are likely to be barely perceptible and result in no change to the view.
- 3.3.48 Views for recreational visitors to the heritage asset of Tilbury Fort are likely to be screened by the intervening maritime transport site and industrial works. The proposed site is likely to be barely perceptible and viewed in the existing context of the industrial landscape and overhead line.
- 3.3.49 Recreational users of this section of the River Thames are likely to view the site within the wider industrial context of the area.

Views from roads, river and rail

- 3.3.50 With the exception of the Tilbury Loop railway line, transport infrastructure is largely absent from the Tilbury study area. Fort Road to the west of the site is approximately 1.2km to the northwest of the Proposed Development and provides access to the industrial sites within the area. Views from this road are screened by the intervening maritime transport site and industrial works. Other minor roads in the study area are generally screened by roadside vegetation.
- 3.3.51 Views of the Proposed Development from the Tilbury loop railway line are likely to be localised and perceived as part of, and an extension to, the existing industrial landscape.
- 3.3.52 This section of the River Thames in the vicinity of Tilbury Docks is largely of industrial use rather than as a public transport corridor.

Views from places of work

- 3.3.53 People at their place of work within the study area are primarily located to the west of the Proposed Development. These include the maritime shipping container terminal, Tilbury sewage treatment works, a concrete plant and the existing National Grid operational land. Whilst the nature of the work involves the opportunity to be outdoors, it is primarily of a heavy industrial nature and contributes to

the setting and the local landscape context. The works within this area are likely to provide screening although some localised views might be possible.

- 3.3.54 There are retail and commercial places of work located within the residential area of Tilbury to the northwest of the Proposed Development. These are screened by intervening buildings with the proposed development resulting in no change to visual amenity for these receptors.
- 3.3.55 Areas of agricultural land to the east of the study area would have views of the Proposed Development site but it would be set against the existing industrial landscape and would therefore be barely perceptible.

Views for those engaged in outdoor sport or recreation

- 3.3.56 Whilst there are sport pitches located to the southwest of the study area, these are likely to be screened by intervening residential and commercial buildings resulting in no change to visual amenity for these receptors.
- 3.3.57 It is noted that for most visual receptors, the Proposed Development at the Tilbury site will be perceived as part of, and an extension to, the existing industrial landscape to both sides of the river. Views of the Gravesend site is likely to be barely perceptible and result in no change.

Gravesend

Views from residential settlements

- 3.3.58 Residential settlement within the Gravesend study area is limited to the northern settlement edge of Chalk and Denton. There may be views from some of the townscape areas of Gravesend but these are likely to be limited due to the topography and intervening buildings. Views from higher ground in the vicinity of Windmill Hill to Proposed Development would be perceived as part of, and an extension to, the existing industrial landscape. Any resulting change in views would be barely perceptible.
- 3.3.59 Views of the proposed Gravesend site from the outskirts of Chalk approximately 750m to the north of the proposed Gravesend site are likely to open across the flat marshland. They will however be perceived as part of, and an extension to, the existing industrial landscape adjacent to the west of the site and across the River Thames to the heavy industry at Tilbury.
- 3.3.60 Views of the proposed Gravesend site from the outskirts of Denton approximately 750m to the northeast of the proposed Gravesend site are likely to open across the flat marshland. Views for some of this receptor group are likely to be screened by the intervening industrial sites located along Dalefield and Dering Way. Where views are seen, they will however be perceived as part of, and an extension to, the existing industrial landscape adjacent to the west of the site and across the River Thames to the heavy industry at Tilbury.
- 3.3.61 There are several scattered farmsteads and isolated properties approximately 1.3 km to the southeast. Whilst views across the intervening marshland are flat with sparse vegetation, the proposed development will be perceived as part of, and an extension to, the existing industrial landscape. The isolated properties at Low Street also have the line of existing overhead power lines receding into the distance.

Views from recreational routes and places of interest

- 3.3.62 Recreational routes are shown on Figure 4c in Appendix A – Figures. The English Coast Path promoted recreational route and Saxon Shore Way pass approximately 150m to the north of the site. The PRoW 0328/NG2/2 and part of the NCN Route 1 runs equidistant to the south of the site along the edge of the disused Thames and Medway Canal. Whilst the Proposed Development will be noticeable within both views it will be perceived as part of, and an extension to, the existing industrial landscape. Views to the Proposed Development at Tilbury are likely to be barely perceptible and result in no change.
- 3.3.63 Views for recreational users of the allotment sites at Chalk and Denton are screened by intervening buildings

- 3.3.64 Recreational users of this section of the River Thames are likely to view the site within the wider industrial context of the area.

Views from roads, river and rail

- 3.3.65 The North Kent Railway line passes closest to the Proposed Development at Gravesend approximately 150m to the south of the site. Passing views are likely to be localised and perceived as part of, and an extension to, the existing industrial landscape to the east of Gravesend.
- 3.3.66 The A226 is the main highway within the study area located approximately 1.3km to the south of the site. Views are likely to be screened by intervening residential and commercial buildings at the settlements of Denton and Chalk. Most minor roads within the area are residential with views screened by intervening buildings and vegetation. Other rural roads are generally screened by roadside vegetation.
- 3.3.67 This section of the River Thames is largely of industrial use rather than as a public transport corridor and is dominated by Tilbury Docks.

Views from places of work

- 3.3.68 People at their place of work within the study area are primarily located to the west of the Proposed Development. These include the industrial hinterland townscape area and includes aggregate suppliers, shipping container repairs, Dering way sewage works, and the Metropolitan Police training school. Whilst the nature of some of the work involves the opportunity to be outdoors, it is primarily of a heavy industrial nature and contributes to the setting and the local landscape context. The works within this area are likely to provide screening although some localised views might be possible.
- 3.3.69 There are retail and commercial places of work located within the residential areas of Denton, Chalk and Gravesend to the southwest of the Proposed Development. These are screened by intervening buildings with the Proposed Development resulting in no change to visual amenity for these receptors.
- 3.3.70 Views from places of work at the Apex Business Park approximately 2km to the east of the proposed development are screened by intervening vegetation.
- 3.3.71 Institutional receptors at North Kent College are also likely to be screened by intervening buildings and vegetation from the adjacent residential area.
- 3.3.72 Areas of agricultural land to the south and east of the study area would have views of the Proposed Development but it would be set against the existing industrial landscape and would therefore be barely perceptible.

Views for those engaged in outdoor sport or recreation.

- 3.3.73 Whilst there are sport pitches located to the southwest of the study area, these are likely to be screened by intervening residential and commercial buildings resulting in no change to visual amenity for these receptors.
- 3.3.74 It is noted that for most visual receptors, the Proposed Development at the Gravesend site will be perceived as part of, and an extension to, the existing industrial landscape to both sides of the river. Views of the Tilbury site are like to be barely perceptible and result in no change.

Summary of Potential Effects

- 3.3.75 Permanent above-ground infrastructure including headhouses, cable sealing end compounds and overhead line modifications would be required at both ends of the new tunnel at the Tilbury and Gravesend sites. Site compounds would also have exterior fencing with the potential requirement for protection / screening panels.

Potential Construction Phase Effects

3.3.76 The Proposed Development would introduce a number of new elements into the landscape during the construction phase for a temporary period of time, creating the potential for landscape or visual effects. There would also be the potential for temporary impacts on the landscape and visual amenity of the study area. Potential construction phase effects may arise at either or both sites from the following activities:

- **Site clearance of vegetation:** to include tree and scrub removal, soil stripping and mounding and erection of temporary security fencing;
- **Utility diversions:** to include any temporary or permanent diversion of overhead lines for safe working, or underground services crossing the site;
- **Temporary compounds:** to be used for storage of large plant and equipment, office accommodation and welfare facilities, parking facilities, material storage, spoil handling and spoil storage;
- **Construction activity:** including approximately 200 staff on site during the tunnelling phase. Movement of materials including HGVs accessing the site for spoil removal;
- **Temporary access tracks:** to facilitate safe and efficient construction and reduce the impact of works upon the local area;
- **Temporary diversion of PROWs:** including local and nationally promoted recreational routes;
- **Drive shaft construction site:** to include the working area for the shaft and its required construction plant (including cranes sat adjacent to the shaft, piling equipment), materials storage and spoil handling and processing areas; and
- **Construction of new cable tunnel infrastructure:** to include new headhouses, cable sealing end compounds and overhead line modifications and any additional associated new pylons.

Potential Operational Phase Effects

3.3.77 The proposed development would introduce a number of new elements into the landscape, creating the potential for landscape or visual effects. These may include:

- **New cable tunnel infrastructure:** to include new headhouses, cable sealing end compounds, security fencing and protection / screening panels, exterior compound lighting and overhead line modifications and any additional associated new pylons; and
- **New planting:** this may include planting to mitigate the visual impact of the new headhouses and cable sealing end compounds.

3.3.78 The potential effects on the landscape and visual amenity during decommissioning would be no worse than those assessed during the construction and operational phases of works.

Potential Cumulative Effects

3.3.79 The cumulative developments within the Tilbury study area cover an extensive area including the Proposed Development site. They are generally industrial in nature which reflects the characteristic land use present within the landscape along with the potential addition of the Lower Thames Crossing which would introduce a large linear infrastructure development. The addition of the Proposed Development which in isolation would result in a very low magnitude of effect on the landscape character and visual amenity, would not cumulatively result in a likely significant cumulative effect, due to its limited additional effects on the landscape and in views.

3.3.80 The cumulative developments within the Gravesend study area are more limited but similarly reinforce the existing landscape characteristics and land uses other than the Lower Thames Crossing which will introduce large scale linear infrastructure across the River Thames immediately adjacent to and across the Proposed Development site area. The addition of the Proposed Development to this cumulative scenario would have a limited additional effect due to the localised

geographical influence and limited change to landscape and visual characteristics that would not result in a significant cumulative effect.

- 3.3.81 Consequently, the cumulative effects of the Proposed Development both within the Tilbury and Gravesend study areas, in addition to the cumulative developments, would reinforce the pattern of large scale industrial and commercial activity which is a characteristic element already present in the landscape and in views. As a result, the potential for cumulative significant landscape and visual effects is considered to be unlikely.

Landscape Character

- 3.3.82 Landscape value within each study area is assessed as low. Susceptibility to industrial/construction processes within the site is very low, given that industrial or commercial activity is the key characteristic of the immediate context of the development and across each study area. The landscape receptors forming the study area are therefore assessed as low sensitivity to the Proposed Development.
- 3.3.83 Construction would be short-term, reversible (construction activity and operations including materials storage), and occur in an industrialised context on both sides of the river. The scale/size of change and geographical extent of impacts, within the 1.5km study area, would be localised in construction and operation. No landscape elements of value would be lost as a result of the construction or operation of the new tunnel and associated infrastructure.
- 3.3.84 The temporary, reversible, nature of construction effects would be of neutral magnitude at the scale of NCA 81: Greater Thames Estuary. Consequently, taking the low sensitivity and neutral magnitude into account, effects on the character of the NCA would be neutral.
- 3.3.85 Similarly, although construction would have a localised influence on the smaller scale character areas/types within the study area, any change in character would be small scale/size and with a localised geographical extent of influence. It would involve no loss of landscape elements of value and occur within the context of the existing, long-established land-use which is characteristic of the context, thus reducing the magnitude of change from new infrastructure. Effects on landscape character in construction and operation would therefore be of very low magnitude on LCAs C5 Tilbury Marshes and E5 Tilbury north of the river and the urban townscape types of Gravesend and Eastern Thames Marshes to the south.

Visual Amenity

- 3.3.86 Viewers of the proposed above ground infrastructure will include some of high susceptibility as a result of expectation of enjoyment or appreciation of the view, including both residents in Tilbury and Gravesend and recreational uses of PRoW. Other visual receptor groups such as users of commercial retail sites, highways or workers at industrial or commercial premises or those engaged in active recreation/sports will be of lower susceptibility based on reduced expectation of enjoyment or appreciation of the view. In all cases the value of existing views is likely to be low or heavily influenced by detracting elements.
- 3.3.87 Construction and the operational above ground infrastructure/overhead cables will be a very low magnitude of change in the view for the majority of potential viewers, including the most sensitive groups of residents in Tilbury/Gravesend and recreational receptors including those visiting Tilbury Fort or engaged in recreational activity on the river. Viewers in proximity will be limited in number and experience the additional infrastructure in the context of more prominent industrial elements, limiting the magnitude of change.
- 3.3.88 Effects on landscape character will therefore be neutral at the NCA level and negligible significance on landscape character at the LCA level in construction and operation. Effects on visual amenity will vary by location, and receptor group, but will predominantly be negligible significance in both construction and operation and unlikely to include any significant adverse effects.

Mitigation

- 3.3.89 The primary aims of the landscape design will be to reduce the visual prominence of the Proposed Development and assimilate it into the landscape context, while providing an enhancement to the provision for biodiversity through embedded mitigation measures. The proposed landscape design would consider the existing conditions to apply development specific design principles to address the positioning and alignment, scale, height and massing and materials and finishes of elements, which contribute to visual appearance. The landscape design would also incorporate any pre-application planning comments.
- 3.3.90 Embedded mitigation measures may include:
- Optimising zones within construction compounds to minimise their temporary impact on the landscape and views, including at night;
 - Returning and reinstating land used temporarily to its former condition and profiles, where appropriate;
 - Confining lighting on new and improved sections of the compound / road within the proposed development sites at Tilbury and Gravesend to locations where safety is a priority to minimise the potential for light spill in night-time views;
 - Designing permanent structures, such as the sealing end compound and security fencing, in a way that minimises their visual impact and achieves good visual appearance. This may include selection of a muted colour palette that appears recessive within views;
 - Raising the elevation of any targeted screen planting using earth bunds that are contoured to soften their appearance and achieve good integration with the rural landscape; and
 - Due to the openness of the site and surrounding marshland landscape, careful consideration will be required when looking to propose landscape planting such that these are considered in keeping with the existing character of the open landscape.

Summary

- 3.3.91 The Proposed Development is situated in the immediate context of the existing TKRE 440 kV cable and infrastructure. It is also situated within the industrial landscape of this area of the River Thames and the associated heavy industrial sites at both Tilbury and Gravesend. The Proposed Development sites at Tilbury and Gravesend are adjacent to industrial areas and are therefore likely to be perceived as part of, and an extension to, this existing industrial landscape.
- 3.3.92 Construction would be short-term, reversible and occur in a wholly industrialised context. No landscape elements of value would be lost as a result of the construction, with effects being temporary and of negligible magnitude on the low value landscape.
- 3.3.93 Construction of above ground infrastructure/overhead cables would result in a very low magnitude of change in the view for the majority of potential viewers, including the most sensitive groups of residents in Tilbury/Gravesend, and recreational receptors. Viewers in proximity to the sites at Tilbury and Gravesend would be limited in number and experience the additional infrastructure in the context of more prominent industrial elements, limiting the magnitude of change.
- 3.3.94 Receptor groups using this section of the River Thames are likely to view both sites within the wider industrial context of the area.
- 3.3.95 Similarly, in operation the effects on landscape character would be very low magnitude. Any change in character would be small scale/size and with a localised geographical extent of influence. It would involve no loss of landscape elements of value and occur within the existing context.
- 3.3.96 Once operational the Proposed Development including headhouses and OHL infrastructure would result in a very low magnitude of change in the view for the majority of potential viewers and would be perceived as part of, and an extension to, this existing industrial landscape.
- 3.3.97 In summary, there would be no likely significant landscape or visual effects during either the construction or operational phases of the Proposed Development.

3.4 Historic Environment

Baseline Environment

- 3.4.1 Detailed baseline conditions for the Historic Environment (archaeology, historic buildings and historic landscapes) are provided in the Historic Environment desk-based assessment, which is included in Appendix D – Historic Environment Desk Based Assessment of this report.
- 3.4.2 A 1km study area surrounding the EIA Screening Boundary (Refer to Figure 1 in Appendix A – Figures) was defined for both designated and non-designated heritage assets. This study area is considered appropriate to identify all designated and non-designated assets within the EIA Screening Boundary and study area, their setting and geographical extent. A site walkover survey was also undertaken on 24 March 2023 in order to inform the desk-based assessment (Appendix D – Historic Environment Desk Based Assessment) by assessing the general historic character of the EIA Screening Boundary, the surrounding study area and topographic setting, the condition of known archaeological and historic building assets and their setting, and to identify evidence for previous ground disturbance.
- 3.4.3 This baseline informs the context and potential survival of both known and previously unrecorded archaeological remains within each of the headhouse and SEC sites and their immediate surroundings. This baseline enables an initial assessment of whether heritage assets may be directly or indirectly impacted by the Proposed Development.

Tilbury

- 3.4.4 A single designated heritage asset, the Tilbury Fort scheduled monument (National Heritage List for England (NHLE) 1021092) is located within the study area, located approximately 700m west of the EIA Screening Boundary. The main defensive structure of the star fort itself is located just west of the study area. The associated grade II* listed Officers' Barracks (NHLE 1375568) lies within the fort just beyond the study area.
- 3.4.5 There are no known non-designated heritage assets located within the EIA Screening Boundary, although there are 21 non-designated assets recorded in the surrounding study area. These comprise isolated findspots of Palaeolithic and Neolithic flint artefacts, several findspots of Romano-British pottery along the Thames foreshore, a possible Romano-British settlement site east of the Proposed Development and a possible saltern or 'red hill' to the north. A medieval sea wall (MEX6629) is recorded to the east of the Proposed Development, however the 1772 Andre and Chapman *Map of Essex* suggests that the sea wall may have extended further into the Proposed Development area, although no evidence for such a feature was recorded during the site walkover. More recent remains include Second World War defensive structures including a pillbox on the Thames foreshore to the south of the Site, anti-glider ditches and former anti-tank defences. The now-demolished Tilbury A and Tilbury B power stations were located immediately west of the Proposed Development.
- 3.4.6 Historic mapping and 1940s aerial photographs demonstrate that the EIA Screening Boundary lay within undeveloped farmland reclaimed from the Tilbury Marshes until the construction of the Tilbury power stations from 1958 onwards. Today the EIA Screening Boundary comprises an area of disused hard standing associated with the former power station, an export car storage area on the site of the former power station coal tip and the access track and parking area for the existing headhouse and sealing end compound.
- 3.4.7 The British Geological Survey records a sequence of superficial deposits within the EIA Screening Boundary comprising extensive alluvial clays and silts, peat deposits and sands and gravel laid down within the Thames floodplain and former Tilbury Marshes. Several ground investigations and geoarchaeological investigations within the study area have confirmed the presence of deep alluvial deposits including horizons of peat overlying river gravels. This sequence of deposits may have potential to contain previously unrecorded archaeological and palaeoenvironmental remains.

Gravesend

- 3.4.8 There are no designated assets located within the EIA Screening Boundary, although there are four grade II listed buildings located within the 1km study area to the southwest of the Proposed Development. These comprise The Readers, a timber-framed house (NHLE 1089019), cottages at 54-58 Vicarage Lane (NHLE 1089005), a farmhouse at 44 Chalk Road (NHLE 1341493) and a cottage at 1 Chalk Road (NHLE 1089043), the latter two associated with Charles Dickens.
- 3.4.9 Forty-eight non-designated heritage assets are recorded within the 1km study area. Of these a single asset, the Milton Rifle Range (TQ 67 SE 1185), is recorded extending into the EIA Screening Boundary, with fragmentary remains of the earthen firing positions surviving.
- 3.4.10 Within the wider study area non-designated heritage assets include prehistoric flint artefacts and Neolithic/Bronze Age pottery recovered during archaeological investigations to the west of the EIA Screening Boundary, cropmarks and excavated pits and ditches recorded 800m west and southwest of the Site. Evidence for Romano-British settlement has been recorded comprising findspots of Roman pottery, the Chalk Roman villa and various ditches and artefacts recorded during archaeological investigations approximately 800m to the southeast of the EIA Screening Boundary. Medieval settlement remains are limited to evidence for ridge and furrow cultivation and a manor house to the west and southwest respectively.
- 3.4.11 During the 18th century, the Thames and Medway Canal (TQ 67 SE 20) and associated bridges was constructed immediately south of the EIA Screening Boundary to allow military craft to move between Deptford and Woolwich Dockyards to Chatham Dockyard. Other non-designated heritage assets of post-medieval and modern date reflect the Thames-side location and include causeways, jetties, a hard and ship breakers. The agricultural landscape south of the Site is evidenced by the recorded locations of several farms and farmsteads. The modern military landscape of the Second World War is represented by former searchlight batteries, an air raid warden post, the Denton Heavy Anti-aircraft Battery and Denton Sewage Works Battle Headquarters.
- 3.4.12 Historic mapping indicates that the EIA Screening Boundary remained undeveloped agricultural fields created by draining parts of Eastcourt Marsh alongside the River Thames, until 1862 when the War Department, established the Milton Firing Range. The western area of the firing range would have originally lain within the EIA Screening Boundary; however, the original extent of the range is no longer survives.
- 3.4.13 As with the Tilbury Site, the British Geological Survey records a sequence of superficial deposits within the Site comprising extensive alluvial clays and silts, peat deposits and sands and gravel laid down within the Thames floodplain. This sequence of deposits may have potential to contain previously unrecorded archaeological and palaeoenvironmental remains.

Key Receptors

Tilbury

- 3.4.14 Key heritage assets identified within the study area surrounding the proposed northern tunnel shaft and SEC at Tilbury include a single designated heritage asset, the Tilbury Fort Scheduled Monument (NHLE 1021092) which as the best-preserved example of a 17th century coastal fort in England, with rare defensive design features, has considerable archaeological, historic, and architectural interest making it of high heritage significance. Key non-designated heritage assets that require consideration in relation to the Proposed Development comprise the medieval sea wall (MEX6629), which although recorded east of the EIA Screening Boundary, is shown on early post-medieval cartographic sources as extending east-west through the Proposed Development. There is potential for buried remains associated with this asset to still survive within the EIA Screening Boundary.
- 3.4.15 The desk-based assessment has also assessed the potential for previously unknown archaeological remains within the Tilbury site as being moderate for Iron Age and Romano-British remains associated with settlement remains recorded east of the site, moderate to high for the survival of peat and organic deposits with the potential to contain archaeological and palaeoenvironmental remains within the alluvial sequence moderate for medieval remains associated with the former sea wall and low for all other periods. Any previously unknown archaeological remains surviving within

the Site are likely to be of low-medium heritage significance contributing to the understanding of local and regional research objectives.

Gravesend

- 3.4.16 Four designated heritage assets all grade II listed buildings; The Readers (NHLE 1089019), 54-58 Vicarage Lane (NHLE 1089005), 44 Chalk Road (NHLE 1341493) and 1 Chalk Road (NHLE 1089043), are located within the 1km study area. These grade II listed buildings all exhibit architectural and historic interest derived from their local vernacular style and historic associations and as such are of medium heritage significance.
- 3.4.17 A single non-designated heritage asset the post-medieval and modern Milton Rifle Range (TQ 67 SE 1185) is recorded within the EIA Screening Boundary, the earthwork and buried remains of which are of low (local) heritage significance. In addition, the Thames and Medway Canal (TQ 67 SE 20) and associated swing bridge (TQ 67 SE 49) are located immediately south of the EIA Screening Boundary, both assets are of low (local) heritage significance.
- 3.4.18 The desk-based assessment (Appendix D – Historic Environment Desk Based Assessment) assessed the potential for previously unknown archaeological remains within the Gravesend site as being moderate for post-medieval and modern remains associated with the Milton Rifle Range that once extended into the EIA Screening Boundary and low for all other periods. The potential for previously unknown archaeological remains is assessed as being moderate to high for the survival of peat and organic deposits with the potential to contain archaeological and palaeoenvironmental remains within the alluvial sequence of the former marsh. Any surviving remains would be of low-medium heritage significance contributing to the understanding of local and regional research objectives.

Summary of Potential Effects

Potential Construction Phase

- 3.4.19 Potential effects arising from construction of the Proposed Development could comprise physical impacts to buried archaeological remains and changes to the setting of heritage assets.
- 3.4.20 The principal impacts will include excavation of the launch shaft at Tilbury and receptor shaft at Gravesend, groundworks and foundations for the new headhouses and SEC, any ground reduction required to create soil storage areas or construction compound at the Gravesend Site and the introduction of new pylons and gantries. The excavation of the proposed replacement tunnel will not result in any impact as the chalk is 65 million years old and archaeologically sterile.

Tilbury

- 3.4.21 At the Tilbury Site the use of cranes during construction of the tunnel launch shaft and the dismantling and construction of new pylons and gantries may introduce temporary visual, aural and lighting intrusion to the setting of the Tilbury Fort Scheduled Monument. The magnitude of change against the existing backdrop of industrial and port activity surrounding the fort would be minimal and these temporary changes to setting would not affect the significance of the asset, or the ability to appreciate and understand the Scheduled Monument.
- 3.4.22 Excavation of the tunnel launch shaft has the potential to remove any surviving previously unknown archaeological or palaeoenvironmental remains within its footprint. Any surviving remains are likely to be associated with buried peat horizons within the alluvial sequence, as recorded at a number of other locations within the study area. Further investigation is required to confirm the presence/absence, state of preservation and significance of any surviving deposits, but it is anticipated that following an appropriate programme of archaeological mitigation any adverse effects arising from the partial loss of any surviving peat and alluvial deposits would be minor, permanent, irreversible and restricted to the footprint of the Proposed Development components.
- 3.4.23 Groundworks including new foundations for the proposed head house and SEC compound may also affect previously unknown archaeological or palaeoenvironmental remains. As with the excavation of the tunnel launch shaft further investigation is required to confirm the presence/absence, state of

preservation and significance of any surviving deposits. It is anticipated that following an appropriate programme of archaeological mitigation any adverse effects would, in the case of the loss/disturbance of an asset of low significance, be minor, or, in the case of the loss/disturbance of an asset of medium significance moderate. In either event the effects would be permanent, irreversible and restricted to the footprint of the Proposed Development components.

- 3.4.24 Use of existing hardstandings and access trackways for the construction compound, laydown and soil storage areas will not result in any effect on known heritage assets or previously unknown archaeological remains.

Gravesend

- 3.4.25 The use of cranes during construction of the tunnel receptor shaft and the dismantling and construction of new pylons and gantries at the Gravesend Site will not result in changes to the setting or significance of the four grade II listed buildings, The Readers (NHLE 1089019), 54-58 Vicarage Lane (NHLE 1089005), 44 Chalk Road (NHLE 1341493) and 1 Chalk Road (NHLE 1089043) identified within the 1km study area. All of the assets are located at some distance from the EIA Screening Boundary, within a suburban setting defined by the mix of 19th and 20th century housing surrounding each asset. The EIA Screening Boundary does not form part of the setting of these listed buildings and none of these assets will be affected by construction noise or lighting. Construction of the Proposed Development will not introduce temporary changes to the setting of these listed buildings and as such there will be no effect on their heritage significance.
- 3.4.26 The Thames and Medway Canal (TQ 67 SE 20) and associated swing bridge (TQ 67 SE 49) located immediately south of the EIA Screening Boundary will experience temporary change arising from construction of the Proposed Development. However, the setting of these two non-designated assets is derived from their interrelationship, the linear form of the canal and the spatial relationship with the River Thames and the former naval dockyards at Deptford and Woolwich Dockyards to Chatham Dockyard. The Gravesend site does not form part of the setting of these assets and the localised changes to this much larger asset will not affect the setting or significance of the canal or swing bridge and the ability to appreciate these assets will be unaffected by construction of the proposed development.
- 3.4.27 Excavation of the tunnel receptor shaft has the potential to remove any surviving earthwork or buried remains associated with former western end of the Milton Rifle Range (TQ 67 SE 1185). The loss or disturbance of any surviving elements of the Rifle Range within the EIA Screening Boundary would represent a minor adverse effect on this larger, well surviving and well understood non-designated heritage asset.
- 3.4.28 Excavation of the tunnel receptor shaft also has the potential to remove previously unknown archaeological or palaeoenvironmental remains within its footprint. Any surviving remains are likely to be associated with buried peat horizons within the alluvial sequence, as recorded at a number of other locations within the study area. Further investigation is required to confirm the presence/absence, state of preservation and significance of any surviving deposits, but it is anticipated that following an appropriate programme of archaeological mitigation any adverse effects would be minor or moderate, permanent, irreversible and restricted to the footprint of the tunnel receptor shaft.
- 3.4.29 Groundworks including new foundations for the proposed head house and SEC compound may also affect previously unknown archaeological or palaeoenvironmental remains. As with the excavation of the tunnel launch shaft further investigation is required to confirm the presence/absence, state of preservation and significance of any surviving deposits and it is anticipated that following an appropriate programme of archaeological mitigation any adverse effects would be minor or moderate, permanent, irreversible and restricted to the footprint of the proposed head house and SEC.

Potential Operational Phase

- 3.4.30 Operation of the Proposed Development will not affect the setting of the Tilbury Fort Scheduled Monument, where the existing electricity pylons already form part of the monument's setting, the

removal of an existing pylon and/or its replacement by a new proposed pylon will not result in any permanent change to the setting of the monument.

3.4.31 Similarly, operation of the Proposed Development will not affect the setting of the four grade II listed buildings identified within the 1km study area surrounding the Gravesend Site.

3.4.32 Operation of the Proposed Development will not affect any buried archaeological remains.

Potential Cumulative Effects

3.4.33 A number of other developments, both consented and potential, have been identified in the vicinity of the both the Tilbury and Gravesend elements of the Proposed Development.

3.4.34 Two Nationally Significant Infrastructure Projects (NSIPs) overlap with the Proposed Development: Lower Thames Crossing (TR010032) and Thurrock Flexible Generation Plant (EN010092). Temporary construction activities associated with these two developments may affect the setting of the Tilbury Fort Scheduled Monument, although this would not result in a cumulative effect with the Proposed Development.

3.4.35 The Lower Thames Crossing will pass through a tunnel beneath the Milton Rifle Range (TQ 67 SE 1185) Thames and Medway Canal (TQ 67 SE 20), resulting no adverse cumulative effects to these assets to their settings.

3.4.36 The remaining developments identified are unlikely to result in cumulative effects on the heritage assets detailed above either during construction or operation.

Mitigation

3.4.37 Construction of the Proposed Development has the potential to remove or disturb archaeological remains associated with the medieval sea wall (MEX6629) and Milton Rifle Range (TQ 67 SE 1185) within the Gravesend Site and previously unknown buried archaeological and palaeoenvironment remains associated with buried peat and alluvial deposits within each of the tunnel shaft locations.

3.4.38 The presence or absence of any surviving peat horizons or organic remains within the alluvial sequence at each site could be confirmed by reviewing any available ground investigation results e.g. borehole logs undertaken to inform the shaft design. The archaeological and palaeoenvironmental potential of any such deposits could be assessed as part of an appropriate programme of archaeological/ geoarchaeological investigation e.g. borehole survey.

3.4.39 The scope and specification of the geoarchaeological investigation would be agreed in consultation with the Historic Environment Officers at Essex and Kent County Council as advisers to Thurrock Council and Gravesham Borough Councils. The results of the archaeological/geoarchaeological investigation could then inform the requirement for and design of an appropriate programme of archaeological and palaeoenvironment investigation, sampling and recording to mitigate any adverse effects of construction.

Summary

3.4.40 The historic environment desk-based assessment prepared to inform this report has identified five designated heritage assets and four non-designated heritage assets within the combined study area of the Proposed Development. The desk-based assessment also identified potential for the survival of previously unknown archaeological and palaeoenvironmental remains within the alluvial deposits at the two tunnel shaft sites.

3.4.41 Construction and operation of the Proposed Development will not affect the setting of the Tilbury Fort Scheduled Monument (NHLE 1021092), the four grade II listed buildings, The Readers (NHLE 1089019), 54-58 Vicarage Lane (NHLE 1089005), 44 Chalk Road (NHLE 1341493) and 1 Chalk Road (NHLE 1089043) or the non-designated Thames and Medway Canal (TQ 67 SE 20) and associated swing bridge (TQ 67 SE 49).

3.4.42 There is potential for adverse effects on any surviving non-designated archaeological remains associated with the medieval sea wall (MEX6629) at Tilbury and the Milton Rifle Range (TQ 67 SE 1185) at Gravesend, in addition to previously unknown buried archaeological and

palaeoenvironmental remains within the buried alluvial deposits at each tunnel shaft site. It is concluded that the potential adverse effects arising from the loss or disturbance of these remains arising from construction of the Proposed Development could be mitigated by an appropriate programme of archaeological investigation, sampling and recording developed in consultation with the Historic Environment Officers at Essex and Kent County Councils.

- 3.4.43 It is therefore not anticipated that the Proposed Development would give rise to any residual significant effects on the historic environment.

3.5 Traffic and Transport

Tilbury

Baseline Environment

- 3.5.1 Baseline traffic flows have been obtained from Department for Transport (DfT) static traffic counters and the National Highways (NH) WebTRIS database for the SRN. Based on these sources for the study area, there is currently insufficient baseline traffic data available for the period after the COVID-19 Pandemic (i.e. 2022 or 2023 onwards) and therefore traffic count data has been obtained from 2019, representing the most recent period available prior to the period of the COVID-19 Pandemic. The data has been used to derive average weekday/ daily vehicle flows and HGV flows during a neutral month. The WebTRIS data has been obtained for the A1089 approximately 3.5km to the south of the A13. The DfT data has been obtained for two sections of the A13 to the east and west of the A1089 junction, in the absence of suitable WebTRIS data for the A13 in the vicinity of the site. The survey sites are marked on Plate 3-1 below and the average weekday two-way flows are shown in Table 3-2.

Plate 3-1: Location of the traffic survey sites at Tilbury



Table 3-2: Traffic count data (2019) on the surrounding highway network (Tilbury)

Location (Plate 3-1)	Count Ref.	Road	HGV Movements (Two-Way)		Total Vehicles (Two-Way)	
			Weekday 12 hours (07:00-19:00)	Daily 24 hours	Weekday 12 hours (07:00-19:00)	Daily 24 hours
1	563885 (6064/1) (WebTRIS)	A1089 (One-Way, Southbound)	3,392*	3,449*	11,949	13,946
	563181 (6063/1) (WebTRIS)	A1089 (One-Way, Northbound)	2,834*	3,140*	11,871	13,983
2	56327 (DfT)	A13 East (Two-Way)	6,972	7,261	60,881	73,543
3	27931 (DfT)	A13 West (Two-Way)	9,702	10,204	66,169	80,978

*WebTRIS data also includes LGVs (represents vehicles >6.6m in length)

- 3.5.2 Further to the above, forecast traffic flows for the Tilbury 2 Port Terminal Road (hereby referred to as the 'Tilbury 2 Road') between the A1089 and Fort Road have been obtained from the Transport Assessment (TA) which supported the DCO submission for Thurrock Flexible Generation Plant (EN010092) submitted in February 2020. Within Table 5.5 of the TA which sets out 24-hour daily flows during the 2022 baseline scenario, the Tilbury 2 Road is shown to accommodate a total of 4,460 vehicles including 2,673 HGVs. These traffic flows have been converted to 12-hour weekday flows by applying factors derived from the A1089 traffic data (two-way) based on the data presented in Table 3-2 above. The A1089 forms a junction with the Tilbury 2 Road and the daily profile of vehicle movements is expected to be comparable. This results in 12-hour weekday flows of 3,957 vehicles (85% of 24-hour daily flow) including 2,526 HGVs (94% of 24-hour daily flow) for the Tilbury 2 Road.
- 3.5.3 The sensitivity of the above roads has been established by taking into consideration the existing level of provision for road users, vehicle composition and presence of sensitive receptors (e.g. schools, hospitals or high-streets) based on the IEMA guidance. The A13 and A1089 are both part of the SRN managed by National Highways (NH). The A13 is a dual carriageway road which runs in an east-west direction between East London and Shoeburyness and is a major road subject to a derestricted speed limit (70mph). It is National Highways trunk road between London and the Tilbury junction, a primary route between Tilbury and the Sadlers Farm roundabout, and a non-primary route between Sadlers Farm roundabout and Shoeburyness. The A1089 is a dual carriageway road subject to a derestricted speed limit (70mph) which runs in a north-south direction between the A13 and Tilbury Fort. Due to the nature of these roads, all have been categorised as non-sensitive (due to them being away from sensitive areas and carrying existing high traffic flows with a high proportion of HGVs (typically at least 10% HGVs, as shown in Table 3-2).
- 3.5.4 The Tilbury 2 Road is a single carriageway road which runs in an east-west direction between the A1089 and Fort Road, providing access to the Tilbury 2 Port Terminal and other local employment sites in this area. The Tilbury 2 Road is designed to accommodate HGVs (given the nature of the land uses which it serves) and does not contain any sensitive receptors as defined by the IEMA guidance. Therefore, the Tilbury 2 Road has also been categorised as non-sensitive.
- 3.5.5 Based on the IEMA guidance, an increase in baseline traffic flows of 30% on non-sensitive roads and an increase of 10% on sensitive roads due to the presence of construction vehicles, would trigger the need for assessment. Therefore, only an increase of over 30% in HGVs or total traffic

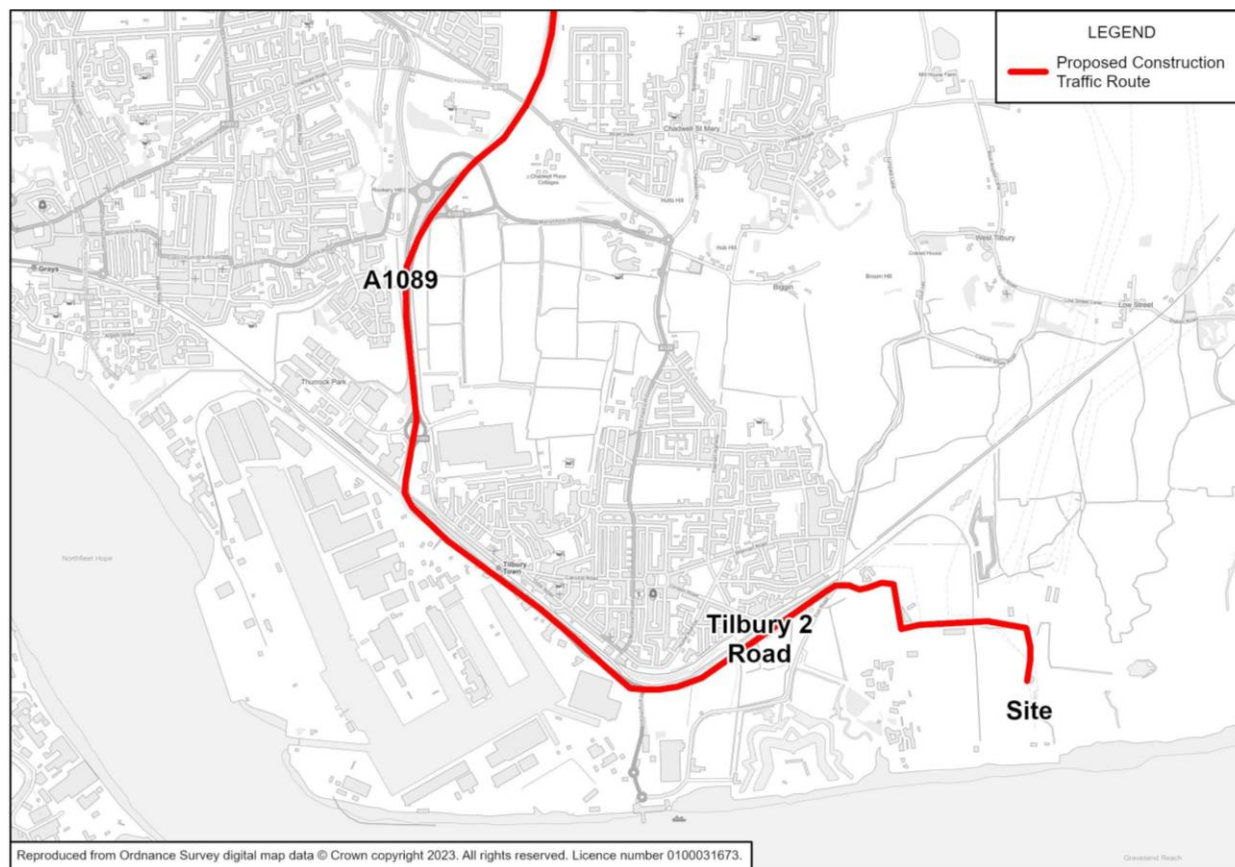
flows on the A13, A1089 or Tilbury 2 Road would trigger the need for further environmental assessment. Changes in traffic flows of below 30% are assumed to result in no discernible environmental impact.

- 3.5.6 Public transport in the vicinity of the site includes Tilbury Town and Grays railway stations approximately 2.5km and 5km to the northwest of the site respectively, as well as East Tilbury station approximately 3.7km to the northeast of the site. Tilbury Town railway station can be accessed via bus route 99 (further details provided below). Tilbury Town Railway station is served by c2c, which operates services between London Fenchurch Street and Shoeburyness via Southend Central. There are four trains in each direction during the AM and PM peak hours.
- 3.5.7 The nearest bus stop to the site is located on Fort Road (Fortress Distribution Park) approximately 1.3km to the northwest. This bus stop is served by bus route 99 which is a circular route operated by Ensign Bus which provides access to Tilbury (including Tilbury Town Station) as well as the Tilbury Ferry Terminal, operating two services per hour (i.e. once every 30 minutes) throughout the day. Additional bus services can be accessed from within Tilbury.

Potential Construction Effects

- 3.5.8 There are expected to be up to 57 HGVs per day (114 two-way movements) during the peak construction phase of the Proposed Development. On average, there will be 44 HGVs per day (88 two-way movements) during this phase of construction. This type of traffic would mainly be associated with the delivery of materials and equipment as follows:
- Shaft construction;
 - Shaft lining segments delivery;
 - AILs for the TBM;
 - Shaft fit out and head house construction;
 - Sealing end compound construction; and
 - 400kv overhead line diversions.
- 3.5.9 It is anticipated that all HGV traffic would access the site from the Tilbury 2 Port Terminal Road as this proposed construction route is the shortest available between the site and the SRN:
- Arrivals: A13 – A1089 – Tilbury 2 Road; and
 - Departures: Tilbury 2 Road – A1089 – A13.
- 3.5.10 The proposed local construction route to/ from the site is shown on Plate 3-2 below, with all trips ultimately travelling to/ from the A13 to the north.

Plate 3-2: Proposed local construction traffic route for the Proposed Development in Tilbury



- 3.5.11 It is National Grid's strong preference that tunnel spoil be removed by barge on the River Thames to reduce the number of HGVs on the wider highway network. This will be reviewed further as part of the Environmental Appraisal Report. For the purposes of this report, it has been assumed that all HGVs (including those transporting spoil) would travel via the routing shown and described above, rather than to/ from a local jetty, to provide a worst-case assessment of potential highway impacts at this stage.
- 3.5.12 A limited number of light vehicle movements are envisaged during the construction phase as a result of construction staff. These are not considered to be significant and would be controlled through the Construction Logistics Plan (CLP). Therefore, construction worker movements have not been considered further for the purposes of this report, although these will be reviewed further as part of the Environmental Appraisal Report if necessary.
- 3.5.13 An initial assessment has been undertaken to identify the likely percentage increase in HGVs and total traffic on the SRN and on the Tilbury 2 Road based on the information presented above for the peak phase of construction. To provide a worst-case assessment of the SRN, 100% of the HGVs have been assigned to the A13 both to the east and west of the junction with the A1089. In addition, the assessment has been based on 12-hour weekday baseline flows rather than 24-hour daily baseline flows which generates higher (more robust) proportional increases in traffic flows on the surrounding highway network as a result of the Proposed Development.
- 3.5.14 The forecast increases in 12-hour (07:00-19:00) weekday traffic flows on the SRN and Tilbury 2 Road as a result of construction traffic during the peak construction phase are shown in Table 3-3.

Table 3-3: Forecast increases in traffic flows due to the Proposed Development in Tilbury (Peak HGVs during the construction phase)

Road (Two-Way)	Baseline Weekday 12 hours (07:00-19:00)		Forecast Daily HGV Movements (Two-Way)	% Increase	
	HGVs	Total Vehicles		HGVs	Total Vehicles
A1089	6,226*	23,802	114	1.8%	0.5%
A13 East	6,972	60,881	114	1.6%	0.2%
A13 West	9,702	66,169	114	1.2%	0.2%
Tilbury2 Road	2,526	3,957	114	4.5%	2.9%

*baseline data also includes LGVs (represents vehicles >6.6m in length)

- 3.5.15 As can be seen from Table 3-3, the predicted increase in two-way construction HGV traffic against the baseline HGV and total traffic flows would be less than 2% along the roads forming the SRN and less than 5% on the Tilbury 2 Road. Therefore, it is expected that there would be a negligible impact with no environmental effects on the surrounding highway network as a result of construction-related HGVs.
- 3.5.16 As above, the initial assessment presented in Table 3-3 offers a worst-case assessment in terms of construction HGVs, as this is based on the peak construction phase and 12-hour weekday baseline flows when proportional increases, as a result of the Proposed Development, would be higher than compared to 24-hour daily baseline flows. Furthermore, the HGV numbers are based on tunnel spoil being transported by road rather than by barge on the River Thames (National Grid's preference).

Construction Phase Mitigation

- 3.5.17 A CLP would be prepared to ensure that all traffic associated with the construction works always operates in a safe and compliant manner. The specific mitigation measures in the CLP would be agreed with Thurrock Council (through regular liaison) and adhered to by the appointed Contractor. The CLP is expected to include the following (note, this is not an exhaustive list):
- Pursuing National Grids' desire to remove tunnel spoil by barge to reduce the number of HGVs on the wider highway network;
 - Measures designed to manage construction traffic (e.g. HGVs and construction staff at the start and end of the working day) in order to minimise the impact on local residents, businesses, road users and other potentially sensitive land uses and ensure all third-party traffic interfacing with the Proposed Development is kept safe from the on-going work;
 - A traffic routing strategy to ensure vehicles accessing the site do so via the most appropriate route(s) and to avoid (or minimise) conflict with sensitive areas such as residential areas;
 - Access security personnel and traffic marshals to ensure the access point is managed safely and securely. Swept path analysis will be undertaken to ensure vehicles can safely enter and exit the Proposed Development from/ to the local highway network without impacting road users;
 - Temporary traffic management/construction signage at the site access point and on the approach to the site access (as required) to ensure safe movements of all road users;
 - A parking review to ensure a clear route is available to construction vehicles travelling to/from the Proposed Development, particularly on local/ access roads;
 - A requirement for vehicles to be correctly maintained and operated in accordance with the manufacturer's recommendations and in a responsible manner;
 - A Driver Information Pack covering a variety of topics and providing information on the requirements of working on the Proposed Development;

- A specialised haulage service to allow AILs to be transported, with the necessary escort, permits and traffic management in place; and
- An access route inspection and swept path analysis for the largest equipment/ construction material delivery vehicles and transporters (including AILs) would also be undertaken to determine the need for any additional control measures.

Potential Cumulative Effects during Construction

3.5.18 There are a number of other current and potential development activities in the vicinity of the Proposed Development which are listed in Appendix B – Cumulative Developments of this report and have the potential to result in cumulative effects during the construction phase. These include:

- Lower Thames Crossing (Planning Inspectorate Reference: TR010032), which is a NSIP. This scheme has not yet been consented and any potential cumulative effects would therefore be subject to the approval of the application and the timescales for construction. Nonetheless, an initial high-level appraisal has been carried out below to inform this report based on the information supplied in support of the DCO submission (October 2022);
- Thurrock Flexible Generation Plant (Planning Inspectorate Reference: EN010092) which is also a NSIP. The supporting TA for this development has been reviewed and the scheme proposes to utilise a similar road network to the Proposed Development during the construction phase. Therefore, an initial high-level appraisal has been carried out below to inform this report; based on the information supplied in support of the DCO submission (February 2020);
- Replacement surface water outfall at Tilbury Power Station (REF: 21/00947/FUL). This is considered to be a minor scheme which is unlikely to give rise to any significant cumulative effects as no TA or Transport Statement was prepared in support of the planning application. It is therefore proposed to scope this scheme out from the assessment of cumulative effects within the Environmental Appraisal Report;
- New Combined Cycle Gas Power Station with a generating capacity up to 2,500 megawatts (MW), Open Cycle Gas Turbines with a generating capacity up to 300MW and an energy storage facility, all on the Tilbury Power Station site (REF: 18/00549/SCO). This scheme will be reviewed as part of the Environmental Appraisal Report, subject to an application/EIA being submitted.
- Use of the land at the former Tilbury B Power Station for a temporary period of no more than 5 years for the external storage of HGVs, new motor vehicles and miscellaneous port-related product with associated minor works (REF: 21/01927/FUL). This is a minor (temporary) scheme which is unlikely to give rise to any significant cumulative effects as no Transport Assessment or Transport Statement was prepared in support of the planning application. The scheme has been consented and the land is in use. It will be captured by the baseline scenario and it is therefore proposed to scope this scheme out from the assessment of cumulative effects within the Environmental Appraisal Report;
- Environmental Impact Assessment Screening Opinion for the variation of conditions relating to the continued use of land for inert waste and soils recycling, primary aggregates extraction, processing, and sale together with ancillary facilities and access (REF: 21/01108/SCO). This is an existing site which will be captured by the baseline scenario, and it is therefore proposed to scope this scheme out from the assessment of cumulative effects within the Environmental Appraisal Report.

3.5.19 There are a number of other potential developments/applications that have been submitted to Thurrock Council which are currently awaiting decision. Therefore, whilst these are acknowledged, a review of these will be carried out as part of the Environmental Appraisal Report if necessary, should these receive planning approval.

3.5.20 As identified above, there is the potential for some overlap between the construction phase of the Proposed Development and the construction of cumulative developments in the vicinity of the Proposed Development including those which intend to share similar construction routes. As detailed previously a high-level appraisal has been carried out to review the potential for any cumulative

effects as a result of the Proposed Development and the two NSIPs identified above; Lower Thames Crossing (LTC) and Thurrock Flexible Generation Plant.

- 3.5.21 The forecast construction traffic flows for the LTC are presented in the Transport Assessment (TR010032/APP/7.9). This identifies that, based on Tables 8.23-8.33, Phase 6 (scheduled to take place in 2027) is expected to be the peak construction phase in terms of construction traffic demand. The forecast changes in traffic flows to the north of the River Thames during Phase 6 are presented in plates 8.57 to 8.59.
- 3.5.22 These identify that there is expected to be additional traffic on the A13 and the A1089 during the peak construction phase of the LTC. No additional movements are expected to use the Tilbury2 Road, as vehicles would instead use Fort Road. The following assumptions have been adopted to estimate peak daily construction vehicle movements on these parts of the network:
- Plates 8.57 (AM peak), 8.58 (Interpeak) and 8.59 (PM peak) present changes in Passenger Car Unit (PCU) flows, in each direction, based on various thresholds. The average value of each threshold (by direction) has therefore been adopted to estimate the change e.g. where a threshold is between +51 and +100 PCUs, a value of +75 PCUs has been adopted. The identified value for each direction has then been combined to identify an overall two-way change in PCU flows;
 - The AM peak is 07:00-08:00, the PM peak is 17:00-18:00 and Interpeak is an average hour within the period 09:00-15:00. For the purposes of this high-level appraisal, daily flows have been estimated by multiplying the Interpeak traffic flows by nine and then combining this with the AM and PM peaks, to represent an overall eleven-hour period of 07:00-18:00; and
 - Table 8.28 (construction traffic demand in Phase 6) has been used to convert PCUs to total vehicles by adopting LTC's PCU conversion values of 1 for staff (to represent cars/ vans) and 2.5 for earthworks and supplies (to represent HGVs). This identifies that a 77% conversion factor should be applied to PCUs to identify total vehicles, and that 19% of total vehicles are expected to be HGVs. For example, 100 PCUs would equate to 77 vehicles including 15 HGVs.
- 3.5.23 The forecast construction traffic flows for the Thurrock Flexible Generation Plant are presented in Table 4.2 of Chapter 10: Traffic and Transport of the Environmental Statement (EN010092 ES Volume 2). This identifies that construction vehicles would utilise the A13, A1089 and the Tilbury2 Road. The peak construction traffic flows have therefore been adopted for these parts of the highway network, to inform the high-level appraisal of potential cumulative effects carried out below.
- 3.5.24 The forecast cumulative increases in construction traffic flows as a result of the Proposed Development, the LTC and Thurrock Flexible Generation Plant are presented in Table 3-4 below, based on peak construction traffic flows and on the worst-case assumption that the peak construction phases would all overlap and that these vehicles could all travel to/from the A13 (via Tilbury2 Road and the A1089) to the east or west.

Table 3-4: Forecast increases in cumulative daily construction traffic flows in Tilbury (Peak construction phases)

Road (Two-Way)	Proposed Development		Lower Thames Crossing		Thurrock Flexible Generation Plant		Total (Cumulative)	
	HGVs	Total Vehicles*	HGVs	Total Vehicles	HGVs	Total Vehicles	HGVs	Total Vehicles
A1089	114	114	415	2,128	164	286	693	2,528
A13 East	114	114	565	2,902	164	286	843	3,302
A13 West	114	114	565	2,902	164	286	843	3,302
Tilbury 2 Road	114	114	0	0	164	286	278	400

*excludes construction workers/ light vehicles, as these are not expected to be significant at this stage

- 3.5.25 The above shows that the Proposed Development is expected to result in significantly fewer construction vehicle trips on the surrounding highway network when compared to both other schemes.
- 3.5.26 The forecast cumulative increases in 12-hour (07:00-19:00) weekday traffic flows on the SRN and Tilbury2 Road as a result of peak construction traffic flows are shown in Table 3-5 below.

Table 3-5: Forecast cumulative increases in daily traffic flows in Tilbury (Peak construction phases)

Road (Two-Way)	Baseline Weekday 12 hours (07:00-19:00)		Forecast Additional Cumulative Daily Movements (Two-way)		% Cumulative Increase	
	HGVs	Total Vehicles	HGVs	Total Vehicles	HGVs	Total Vehicles
A1089	6,226*	23,802	693	2,528	11.1%	10.6%
A13 East	6,972	60,881	843	3,302	12.1%	5.4%
A13 West	9,702	66,169	843	3,302	8.7%	5.0%
Tilbury 2 Road	2,526	3,957	278	400	11.0%	10.1%

*baseline data also includes LGVs (represents vehicles >6.6m in length)

- 3.5.27 As can be seen from Table 3-5, the predicted cumulative increases in two-way construction traffic against the baseline HGV and total traffic flows are expected to remain below the 30% threshold for non-sensitive roads as identified by the IEMA guidance. Therefore, the cumulative increases identified above are considered to result in no discernible environmental impact.
- 3.5.28 As above, the initial cumulative appraisal presented in Table 3-5 offers a worst-case assessment as this assumes that the peak construction phases for the Proposed Development, LTC and the Thurrock Flexible Generation Plant (in terms of additional cumulative construction vehicle movements within Tilbury) would all overlap. In reality, the peak construction phases of these three projects are unlikely to fully overlap and the construction phase of the Thurrock Flexible Generation Plant may have been completed prior to the peak construction phase of the Proposed Development.
- 3.5.29 The potential for any cumulative effects will be assessed further as part of the Environmental Appraisal Report and mitigated through the control measures to be included in the CLP.

Potential Operational Effects

- 3.5.30 During normal operation of the Proposed Development, the only traffic generated would be associated with infrequent repair and routine maintenance works. Therefore, additional traffic movements during the operational phase are not anticipated to have a significant effect on the transport network or receptors.

Summary

- 3.5.31 It is considered that each of the potential impacts and environmental risks relating to Traffic and Transport associated with the works can be managed through the application of accepted good practice and compliance with the measures outlined above. As a result, the Proposed Development itself, both alone and in combination with other schemes, is not expected to result in any significant environmental effects in terms of Traffic and Transport.

Gravesend

Baseline Environment

- 3.5.32 Baseline traffic flows have been obtained from DfT static traffic counters and the NH WebTRIS database for the SRN and the local road network. Based on these sources for the study area, there is currently insufficient baseline traffic data available for the period after the COVID-19 Pandemic

(i.e. 2022 onwards) and therefore traffic count data has been obtained from 2019, representing the most recent period available prior to the COVID-19 Pandemic. The data has been used to derive average daily vehicle flows and HGV flows during a neutral month. WebTRIS data has been obtained for the M2 approximately 5.4km to the southeast of the Proposed Development, and the DfT data has been obtained for the A289 approximately 5.3km to the southeast of the Proposed Development as well as for the A226 at two separate locations (approximately 3km southeast and 1.5km southwest of the Proposed Development respectively). The survey sites are marked on Plate 3-3 and the average weekday two-way flows are shown in Table 3-6.

Plate 3-3: Location of traffic survey sites at Gravesend



Table 3-6: Traffic flow data (2019) on the surrounding highway network (Gravesham)

Location (Plate 3-3)	Count Ref.	Road	HGV Movements (Two-Way)		Total Vehicles (Two-Way)	
			Weekday 12 hours (07:00-19:00)	Daily 24 hours	Weekday 12 hours (07:00-19:00)	Daily 24 hours
1a	3815 (8436A) (WebTRIS)	M2 (One-Way, Eastbound)	5,180*	5,949*	37,466	46,345
1b	7651 (58482/2) (WebTRIS)	M2 (One-way, Westbound)	4,918*	6,019*	35,437	46,698
2	70382 (DfT)	A289 (Two-way)	3,960	4,015	44,838	54,461
3	36834 (DfT)	A226 East (Two-way)	320	306	10,204	10,809
4	78186 (DfT)	A226 West (Two-way)	279	263	13,215	15,200

*WebTRIS data also includes LGVs (represents vehicles >6.6m in length)

- 3.5.33 The sensitivity of the above roads has been established by taking into consideration the existing level of provision for road users, vehicle composition and presence of sensitive receptors (e.g. schools, hospitals or high-streets) based on the IEMA guidance.
- 3.5.34 The M2 is part of the SRN managed by NH and is a dual carriageway road which runs in a southeast direction from the junction with the A2 and the A289 (which form M2 Junction 1). The M2 is subject to a derestricted speed limit (70mph) and links two sections of the A2 to the east and west, ultimately providing access between London and Dover. The M2 has been categorised as non-sensitive due to the strategic nature of this route with high traffic flows including a high proportion of LGVs and HGVs (above 10% as shown in Table 3-6).
- 3.5.35 The A289 is a dual carriageway road which runs in a northeast direction from the M2 Junction 1 and provides access to Gillingham. The A289 is subject to a derestricted speed limit (70mph) between M2 Junction 1 and the Sans Pareil Roundabout (junction with the A228), and then reduces to 50mph and 40mph as it runs through Gillingham. The section of the A289 between M2 Junction 1 and the junction with the A226 Gravesend Road has been classified as non-sensitive due to the strategic nature of this route away from any sensitive receptors.
- 3.5.36 The A226 is a single carriageway road which runs between Dartford in the northwest (via Gravesend) and Strood in the southeast. The A226 is subject to various speed limits (ranging between 30-50mph) along its extents. The eastern extent of the A226 between the junction with the A289 to the east and the Lion Roundabout (junction with the B261 and Lower Higham Road) to the west has been classified as non-sensitive as this section of the A226 is predominantly situated outside of built-up areas with no sensitive receptors. The western extent of the A226 between the Lion Roundabout to the east and the junction with Ordnance Road to the west, where it approaches the centre of Gravesend, has been classified as sensitive due to multiple sensitive receptors being located along this section as it passes through a built-up area including residential properties, a place of worship, several schools and a high street.
- 3.5.37 Ordnance Road is considered as sensitive (due to the presence of a school on it) however in terms of the remainder of the local highway network within the study area (which is expected to be utilised

by construction traffic associated with the Proposed Development), (namely Canal Road, Norfolk Road, Mark Lane and Wharf Road) these are considered to be non-sensitive due to their industrial nature. No baseline traffic data is currently available for these roads based on a search of DfT traffic counts and planning applications in the area. An assessment of these roads will be carried out, if deemed to be required/ appropriate, as part of the Environmental Appraisal Report.

- 3.5.38 Based on the IEMA guidance, an increase in baseline traffic flows of 30% on non-sensitive roads and an increase of 10% on sensitive roads due to the presence of construction vehicles, would trigger the need for assessment. Therefore, only an increase of over 30% in HGVs or total traffic flows on the M2, A289 or A226 (eastern section) and/ or an increase of over 10% in HGVs or total traffic flows on the A226 (western section) or Ordnance Road would trigger the need for further environmental assessment. Changes in traffic flows below these levels are assumed to result in no discernible environmental impact.
- 3.5.39 Public transport in the vicinity of the site includes Gravesend and Ebbsfleet International railway stations approximately 3km and 6km to the west of the site respectively and Higham railway station approximately 4.5km to the southeast of the site. Gravesend railway station is served by Thameslink and Southeastern services, with a high frequency of services during the weekday peak hours including four Thameslink services in each direction (covering two different routes) and approximately six Southeastern services in each direction (covering five different routes). Destinations served by these services include those towards Dartford, London, St Albans and Luton to the west, as well as Gillingham, Sittingbourne and Maidstone to the east.
- 3.5.40 The nearest key bus stops to the site are located on the A226 approximately 1.7km to the southwest which are served by bus routes G1, 111, 190, 311, 416, 417, 480, 481, 489, 735 and 736. The Clock Tower bus stop located on the A226 Milton Road is the closest stop to the Proposed Development, approximately 2.5km to the southwest. The following bus routes, their destinations and the typical frequency between 8-9 AM serve the Clock Tower bus stop;
- 190: Gravesend – Chatham; two services;
 - 416: Gravesend – Meopham; one service;
 - 417: Gravesend – Cliffe; First service at 9:04 AM;
 - 480: Dartford – Riverview Park; Three services;
 - 481: Riverview Park – Ebbsfleet International Railway Station; One service; and
 - 489: New Ash Green – Gravesend; Two services between 7-8 AM, zero between 8-9 AM.

Potential Construction Effects

- 3.5.41 There are expected to be up to 21 HGVs per day (42 two-way movements) during the peak construction phase of the Proposed Development. On average, there will be 10 HGVs per day (20 two-way movements) during this phase of construction. This type of traffic would mainly be associated with the delivery of materials and equipment as follows:
- Tunnel shaft construction;
 - Tunnel shaft lining segments delivery;
 - AILs for the TBM;
 - Shaft fit out and head house construction;
 - Sealing end compound construction; and
 - 400kv overhead line diversions.
- 3.5.42 It is anticipated that all HGV traffic would access the site from Wharf Road. The proposed construction route is the shortest available between the site and the SRN:
- Arrivals: M2/A2 – A289 – A226 – Ordnance Road – Canal Road – Norfolk Road – Mark Lane – Wharf Road; and

- Departures: Wharf Road – Mark Lane – Norfolk Road – Canal Road – Ordnance Road – A226 – A289 – M2/A2.

3.5.43 The proposed construction routes to/ from the site are shown on Plate 3-4 (regional) and Plate 3-5 (local).

Plate 3-4: Proposed regional construction vehicle routes for the Proposed Development in Gravesend

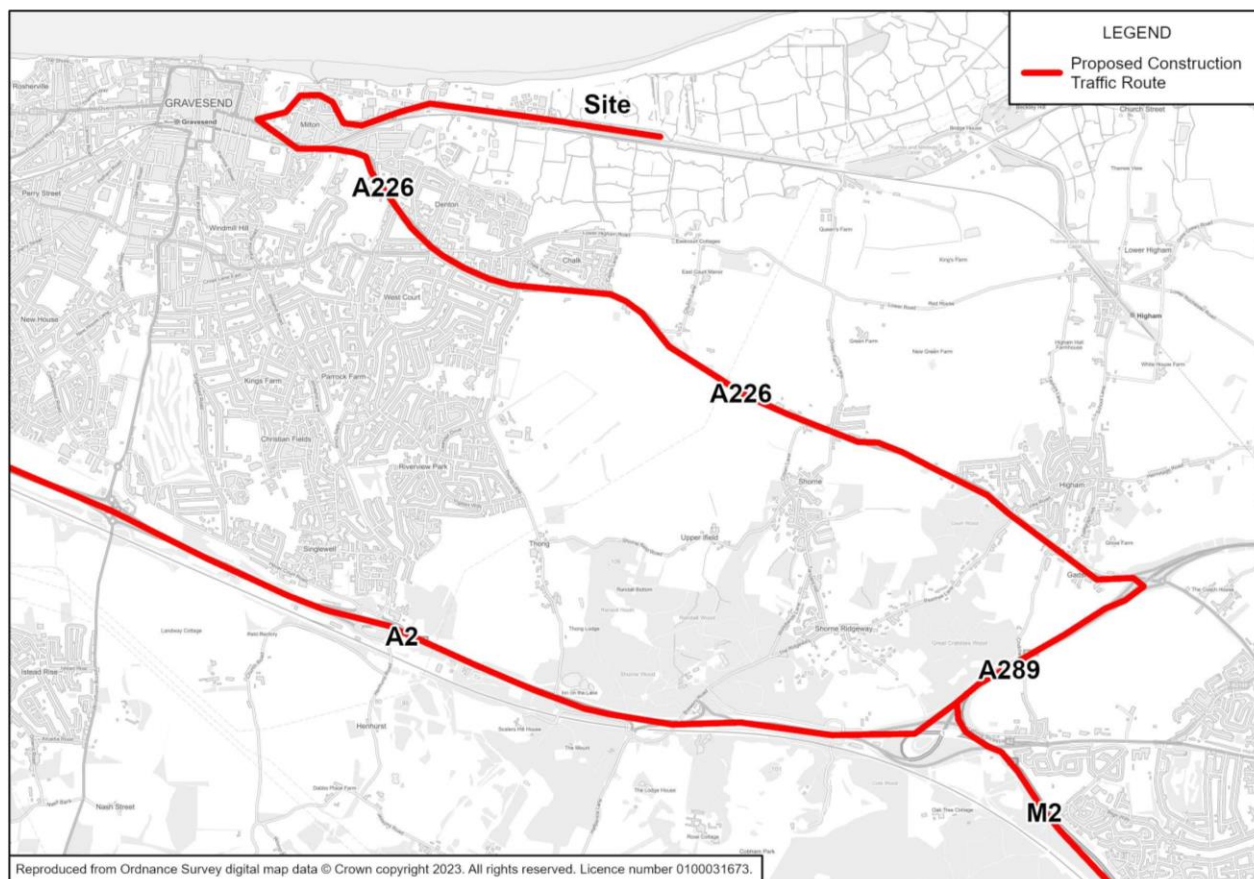
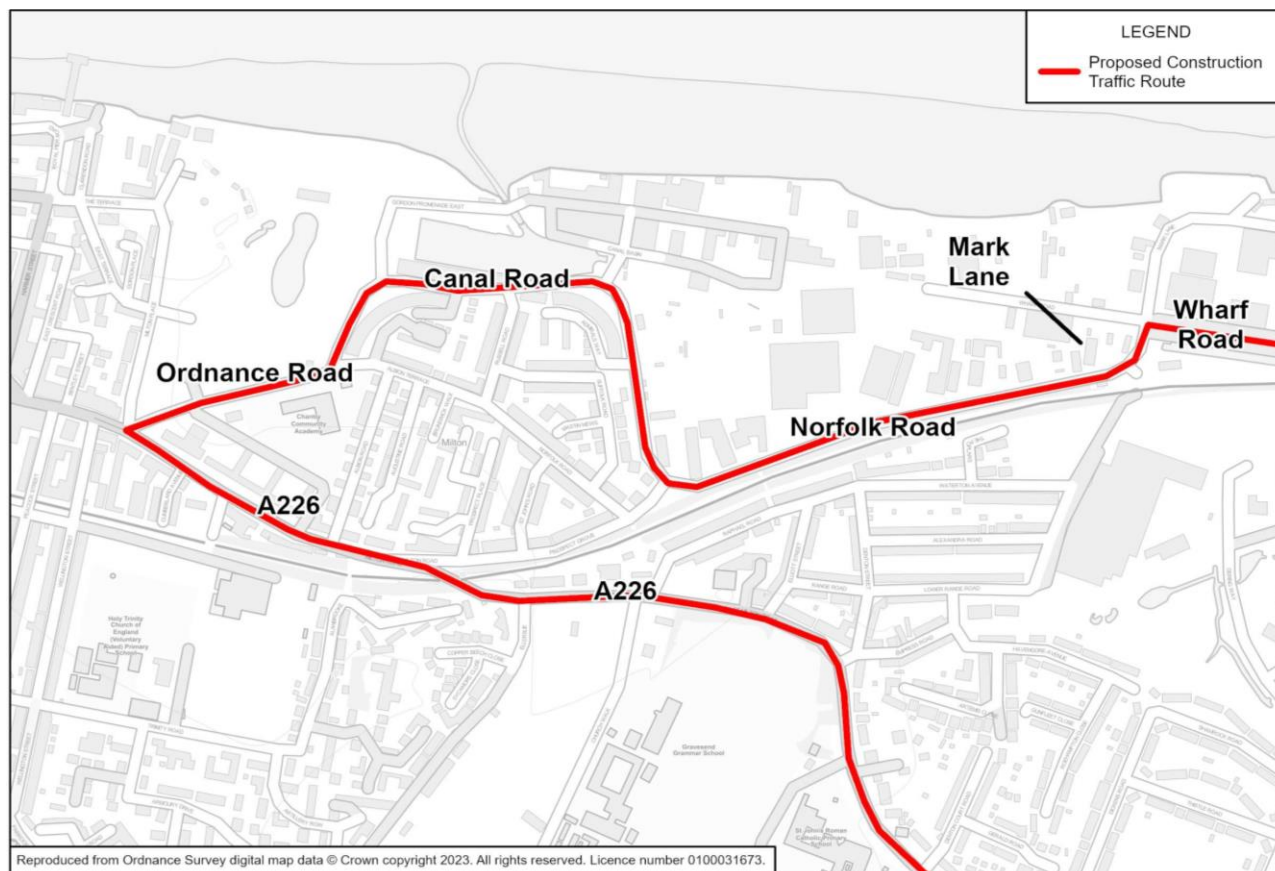


Plate 3-5: Proposed local construction vehicle route for the Proposed Development in Gravesend



- 3.5.44 A limited number of light vehicle movements are envisaged during the construction phase as a result of construction staff. These are not considered to be significant and would be controlled through the CLP. Therefore, construction worker movements have not been considered further for the purposes of this report, although these will be reviewed further as part of the Environmental Appraisal Report if necessary.
- 3.5.45 An initial assessment has been undertaken to identify the likely percentage increase in HGVs and total traffic on the SRN (M2/A2) and on the A289 and A226 based on the information presented above for the peak phase of construction. The assessment has been based on 12-hour weekday baseline flows rather than 24-hour daily baseline flows which generates higher (more robust) proportional increases in traffic flows on the surrounding highway network as a result of the Proposed Development.
- 3.5.46 The forecast increases in 12-hour (07:00-19:00) weekday traffic flows on the SRN and the A289 and A226 as a result of construction traffic during the peak construction phase are shown in Table 3-7.

Table 3-7: Forecast increases in traffic flows due to the Proposed Development in Gravesham (Peak HGVs during the construction phase)

Road (Two-Way)	Baseline Weekday 12 hours (07:00-19:00)		Forecast Daily HGV Movements (Two-Way)	% Increase	
	HGVs	Total Vehicles		HGVs	Total Vehicles
M2	10,098*	72,903	42	0.4%	0.1%
A289	3,960	44,838	42	1.1%	0.1%
A226 East	320	10,204	42	13.1%	0.4%
A226 West	279	13,215	42	15.0%	0.3%

*baseline data also includes LGVs (represents vehicles >6.6m in length)

- 3.5.47 As can be seen from Table 3-7, the predicted increase in two-way construction HGV traffic against the baseline total traffic flows would be less than 1% along the M2 (the SRN), the A289 and the A226. Whilst there is expected to be a maximum increase of 15% HGVs on the A226 (West) when compared to baseline HGV flows (which exceeds the 10% threshold identified by the IEMA guidance for a sensitive receptor), the overall increase when compared to total traffic flows is below 1%. In addition, the additional 21 HGVs per day would equate to approximately 2-3 additional HGVs per hour on this part of the network. Therefore, this is expected to result in a negligible impact with no environmental effects on the A226 (West) as a result on construction HGVs.
- 3.5.48 In terms of the remainder of the surrounding highway network, which includes the M2, A289 and the A226 (East) as non-sensitive receptors (where the 30% threshold applies based on the IEMA guidance), it is expected that there will be a negligible impact with no environmental effects as a result of construction-related HGVs.
- 3.5.49 As above, the initial assessment presented in Table 3-7 offers a worst-case assessment as this is based on the peak construction phase and 12-hour weekday baseline flows and so proportional increases as a result of the Proposed Development would be higher than compared to 24-hour daily baseline flows.

Construction Phase Mitigation

- 3.5.50 A CLP would be prepared to ensure that all traffic associated with the construction works operate in a safe and compliant manner at all times. The specific mitigation measures in the CLP would be agreed with Gravesham Borough Council and/ or Kent County Council (through regular liaison) and adhered to by the appointed Contractor. The CLP is expected to include the following (note, this is not an exhaustive list):
- Measures designed to manage construction traffic (e.g. HGVs and construction staff at the start and end of the working day) in order to minimise the impact on local residents, businesses, road users and other potentially sensitive land uses and ensure all third-party traffic interfacing with the Proposed Development is kept safe from the on-going work;
 - A traffic routing strategy to ensure vehicles accessing the site do so via the most appropriate route(s) and to avoid (or minimise) conflict with sensitive areas such as residential areas;
 - Access security personnel and traffic marshals to ensure the access point is managed safely and securely. Swept path analysis will be undertaken to ensure vehicles can safely enter and exit the Proposed Development from/ to the local highway network without impacting road users;
 - Temporary traffic management/ construction signage at the site access point and on the approach to the site access (as required) to ensure safe movements of all road users;

- A parking review to ensure a clear route is available to construction vehicles travelling to/ from the Proposed Development, particularly on local/ access roads;
- A requirement for vehicles to be correctly maintained and operated in accordance with the manufacturer's recommendations and in a responsible manner;
- A Driver Information Pack covering a variety of topics and providing information on the requirements of working on the Proposed Development;
- A specialised haulage service to allow AILs to be transported, with the necessary escort, permits and traffic management in place; and
- An access route inspection and swept path analysis for the largest equipment/ construction material delivery vehicles and transporters (including AILs) would also be undertaken to determine the need for any additional control measures.

Potential Cumulative Effects during Construction

- 3.5.51 There are a number of other current and potential development activities in the vicinity of the Proposed Development which are listed in Appendix B – Cumulative Developments of this report and have the potential to result in cumulative effects during the construction phase. These include the LTC (Planning Inspectorate Reference: TR010032), which is a NSIP. This scheme has not yet been consented and any potential cumulative effects would therefore be subject to the approval of the application and the timescales for construction. Nonetheless, an initial high-level appraisal has been carried out below to inform this report.
- 3.5.52 There are a number of other potential developments that have been submitted to Gravesham Borough Council, however, the vast majority of these are considered to be minor and would not be expected to have any impact from a traffic or transport perspective.
- 3.5.53 As identified above, there is the potential for some overlap between the construction phase of the Proposed Development and the construction of cumulative developments in the vicinity of the Proposed Development including those which intend to share similar construction routes. An initial high-level appraisal has been carried out to review the potential for any cumulative effects as a result of the Proposed Development and the LTC.
- 3.5.54 The forecast construction traffic flows for the LTC are presented in the Transport Assessment (TR010032/APP/7.9). This identifies that, based on Tables 8.23-8.33, Phase 6 (scheduled to take place in 2027) is expected to be the peak construction phase in terms of construction traffic demand. The forecast changes in traffic flows to the south of the River Thames during Phase 6 are presented in plates 8.60 to 8.62. These identify that there is expected to be additional traffic on the A289 and the A226 during the peak construction phase of the LTC. However, there is expected to be a temporary reduction in traffic on the M2 and A2 as a result of Temporary Traffic Management measures associated with LTC. The following assumptions have been adopted to estimate peak daily construction vehicle movements on these parts of the network:
- Plates 8.60 (AM peak), 8.61 (Interpeak) and 8.62 (PM peak) present changes in PCU flows, in each direction, based on various thresholds. The average value of each threshold (by direction) has therefore been adopted to estimate the change e.g. where a threshold is between +51 and +100 PCUs, a value of +75 PCUs has been adopted. The identified value for each direction has then been combined to identify an overall two-way change in PCU flows.
 - The AM peak is 07:00-08:00, the PM peak is 17:00-18:00 and Interpeak is an average hour within the period 09:00-15:00. For the purposes of this high-level appraisal, daily flows have been estimated by multiplying the Interpeak traffic flows by nine and then combining this with the AM and PM peaks, to represent an overall eleven-hour period of 07:00-18:00.
 - Table 8.28 which presents construction traffic demand in Phase 6, has been used to convert PCUs to total vehicles by adopting LTC's PCU conversion values of 1 for staff (to represent cars/ vans) and 2.5 for earthworks and supplies (to represent HGVs). This identifies that a 77% conversion factor should be applied to PCUs to identify total vehicles, and that 19% of total vehicles are expected to be HGVs. For example, 100 PCUs would equate to 77 vehicles including 15 HGVs.

- 3.5.55 The forecast cumulative increases in construction traffic flows as a result of the Proposed Development and the LTC are presented in Table 3-8, based on peak construction traffic flows and on the worst-case assumption that the peak construction phases would both overlap.

Table 3-8: Forecast increases in cumulative daily construction traffic flows in Gravesham (Peak construction phases)

Road (Two-Way)	Proposed Development		Lower Thames Crossing		Total (Cumulative)	
	HGVs	Total Vehicles*	HGVs	Total Vehicles	HGVs	Total Vehicles
M2	42	42	0	0	42	42
A289	42	42	75	387	117	429
A226 East	42	42	611	3,134	653	3,176
A226 West	42	42	611	3,134	653	3,176

*excludes construction workers/ light vehicles, as these are not expected to be significant at this stage

- 3.5.56 The above shows that the Proposed Development is expected to result in considerably fewer construction vehicle trips on the surrounding highway network, when compared to the LTC. The forecast cumulative increases in 12-hour (07:00-19:00) weekday traffic flows on the SRN, A289 and A226 as a result of peak construction traffic flows are shown in Table 3-9. Table 3-10 reviews forecast increases as a result of the LTC only, without the Proposed Development.

Table 3-9: Forecast cumulative increases in daily traffic flows in Gravesham (Peak construction phases)

Road (Two-Way)	Baseline Weekday 12 hours (07:00-19:00)		Forecast Additional Cumulative Daily Movements (Two-way)		% Cumulative Increase	
	HGVs	Total Vehicles	HGVs	Total Vehicles	HGVs	Total Vehicles
M2	10,098*	72,903	42	42	0.4%	0.1%
A289	3,960	44,838	117	429	3.0%	1.0%
A226 East	320	10,204	653	3,176	204.2%	31.1%
A226 West	279	13,215	653	3,176	233.7%	24.0%

*baseline data also includes LGVs (represents vehicles >6.6m in length)

Table 3-10: Forecast increases in daily traffic flows in Gravesham as a result of Lower Thames Crossing only (Peak construction phases)

Road (Two-Way)	Baseline Weekday 12 hours (07:00-19:00)		Forecast Additional Lower Thames Crossing Daily Movements (Two-way)		% Cumulative Increase	
	HGVs	Total Vehicles	HGVs	Total Vehicles	HGVs	Total Vehicles
M2	10,098*	72,903	0	0	0.0%	0.0%
A289	3,960	44,838	75	387	1.9%	0.9%
A226 East	320	10,204	611	3,134	191.0%	30.7%
A226 West	279	13,215	611	3,134	218.6%	23.7%

*baseline data also includes LGVs (represents vehicles >6.6m in length)

- 3.5.57 As can be seen from Table 3-9, the predicted cumulative increases in two-way construction traffic against the baseline HGV and total traffic flows on the M2 and A289 are expected to remain below the 30% threshold for non-sensitive roads as identified by the IEMA guidance. Therefore, the cumulative increases identified above are assumed to result in no discernible environmental impact for these parts of the highway network.
- 3.5.58 However, based on Table 3-9 and Table 3-10, the predicted increases exceed the 30% threshold for the A226 East (non-sensitive receptor) and the 10% threshold for the A226 West (sensitive receptor), as a result of construction traffic associated with the LTC, both with and without the Proposed Development. Therefore, whilst the cumulative increases identified above have the potential to result in a discernible environmental impact on the A226, this remains the case without the Proposed Development which in itself is expected to have a negligible impact with no environmental effects as a result of construction-related HGVs (see Table 3-7). Therefore, the cumulative increases identified above as a result of the Proposed Development are assumed to result in no discernible environmental impact.
- 3.5.59 The potential for any cumulative effects will be assessed further as part of the Environmental Appraisal Report and mitigated through the control measures to be included in the CLP.

Potential Operational Effects

- 3.5.60 During normal operation of the Proposed Development, the only traffic generated would be associated with infrequent repair and routine maintenance works. Therefore, additional traffic movements during the operational phase are not anticipated to have a significant effect on the transport network or receptors.

Summary

- 3.5.61 It is considered that each of the potential impacts and environmental risks relating to Traffic and Transport associated with the works can be managed through the application of accepted good practice and compliance with the measures outlined above. Whilst the cumulative increases in construction traffic have the potential to result in a discernible environmental impact on the A226 following the inclusion of the LTC, this remains the case without the Proposed Development which is in itself expected to have a negligible impact with no environmental effects on the A226 as a result of construction-related HGVs. As a result, the Proposed Development is not in itself expected to result in any significant environmental effects in terms of Traffic and Transport.

3.6 Noise and Vibration

Baseline Environment

Tilbury

- 3.6.1 The baseline environment in the vicinity of the Tilbury Site is dominated by activities in the surrounding industrial area, which consists of:
- P&O Roro Terminal;
 - Tilbury Sewage Treatment Works;
 - Tarmac Tilbury;
 - Tilbury Substation; and
 - Inglebourne Valley Landfill activity.
- 3.6.2 In addition to the above, noise in the vicinity of the Tilbury Site is also generated by river traffic on The Thames.
- 3.6.3 At nearby sensitive receptors, the baseline noise environment is influenced by road and rail traffic in addition to the industrial noise sources described above.

Gravesend

- 3.6.4 The baseline noise environment in the vicinity of the Gravesend Site is influenced by a number of different noise sources as follows:
- Eastcourt Marshes Electricity Substation;
 - Milton Rifle Range;
 - Southern K9 Training area;
 - Concrete works and associated heavy vehicle movements;
 - river traffic on the River Thames; and
 - rail traffic.
- 3.6.5 At nearby sensitive receptors, the baseline noise environment is also influenced by road traffic noise.

Key Receptors

- 3.6.6 Sensitive receptors are defined as residential or non-residential. Sensitive ecological receptors are discussed in section 3.2.

Tilbury

- 3.6.7 The nearest sensitive receptors to the Tilbury Site are residential properties on Sandhurst Road approximately 980m to the northwest. Additionally, Tilbury Fort is located approximately 850m to the west of the Tilbury Site.

Gravesend

- 3.6.8 The nearest sensitive receptors to the Gravesend Site are the National Maritime Training Centre (NMTTC) and the Metropolitan Police Specialist Training Centre (MPSTC), which are non-residential receptors located directly to the west of the Gravesend Site at a minimum distance of approximately 50m. The nearest residential receptors are located to the south of the Gravesend Site at a distance of approximately 680m south-east.

Summary of Potential Effects

Potential Construction Effects

- 3.6.9 A screening distance of 300m for construction noise, which has been selected as guidance in BS 5228-1 (Ref 15) indicates that construction noise predictions are generally reliable up to 300m. Additionally, a study area of 50m either side of construction traffic routes has been defined based on guidance in the Design Manual for Roads and Bridges LA111 (DMRB) (Ref 16).

Tilbury

- 3.6.10 There are no receptors within 300m of the Tilbury Site so construction noise and vibration effects will not be significant.
- 3.6.11 There are forecast to be 114 two-way construction HGV movements forecast during the peak period. Construction traffic will use the A1089 and the Tilbury 2 Road to access/ egress the Site. These roads experience high levels of HGV traffic with the largest percentage increase in HGV movements on Tilbury 2 Road of 4.5%. Construction traffic would result in an increase in noise of less than 1 dB so noise effects would not be significant.

Gravesend

- 3.6.12 As there are receptors at a closest distance of approximately 50m to the Gravesend Site, there is potential for significant construction noise and vibration effects. As these receptors will only be occupied during the day, they will not be impacted by out-of-hours work that will occur during tunnelling.
- 3.6.13 The level of temporary vibration from tunnelling at sensitive receptors is dependent on the tunnel depth, distance to receptors and ground conditions. Based on the tunnel depth of approximately 50m and the distance to nearest sensitive receptor, tunnelling induced vibration effects would not be significant.
- 3.6.14 There are forecast to be 42 two-way construction HGV movements forecast during the peak period. Construction traffic will access/ egress the Site via from the A226 via Ordnance Road, Canal Road, Norfolk Road and Wharf Road. Although local roads do not experience high levels of baseline traffic flows, the number of forecast peak construction HGV traffic is not substantial enough to result in a significant effect.

Potential Operational Effects

- 3.6.15 Operational noise emissions would be associated with the operation of the tunnel ventilation systems located within the proposed headhouses. A screening distance of 1km is applied to operation noise, which, in the absence of any specific guidance, is conservatively assumed to cover receptors that may experience adverse levels of noise.

Tilbury

- 3.6.16 As the nearest sensitive receptor is approximately 850m from the Tilbury Site, there is potential for noise to be at a level that could be considered adverse; however, the distance is sufficient that it is unlikely that significant effects may occur.

Gravesend

- 3.6.17 At the Gravesend Site, the nearest sensitive receptor is approximately 50m away, there is potential for significant effects. However, as noise from the new head house will be similar to the existing head house, it is unlikely that there will be significant effects. Residential receptors are sufficiently far from the Gravesend Site that it is unlikely that significant effects may occur.

Potential Cumulative Effects

- 3.6.18 Cumulative effects due to construction and operational activities at the Proposed Development and nearby developments have the potential to adversely affect receptors. The degree of potential cumulative effects is dependent on the location of the receptor.

Tilbury

- 3.6.19 As there are no sensitive receptors within the construction noise screening area, there will be no cumulative construction noise and vibration effects. However, the number of industrial cumulative developments in the area means there is potential for significant cumulative operational effects. The cumulative industrial developments will be designed in accordance with local planning policy, which will control noise at sensitive receptors. Consequently, it is expected that compliance with planning requirements will prevent operational significant effects from occurring.

Gravesend

- 3.6.20 The only cumulative development that may result in cumulative construction noise effects is Planning Application No 20211541 "Erection of a new concrete live fire skills house training building (plus abseil frame) with new ancillary support building and associated works". This cumulative development is on the NMTC and MPSTC sites and, as such, will be constructed with mitigation measures to protect on-site noise sensitive locations. Consequently, significant cumulative construction noise effects are not likely to occur.
- 3.6.21 There are no cumulative developments that will generate industrial noise so no cumulative significant operation effects will occur.

Mitigation

Tilbury

- 3.6.22 Construction noise and vibration mitigation will be secured in the CEMP covering 'best practicable means' as defined in Section 72 of the Control of Pollution Act. This mitigation will ensure that all reasonable steps are taken to minimise noise and vibration emissions from construction activities. Examples of best practicable means that will be implemented during construction works are presented below:
- Unnecessary revving of engines will be avoided, and equipment will be switched off when not in use;
 - Appropriate routing of construction traffic on public roads and along access tracks;
 - Drop heights of materials will be minimised;
 - Plant and vehicles will be sequentially started up rather than all together;
 - Plant will always be used in accordance with manufacturers' instructions. Care will be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading will also be carried out away from such areas; and
 - Regular and effective maintenance by trained personnel will be undertaken to keep plant and equipment working to manufacturer's specifications.
- 3.6.23 No specific operational noise mitigation measures are anticipated to be required; however, all reasonable steps will be adopted in the detailed design to minimise noise emissions. This will include the use of attenuators and acoustic louvers where appropriate.

Gravesend

- 3.6.24 Construction noise and vibration mitigation will be secured in the CEMP, as described in paragraph 3.6.22. In addition, management measures such as noise monitoring and a communication strategy will be adopted to reduce the potential for significant noise effects.

- 3.6.25 As construction traffic routes pass through residential areas, construction traffic has been kept to a minimum by locating the drive shaft, which requires the most amount of HGV construction traffic, at the Tilbury Site.
- 3.6.26 Operational mitigation measures such as the use of attenuators and acoustic louvers will be implemented in the detailed design where appropriate. These mitigation measures will prevent any likely significant effects.

Summary

Tilbury

- 3.6.27 Due to the distance between the Tilbury Site and sensitive receptors, no significant noise or vibration effects are expected during the construction or operational phases.

Gravesend

- 3.6.28 In the absence of mitigation, significant noise and vibration effects at NMTC and MPSTC during construction and/ or operational phases. However, it is considered that appropriate mitigation measures such as the 'best practicable means' as defined in Section 72 of the Control of Pollution Act and the use of attenuators and acoustic louvers will be incorporated into the design and construction such that residual effects are unlikely to be significant. It is proposed that more detail on potential effects and mitigation requirements will be set out in an Environmental Report which accompanies the relevant consent application.

3.7 Air Quality

Baseline Environment

- 3.7.1 Under the requirements of the Environment Act, Local Authorities have a duty to review and assess local air quality within their administrative areas. Where Local Authorities identify locations that exceed an air quality objective where there is sensitive exposure, they are required to declare an Air Quality Management Area (AQMA) and publish an Air Quality Action Plan (AQAP), setting out how emissions will be reduced and improving air quality at these locations improved. This section sets out the recent review and assessment of local air quality undertaken by Thurrock and Gravesham Councils.

Tilbury

- 3.7.2 There is one AQMA in Tilbury, AQMA 24, declared by Thurrock Council due to exceedances of the annual mean nitrogen dioxide (NO₂) air quality objective, as shown on Figure 3a in Appendix A. Pre-COVID pandemic, in 2019, annual mean concentrations of nitrogen dioxide (NO₂) peaked at 41.2 µg/m³ within this AQMA. During the pandemic, in 2020, NO₂ concentrations fell to 32.8 µg/m³. Thurrock Council are yet to publish air quality monitoring data for 2021, but NO₂ concentrations are now likely to be closer to pre-pandemic levels.

Gravesend

- 3.7.3 There are three AQMAs located near the southern site, in Gravesend. These AQMAs have been declared by Gravesham Borough Council due to exceedances of the annual mean NO₂ air quality objective, as shown on Figure 3a in Appendix A. Pre-COVID pandemic, in 2019, annual mean concentrations of NO₂ were as high as 46.1 µg/m³ within these AQMAs. Post-pandemic, in 2021, NO₂ concentrations were 41.2 µg/m³.

Key Receptors

- 3.7.4 Air quality sensitive receptors include those sensitive to dust and harm to amenity (e.g. residential properties, commercial property and public spaces), those sensitive to the potential for harm to human health (e.g. residential properties, schools and medical facilities with overnight wards), and sensitive nature conservation sites (e.g. SSSI, SAC and SPA).

Tilbury

- 3.7.5 There are limited receptors sensitive to harm to amenity and human health in close vicinity of the Tilbury site. Further afield, key receptors sensitive to harm to human health are residential properties in Tilbury located adjacent to the A1089, including those within the Thurrock Council AQMA 24.
- 3.7.6 Key nature conservation receptors relevant to the Tilbury site include the proposed SSSI adjacent to site's eastern boundary, the Local Nature Reserve (LNR) to the south of the site, and the Thames Estuary Ramsar, SPA and Mucking Flats and Marshes SSSI 3 km to the east.

Gravesend

- 3.7.7 There are receptors sensitive to harm located adjacent to the Gravesend site's western boundary including NMTC and the MPSTC, but there is limited sensitivity to human health impacts in close proximity of the site. Further afield, key receptors sensitive to harm to human health are residential properties in Gravesend, including those within the Gravesham Borough Council A226 AQMA and A227 AQMA.
- 3.7.8 Key nature conservation receptors relevant to the Gravesend site include the Local Wildlife Site (LWS) within the site boundary, the South Thames Estuary and Marshes SSSI to the south of the site and further away to the east, and the Thames Estuary & Marshes Ramsar and SPA to the east.

Summary of Potential Effects

Tilbury

Potential Construction Effects

- 3.7.9 Construction activities at the northern site have the potential to generate dust emissions, if unmitigated. These emissions may result in adverse impacts on human health, amenity and nature conservation through construction, earthworks and trackout (the movement of construction vehicles on the public road network) activities. Potential impacts could include increased exposure to short-term concentrations of Particulate Matter (PM)₁₀, and increased rates of dust soiling on property and on ecologically sensitive habitats. The Institute of Air Quality Management provide a guidance method that identifies the level of mitigation required to ensure that a significant effect does not occur.
- 3.7.10 It is also anticipated that the construction at the northern site will result in increased traffic on the surrounding road network, namely HGVs travelling to and from the northern site. Potential impacts from increased traffic emissions would increase exposure to long-term concentrations of NO₂ and particulate matter (PM₁₀ and PM_{2.5}) at sensitive receptors located adjacent to affected roads. During the most intensive phases of construction, it is currently estimated that the northern site will generate a daily average of 25 two-way HGV movements during the 8-months of tunnel construction and 40 two-way HGV movements during the 6-months of tunnel lining segments delivery. According to Institute of Air Quality Management guidance, an increase in heavy vehicles of 25 or more two-way movements per day has the potential to have a significant effect on air quality, where the increase occurs on roads within or adjacent to an AQMA. The potential for this source to contribute to a significant effect is therefore limited to sensitive locations within the Thurrock Council AQMA 24, where air quality is already constrained, particularly if construction traffic accesses and leaves the site via the A1089.
- 3.7.11 Construction traffic emissions impacts on ecologically sensitive habitats close to the northern site is also likely, through increased rates of nitrogen deposition. Emissions from construction traffic therefore have the potential to contribute to a significant air quality effect, without mitigation.
- 3.7.12 It is understood that alternatively, tunnel spoil may be removed from site by barge via the river Thames. This would potentially reduce the traffic emissions impact at receptors located within the Tilbury AQMA, if the route between the northern site and the barge jetty avoids the A1089 adjacent to the AQMA. Construction emissions associated with the removal of spoil by barge would be limited to those associated with barge engines and the engines of the site plant used to unload and distribute the spoil across the disposal site. There is the potential for such emissions to impact on the sensitive habitats within the Thames Estuary and Marshes Ramsar Site and SPA and such impacts will need to be considered in the air quality assessment and to inform the Habitats Regulations Assessment.
- 3.7.13 Construction of the Proposed Development will require the use of TBM. It is National Grids preference that the energy demand of the TBMs will be met by connection to the existing National Grid electrical assets. However, if this is not feasible, the energy demand will need to be met by onsite generators. In this instance, potential impacts on human health sensitive receptors could occur and include increased exposure to short-term and long-term concentrations of combustion pollutants, which will include NO₂ and possibly PM₁₀ and PM_{2.5}, as well as others. Potential impacts on nearby nature conservation sites could also occur, with increased levels of nitrogen deposition. Without mitigation, there is the potential for these emissions to have a significant effect on air quality, particularly at the adjacent proposed SSSI, should onsite generators be required.

Potential Operational Effect

- 3.7.14 The emissions associated with the operational phase at the northern site are likely to be limited to maintenance vehicles only. Due to the limited number of anticipated vehicle movements required for this activity, operation impacts are unlikely to contribute to a significant effect on local air quality.

Potential Cumulative Effects

- 3.7.15 There is the potential for cumulative air quality effects to occur, should the construction of the northern site coincide with the construction and/or operation of nearby committed or reasonably foreseeable developments. Cumulative effects could result from any dust generating activities of neighbouring development sites coinciding with dust generating construction activities at the northern site, and/or when the construction and/or operation of other developments increase traffic flows on roads used by northern site construction traffic.
- 3.7.16 There are a number of committed and reasonably foreseeable developments in the vicinity of the northern site, which are described in Appendix B – Cumulative Developments. The following other developments have the potential to have a cumulative effect with the northern site, due to their scale and quantity of emissions to air:
- Lower Thames Crossing (DCO examination expected during summer 2023); and
 - Thurrock Flexible Generation Plant (DCO made February 2022).
- 3.7.17 To account for cumulative effects, any assessment of air quality impacts required as part of the planning process will include cumulative emissions, including those of dust and construction traffic emissions on the local road network. Traffic data used to inform any dispersion modelling will be provided by the transport team working on the project and will include data for all committed and reasonably foreseeable developments within each scenario.
- 3.7.18 Cumulative emissions from existing non-road sources will be accounted for in the background data used in the air quality assessment.

Gravesend

Potential Construction Effects

- 3.7.19 Construction activities at the southern site also have the potential to generate dust emissions, if unmitigated, impacting on human health, amenity, and nature conservation. The Institute of Air Quality Management provide a guidance method that identifies the level of mitigation required to ensure that a significant effect does not occur.
- 3.7.20 Construction at the southern site will also result in increased traffic and associated emissions on the surrounding road network, but not to the extent anticipated at the northern site. During the most intensive phases of construction at the southern site, generated daily average HGVs will not exceed 25 two-way movements. In line with Institute of Air Quality Management, such an increase in traffic movements is not likely to contribute to a significant effect on air quality.

Potential Operational Effect

- 3.7.21 The emissions associated with the operational phase at the southern site are likely to be limited to maintenance vehicles only. Due to the limited number of anticipated vehicle movements required for this activity, operation impacts are unlikely to contribute to a significant effect on local air quality.

Potential Cumulative Effects

- 3.7.22 There is the potential for cumulative air quality effects to occur, should the construction of the southern site coincide with the construction and/or operation of nearby committed or reasonably foreseeable developments.
- 3.7.23 There are limited committed and reasonably foreseeable developments in the vicinity of the southern site, and include:
- Erection of a new concrete live fire skills house training building (plus abseil frame) with new ancillary support building and associated works (Planning Application No: 20211541); and
 - Erection of 3 industrial units (Use Class B1/B2 and B8) with site access, related parking and circulation space (Planning Application No: 20160314).
- 3.7.24 These other developments are small in scale and have limited potential to have a cumulative effect with the southern site.

Mitigation

- 3.7.25 Any construction dust assessment to accompany the planning process will be undertaken in line with Institute of Air Quality Management guidance, which will identify the level of mitigation required to ensure that the effect of construction dust impacts is not significant. These measures will be standard best practice commonly implemented on all well managed construction sites across the UK.
- 3.7.26 In terms of construction traffic emissions, it is anticipated that air quality mitigation would be incorporated in a CLP that would support the planning process. This would include information and measures to reduce emissions from construction vehicles, such as setting out an appropriate vehicle emission standard and defined construction traffic routes. The latter example with the aim of avoiding the worsening of air quality within the AQMAs.
- 3.7.27 When considering the potential emissions associated with onsite energy generation plant, the key mitigation would be to remove this source completely and power on site plant, such as the TBMs, via connection to the National Grid. If such an approach is not possible, on-site energy generation plant emissions impacts could be mitigated to some extent by the choice of combustion fuel, the selection of plant with low nitrogen oxides (NO_x) emissions, the siting of construction plant as far away from the nearest or most sensitive receptors and the release of emissions from a stack height that encourages good dispersion.

Summary

- 3.7.28 The Proposed Development has the potential to impact on local air quality through construction phase dust emissions, construction phase traffic emissions and construction phase energy plant emissions. These impacts have the potential to impact on amenity, human health and nature conservation receptors close to the site, and human health sensitive receptors adjacent to the road network on the construction traffic route. In the absence of the mitigation, there is potential for increased emissions from construction to result in likely significant effects on local air quality. However, it is considered that the proposed mitigation measures to be incorporated into design and construction will reduce effects such that they are unlikely to be significant.

3.8 Geology and Hydrogeology

3.8.1 This section considers the existing ground conditions present in the vicinity of the Proposed Development and identifies the potential for any significant effects that the construction and operation of the Proposed Development may have on the geological and hydrogeological characteristics of the study area.

3.8.2 This section considers the potential for:

- the effects on bedrock geology and superficial deposits and hydrogeology, including land stability; and
- the effects from contamination on human health, controlled waters, sensitive ecological receptors and buildings/infrastructures.

3.8.3 The following sources of information have been reviewed and have informed this report, in relation to geology and hydrogeology, including contaminated land:

- The Department for Environment, Food and Rural Affairs (Defra) Multi-Agency Geographic Information for the Countryside (MAGIC) Map online search tool (Ref 17);
- BGS Geoindex Onshore online geological mapping (Ref 18);
- Groundsure Enviro Data Viewer (Ref 19);
- Environment Agency Flood map for planning (Ref 20);
- UK Health Security Agency (UKHSA). UK Maps for Radon (Ref 21);
- Zetica Risk Map (Ref 22); and
- Geotechnical and Geoenvironmental Desk Study, including an Envirocheck report. (Ref 23).
Note that the site boundary differs from the EIA Screening Boundary considered in this report.

Baseline Environment

Tilbury

3.8.4 Review of the information sources has established the following in relation to the baseline condition of the permanent aspects of the Proposed Development (hereafter “the site”) in relation to geology and soils:

- The Site is currently on previously developed land, with Tilbury 2 Terminal beyond, to the west. National Grid’s electricity substation occupies the area to the north of the Site (google maps);
- The Geotechnical and Geoenvironmental Desk Study (Ref 23) indicates that Tilbury Power Station was present at the Site between mid-1960’s and mid-1970. Areas of ash waste from the power stations are located adjacent to the east of the Site;
- The Groundsure Enviro Data Viewer (Ref 19) indicates that the eastern part of the Site sits on an historical landfill site (Tilbury B Power Station Fort Road landfill). This area is also associated with two authorised landfill sites, named “Area A1, A2 and C”, described as A07: Industrial Waste Landfill (factory curtilage); and “Tilbury Ash Disposal Site” described as “waste landfilling, excluding inert waste”;
- The Site is bordered to the east by an elongated waterbody. The River Thames is approximately 420m south of the Site;
- Published geological mapping (Ref 18) indicates that the natural geology across Site comprises superficial deposits of Alluvium. The bedrock consists of chalk formations, including Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) of the White Chalk Subgroup. In addition to natural strata, Made Ground may be present at the Site. The Geotechnical and Geoenvironmental Desk Study (Ref 23) indicates that several ground investigations have been undertaken in the proximity of the Site; and

generally identified Made Ground over superficial deposits of the Alluvium and River Terrace Deposits, with Chalk at depth;

- The Alluvium is classified as Secondary (undifferentiated) aquifer; the River Terrace Deposits as a Secondary A aquifer; and the chalk is classified as a Principal aquifer (Ref 17);
- The northern part of the Site lies within a groundwater Source Protection Zone (SPZ) III (Total Catchment. (Ref 17);
- There are sensitive ecological receptors located on-site and within 1km of the Site, refer to section 3.2 for more information (Ref 17);
- The Site is within a lower probability radon area where less than 1% of homes are estimated to be at or above the Action Level (Ref 21);
- According to the Zetica Preliminary Unexploded Ordnance (UXO) risk maps, the Site is recorded as having a moderate density of Unexploded Ordnance (Ref 22). A Preliminary UXO Threat Assessment, appended to the Geotechnical and Geoenvironmental Desk Study (Ref 23), indicates that the potential for a UXO hazard to occur, and more specifically, the potential for unexploded World War (WW) I and WWII ordnance to exist at the Site is assessed as being likely. A detailed UXO Threat and Risk Assessment was recommended;
- The Environment Agency Flood map for planning (Ref 20) indicates that the Site is in an area characterised by low flood risk from river or the sea, meaning that this area has change of flooding of between 0.1% and 1% each year. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail; and
- Online Agricultural Land Classification (ALC) mapping from Natural England (Ref 17) indicates that the Site is not within an agricultural area.

Gravesend

3.8.5 Review of the information sources has established the following in relation to the baseline condition of the site in relation to geology and soils:

- The Site is located to the south-east of National Grid's Eastcourt Marshes Electricity Substation. Milton Rifle Range extends to the east of the Site. A training provider (Thameside Campus - National Maritime Training Centre) is located adjacent to the west of the Site, with the Metropolitan Police Specialist Training Centre beyond (Ref 26);
- Gravesend Power Station, was located approximately 1.5km to the west of the Site. Ash waste from the power station was placed 100m south of the Site, beyond a railway line. The Geotechnical and Geoenvironmental Desk Study (Ref 23) indicates that Milton Rifle Range was located at the Site from late 1890's and mid-1975;
- The Groundsure Enviro Data Viewer (Ref 19) indicates that an historical landfill site (Shamrock Road landfill) is located 470m south-west of the Site;
- The Site is adjoined to the east and south by an unnamed watercourse. The River Thames is approximately 140m north of the Site and the Thames and Medway Canal is approximately 85m south of the Site;
- Published geological mapping (Ref 18) indicates that the natural geology across Site comprises superficial deposits of Alluvium. The bedrock consists of chalk formations, including Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) of the White Chalk Subgroup. In addition to natural strata, Made Ground may be present at the Site;
- The Alluvium is classified as a Secondary (undifferentiated) aquifer and the chalk is classified as a Principal aquifer (Ref 17);
- The Site does not lie within a groundwater Source Protection Zone (SPZ) and there are no SPZ within 1km of the Site (Ref 17);

- The South Thames Estuary and Marshes SSSI extends from approximately 100m south of the Site, beyond the Thames and Medway Canal, refer to section 3.2 for more information (Ref 1);
- The Site is within a lower probability radon area where less than 1% of homes are estimated to be at or above the Action Level (Ref 21);
- According to the Zetica UXO risk maps, the Site is recorded as having a high density of Unexploded Ordnance (Ref 22). A Preliminary UXO Threat Assessment, appended to the Geotechnical and Geoenvironmental Desk Study (Ref 23), indicates that the potential for a UXO hazard to occur, and more specifically, the potential for unexploded WWI and WWII ordnance to exist at the Site is assessed as being likely. A detailed UXO Threat and Risk Assessment was recommended;
- The Environment Agency Flood map for planning (Ref 20) indicates that the Site is in an area characterised by low flood risk from river or the sea, meaning that this area has change of flooding of between 0.1% and 1% each year. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail. Areas of high risk from flooding border the Site to the east and south. High risk means that this area has a chance of flooding of greater than 3.3% each year;
- Online ALC mapping from Natural England (Ref 17) indicates that the Site is located in areas of Grade 4. Agricultural land is classified into five grades; where Grade 1 is best quality and Grade 5 is poorest quality. Grade 3 is further sub-divided into Subgrade 3a and Subgrade 3b, with Grades 1 to 3a considered best and most versatile (BMV) agricultural land and Grades 3b to 5 considered non BMV agricultural land; and
- The Geotechnical and Geoenvironmental Desk Study (Ref 23) indicates that “a full site investigation is recommended to confirm the ground conditions along the proposed tunnel route and at the location of the proposed shaft sites. This will include boreholes to below the anticipated tunnel invert and along the proposed tunnel route, near surface investigations for sealing end compound and head house design”. This applies for both the Gravesend and Tilbury sites.

Key Receptors

Tilbury

- 3.8.6 Human receptors on-site (high sensitivity receptors) are considered to be construction and maintenance workers; and future site users, including maintenance workers. Human receptors off-site (high sensitivity receptors) include neighbouring users, occupiers and the general public immediately adjacent to the Proposed Development.
- 3.8.7 Groundwater within the Principal aquifer (various chalk formations) are receptors of high sensitivity in relation to land contamination. Principal aquifers are classified by the Environment Agency as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. The Secondary (undifferentiated) aquifer in the alluvial deposits is of medium sensitivity.
- 3.8.8 Surface water receptors including the River Thames and the waterbody adjacent to the east of the Site have a medium sensitivity.
- 3.8.9 Property receptors (of medium sensitivity) include proposed infrastructure on-site and infrastructures/utilities in close proximity to the Site.

Gravesend

- 3.8.10 Human receptors on-site (high sensitivity receptors) are considered to be construction and maintenance workers; and future site users, including maintenance workers. Human receptors off-site (high sensitivity receptors) include neighbouring users, occupiers and the general public immediately adjacent to the Proposed Development.

- 3.8.11 Groundwater within the Principal aquifer (various chalk formations) are receptors of high sensitivity in relation to land contamination. Principal aquifers are classified by the Environment Agency as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. The Secondary (undifferentiated) aquifer in the alluvial deposits are of medium sensitivity.
- 3.8.12 Surface water receptors including the River Thames, unnamed watercourses and the Thames and Medway Canal have a medium sensitivity.
- 3.8.13 Property receptors (of medium sensitivity) include proposed infrastructure on-site and existing buildings/infrastructures/utilities in close proximity of the Site.
- 3.8.14 There are no sensitive ecological receptors located on-site. South Thames Estuary and Marshes SSSI, located 100 m south of the Site, is considered a high sensitivity receptor.
- 3.8.15 Soil resource on the Site is considered a potential receptor of low sensitivity.

Summary of Potential Effects

Potential Construction Effects

Tilbury and Gravesend

- 3.8.16 There is the potential for construction to affect human and controlled waters receptors and for the ground conditions to impact on the design of the proposed development. Potential impacts include, but are not limited to:
- mobilising existing contamination in soil and groundwater as a result of ground disturbance (due to the installation of foundations/ structures) and dewatering (if needed) during construction;
 - increasing the potential for contaminants in unsaturated soils to leach to groundwater in open excavations during construction;
 - increasing the potential for contaminated surface run-off to migrate to surface water and groundwater receptors as a result of leaching from uncovered stockpiles;
 - discharge of water from dewatering to surface watercourses;
 - introducing new sources of contamination, such as fuels and oils used in construction plant;
 - creating preferential pathways for the migration of contamination and gases, for example along new below ground service routes, service ducts and as a result of dewatering; and
 - introducing new human health receptors such as site staff during construction.

Potential Operational Effects

Tilbury and Gravesend

- 3.8.17 It is not anticipated that there would be interaction with groundwater or ground disturbance during the operational phase. Therefore, operational effects are not likely to be significant in relation to Geology and Hydrogeology.

Potential Cumulative Effects

- 3.8.18 Provided that the requirements of relevant policy and legislation relating to land contamination and remediation are adopted in design and that appropriate mitigation measures are applied during the construction phases of each development, it is considered that the residual cumulative effects of the identified developments on ground conditions would be not significant.
- 3.8.19 It is considered that there should be a beneficial cumulative effect to the local environment as any identified contamination within each development site will be managed as part of that development. In addition, should any remediation works, or the removal of contaminated soils associated with the

preparatory ground works, be carried out on these development sites as part of their development, this would be expected to result in a beneficial effect to the local environment.

Mitigation

Tilbury and Gravesend

- 3.8.20 There is potential for contaminative land uses to have been present within both the Sites and in the surrounding areas. The National Planning Policy Framework (NPPF), Paragraph 183. a), states that *“a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination”* and *“where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner”*.
- 3.8.21 In line with the Environment Agency’s Land Contamination Risk Management (LCRM) (Ref 25), assessment of land contamination will take the form of a tiered, risk-based approach, as summarised below:
- **Tier 1:** preliminary risk assessment based on a desktop study of available information to identify potential sources of contamination, receptors to contamination and potential pathways between them. The identified sources, pathways and receptors are presented in the form of an initial Conceptual Site Model (CSM) showing the potential contaminant linkages (PCL);
 - **Tier 2:** If PCL are identified, this means there is a theoretical risk to receptors from contamination. Therefore, intrusive investigation should be used to provide data to inform a generic quantitative risk assessment (GQRA). The GQRA involves comparison of site-specific, laboratory analytical data against appropriate generic assessment criteria (GAC) for human health and/or controlled waters which represent minimal or tolerable risk; and
 - **Tier 3:** detailed quantitative risk assessment to identify whether contamination identified above minimal or tolerable risk levels represents an unacceptable risk and therefore requires remediation.
- 3.8.22 A number of environmental design and management measures will be employed as standard best practice to minimise impacts to human health, controlled waters and soil resources during the construction of the Proposed Development. These will be incorporated into the Outline CEMP to be prepared alongside the Environmental Appraisal Report. Potential environmental impacts that will be avoided, prevented, reduced or offset through the implementation of these mitigation measures include:
- human exposure through direct contact/inhalation/dermal uptake of contaminants;
 - creation of preferential pathways and mobilisation of contamination;
 - contamination of natural soils, contamination of groundwater with concrete, paste or grout;
 - pollution and degradation of water quality of any underlying aquifer;
 - infiltration and/or runoff into the local drainage/sewerage network - pollution of drainage and sewerage network and any adjacent surface water features;
 - run-off and infiltration of contaminants from material stockpiles;
 - contamination of drainage and sewerage network and/or groundwater; and
 - spread of nuisance dusts and soils to the wider environment and local roads.
- 3.8.23 A ground investigation is currently on-going at the Site, to characterise existing ground conditions. It is assumed that the works will be completed in accordance with BS10175:2011+A2:2017 (Ref 24) and the Environment Agency’s LCRM guidance (Ref 25) as well as other relevant standards and guidance. Such investigations have been undertaken in conjunction with geotechnical investigations in order to provide additional data upon which risks, impacts and effects can be assessed. The investigation will allow a quantitative assessment as to whether any of the potential risks identified are present and are of material concern to the Proposed Development. Subject to the findings of intrusive investigations, a site-specific Remediation Strategy (and subsequent verification reporting) may be required if contamination is encountered or considered to pose an unacceptable risk.

- 3.8.24 Page 40 of the Geotechnical and Geoenvironmental Desk Study (Ref 23) indicates that “*there is risk of compressible ground and running sand in both proposed sealing end compound areas*”. The risk to land stability will be considered as part of the geotechnical design, ensuring that the risk is designed out. Section 5 of the Geotechnical and Geoenvironmental Desk Study (Ref 23) includes several geotechnical considerations and recommendations to be considered during construction.

Summary

- 3.8.25 On the basis of the above, the potential for contaminative land uses has been identified at both the sites and in the surrounding areas. A Phase 1 Preliminary Risk Assessment (PRA) report, to be completed in accordance with the Environment Agency’s Land LCRM guidance and the NPPF, will be undertaken for both of the sites and submitted to the Local Planning Authorities. Although the existing Geotechnical and Geoenvironmental Desk Study (Ref 23) provides an indication that potential ground contamination may be present at the Site, it does not include a risk assessment and would not be considered to meet the requirements of LCRM (Ref 25).
- 3.8.26 The primary objective of a Phase 1 PRA report is to identify potential land quality liabilities and contamination risks at the sites. Potential liabilities and risks in this context may derive from:
- Contamination due to past and current uses of the site and surrounding land, in the context of the environmental sensitivity of the site setting;
 - Changes in land use; and
 - Potential natural ground hazards and constraints associated with the local ground conditions.
- 3.8.27 It is anticipated that the results and recommendations of the Phase 1 PRA, once incorporated into the Draft CEMP, along with the environmental design and management measures for the construction, operation and decommissioning phases, will negate the need for a statutory geology and hydrogeology assessment.

3.9 Surface Water Environment and Flood Risk

Baseline Environment

Features and Attributes

- 3.9.1 For the assessment of potential significant effects on the surface water environment and flood risk and taking into account the nature of the proposed development, a study area considering the immediate environs of the above ground working areas was assessed in addition to the Thames estuary. Impact sources and receptors have been considered at the appropriate scale taking into account site-specific conditions. Details of this are provided below.

Tilbury

- 3.9.2 The Tilbury site situated just north of the Thames estuary at an approximate elevation of around 5 m AOD. To the east of the former power station concrete base in the southern portion of the Site, there is an overwide drain that runs generally north to south. This may be connected to the Thames via a sluice gate or other similar structure, with tide locking events a contributing factor to the overwide nature of the drain. To the southeast the land has been extensively worked with large areas of bare ground that may be being used for the storage of aggregates and other materials. This has led to significant changes to natural land drainage, that would likely have been coastal marsh in the past before the creation of river flood defences. Another linear drainage feature runs north to south to the east of West Road, then east to west to the north of an access road and the area of ash deposition for the former power station. To the east of this area of ash placement, another linear drainage feature is located. These two features are also over wide and it is not evident from online aerals and digital mapping whether they have any flow or connectivity with the Thames Estuary. Rather than being drains, they may alternatively be artificial linear ponds and wetland features that are a product of past land use change.

Gravesend

- 3.9.3 The Gravesend site is around 200m south of the Thames estuary and at an elevation of just above sea level at approximately 4m above ordnance datum (AOD) (Ref 26). It is bordered by a series of drainage ditches that are part of Eastcourt Marshes. These are designated as Main Rivers by the Environment Agency. From a review of online aerial imagery, the existing substation site appears to be surrounded by a drain, although to the west it appears to be increasingly dry and not connected to the Thames Estuary. To the east, the drain is approximately a few meters wide and it enters a structure through flood embankments along the southern margin of the Thames Estuary. It is unclear whether there is a free-flowing connection with the estuary, with it being more likely that there are tidal flap gates that impound the flow in the ditch at high tide. Approximately 100 m south of the site is the Thames and Medway Canal. This canal was used until 1934 but is now disused and only an isolated open reach approximately 3km long still exists. As this water feature is upstream of the site, it is unlikely to be impacted.
- 3.9.4 The Gravesend site is within a Nitrate Vulnerable Zone (NVZ), which is a designated area where land and water resources are susceptible to nitrate pollution, primarily from agricultural sources such as fertilisers and manure. However, this designation is not relevant to the assessment of impacts and would not be considered any further. The Site is not within a Drinking Water Protected Area (surface water) or Safeguard Zone (surface or groundwater).
- 3.9.5 Although the Tilbury site is nominally located within the Mardyke operational catchment, and the Gravesend site is located within the Medway Lower Operational catchment (Ref 28), they are not hydrologically connected to these WFD watercourses. Rainfall at the sites does not contribute to the Mardyke or Medway Lower flows, with surface water runoff ending up in the Thames estuary directly. There is no WFD water body classified for this part of the operational catchment and thus no WFD status for any watercourse present. Both sites are effectively in the Thames Middle water body catchment, although given the very different nature of the Thames Estuary the WFD classification for this water body would not be a suitable proxy for the small coastal drainage ditches present on the sites.

Thames Estuary

- 3.9.6 The Thames estuary at this location is tidal and is identified under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 and Thames River Basin Management Plan (RBMP) as the Thames Middle waterbody (Waterbody ID: GB530603911402).
- 3.9.7 The Thames Middle is a large heavily modified transitional water body (TRaC) with a surface area of 44.2km². Under cycle 3 (2019) of the Thames RBMP (Ref 27) it is currently at Moderate Ecological Potential (but Good in regard to fish, invertebrates, macroalgae and phytoplankton) and failing to meet Good Chemical Status. The Reasons for Not Achieving Good (RNAG) Ecological Status are listed on the catchment data explorer website (CDE) (Ref 27) as diffuse pollution from urban development, contaminated sediments, landfill leaching, sewage discharge and physical modifications. This water body had the objective of achieving Moderate Ecological Status by 2015, due to disproportionate costs and burdens and good status being prevented by an artificial/ heavily modified designated use (Ref 28). The disused Thames and Medway Canal is not a designated artificial WFD water body.
- 3.9.8 The closest gauging station recording fluvial discharge of the Thames estuary is at Kingston approximately 74 km upstream of the proposed development and therefore will not accurately reflect hydrological conditions within the study area as the Thames is tidal.
- 3.9.9 There is the potential for licenced and unlicenced water abstractions that will need to be confirmed with the Environment Agency and LPA.
- 3.9.10 The South Thames Estuary and Marshes SSSI is located approximately 600 m to the east along the Thames estuary. It is a water dependant designated site with a diversity of habitats including grazing marsh, saltmarsh and mudflats. The Thames Estuary and Marshes Ramsar and Thames Estuary and Marshes Special Protection Area (SPA) are also approximately 600 m to the east. However, the risk from water pollution effects to these designated sites will be limited by available dilution and dispersion of any potential contamination in the estuary, as well as potential tidal influences on the impact pathway. Other downstream designated sites include Mucking Flats and Marshes SSSI (2.3km to the northeast) (as shown on Figure 3a, Appendix A – Figures), which at this distance is less likely to be affected by water.
- 3.9.11 At this stage there is no detailed information on any water resources (e.g. discharge consents, licenced or unlicenced water abstractions) that may be affected. The Defra Discharges to Water and Groundwater website (Ref 29) shows that there are discharges by companies such as Southern Water, Anglian water, and the National Grid within the study area. Further detail on what these discharges will be obtained via a data request to the Environment Agency.

Flood Risk Baseline

Fluvial/Tidal Flood Risk

- 3.9.12 The Environment Agency Flood Map for Planning (Ref 30) shows that the Tilbury site and Gravesend site are located within Flood Zone 3. Flood Zone 3 is defined as land which in any year has a 1% or more chance of flooding from rivers, or a 0.5% or more chance of flooding from the sea when flood defences are not considered. The Environment Agency's Reduction in Risk of Flooding from Rivers and the Sea due to Defences (Ref 31) shows that the majority of the Tilbury and Gravesend sites are in an area where there is a reduction in risk of flooding from rivers and the sea due to defences present along the banks of the Thames estuary. The design standard of protection of the defences for both sites is up to the 0.1% AEP event. The main source of flooding for both sites is due to the Thames estuary. As mentioned in the previous sections there are two unnamed ordinary watercourses within close proximity to the Tilbury site and a series of ditches that are part of Eastcourt Marches which are recognised as Main River which bound the east and south of the Gravesend site. See Figure 3b (Appendix A – Figures).

Surface Water Flood Risk

- 3.9.13 The Environment Agency Flood Risk from Surface Water (Ref 32) map indicates that at the Tilbury site, there are areas of medium to high risk from surface water flooding. Medium risk means that the

area has a chance of flooding of between 1% and 3.3% each year. High risk means that the area has a chance of flooding of greater than 3.3% each year. At the Gravesend site, the majority of the site is located within an area of very low risk from surface water flooding. Very low means that the area has a chance of flooding of less than 0.1% each year. At the southern and eastern boundary of the site, there are areas of medium risk associated with the Main River. See Figure 3b (Appendix A).

- 3.9.14 As the current Tilbury site is mainly impermeable land, it is expected that surface water runoff drains into existing sewers/the surrounding ditch network. It is expected that any surface water runoff from the greenfield parts of the site infiltrates into the ground.
- 3.9.15 The Gravesend site is currently greenfield and it is therefore assumed that surface water runoff from the site infiltrates into the ground. A Drainage Strategy will be required to confirm the management of surface water runoff from the Proposed Development to ensure no increase in flood risk.

Groundwater Flood Risk

- 3.9.16 Figure 3-5 in the Thurrock Local Flood Risk Management Strategy (Ref 33) maps the Areas Susceptible to Groundwater Flooding which indicates that the Tilbury site is located in an area where the susceptibility to groundwater flood emergence is <25%. According to Figure 7-3 in the Strategic Flood Risk Assessment of Kent Thameside (Ref 34), the Gravesend site is not located within a groundwater risk area. There are no recent site-specific ground investigations which confirm the depth of groundwater beneath the sites.

Other Sources Flood Risk

- 3.9.17 The Environment Agency Flood Risk from Reservoirs (Ref 35) map indicates that the Tilbury site and Gravesend site are not located within an area at risk of flooding from reservoirs when river levels are normal or when there is also flooding from rivers.

Potential Construction Effects

- 3.9.18 The proposed development includes a new 2.14km tunnel (from headhouse to headhouse) underneath the River Thames and associated infrastructure either side of the River. Shaft headhouses and sealing end compounds will be located either side of the proposed pipeline in close proximity to the River Thames. The shaft headhouse located on the north bank looking downstream is approximately 450m from the estuary and the shaft headhouse on the south bank are less than 200m from the River Thames. There will also be the reconfiguration of new overhead lines and pylons at both sites.
- 3.9.19 There may be potential to impact on flood conveyance routes during construction if materials are stored within the floodplain. Appropriate mitigation measures will be implemented where required to minimise the impact on flood conveyance routes.
- 3.9.20 During construction, appropriate measures will be implemented when tunnelling beneath the River Thames flood defences to ensure no negative impacts on the structural integrity of the Tidal Thames Defences due to settlement. These measures will be provided by the contractor and documented within the site-specific Flood Risk Assessment (FRA).
- 3.9.21 There are potential impacts on workers and machinery during construction due to fluvial, tidal, surface water and groundwater flood risks. Flood defences are present along the River Thames which offer protection from tidal flooding to both sites. The sites will be signed up to the Environment Agency Flood Warning Service so in an unlikely flood event where defences could be overtopped, workers can be warned and evacuate the sites. Appropriate mitigation measures will be implemented to mitigate the risks from the other sources of flooding.
- 3.9.22 There are potential impacts on groundwater flood risk during construction due to piling and tunnelling. Although strategic evidence suggests groundwater flood risk is not an issue at the sites, it is likely that groundwater will be present due to the extensive alluvium and chalk, and further ground investigation will be required to confirm the depth of groundwater. Appropriate construction methods will be implemented to ensure flood risk is not increased to both the sites and to third

parties. Overall, there are unlikely to be any significant flood risk effects to receptors during construction.

- 3.9.23 Impacts on surface (and ground) water quality due to deposition or spillage of soils, sediments, oils, fuels, or other construction chemicals may occur during construction works. However, through careful management and the implementation of best practice mitigation measures (e.g. as described in General Pollution Prevention guidance documents, Construction Industry and Research Associated guidance C692, C650, C648 etc.) these risks can be effectively managed and significant environmental effects on nearby drainage ditches (direct impacts) or the Thames estuary (indirect impacts) should not occur.
- 3.9.24 There is the potential for a temporary increase in the volume and rate of surface water runoff from bare earth or new impervious areas, changes in surface water flow paths, or dewatering of excavations including the tunnel construction. The temporary storage, potential dewatering and transportation of very large quantities of arisings from the tunnelling operations will require a large area and a robust surface water runoff strategy with measures to filter fine sediments and control the risk of chemical contamination.
- 3.9.25 Runoff control and filtration would be used on site to prevent sediment runoff into the Thames (indirectly via other watercourses) or unnamed watercourses in the vicinity of each site (directly but noting that flow pathways to the Thames are far less certain from the Tilbury site given extensive workings of the land to the southeast of the site). This would apply to sediment stored from construction of both AGI sites and sediment removed as part of the shaft and tunnel excavation. Material removed by the TBM will surface in a mostly liquid form mixed with bentonite to ease removal from the tunnel and this will most likely require a separate plant, that will require adequate space and storage volume. The estimated total volume of excavated material is 69,600 m³. The duration of temporary stockpiling of material will be minimised and any material stored will be done in line with best practice to ensure no leeching takes place (e.g. provision of geotextile liners). Areas where excavated material is transferred into removal HGVs must also be planned with best practice procedures to prevent runoff of sediment heavy water. HGV removal of material is expected to happen Monday to Friday and Saturday mornings. Where slurry treatment or spoil bins are used best practice should be followed to prevent spills or leaks. The type of removed material will depend on which type of TBM is chosen for the project (e.g. either Earth Pressure Balance or Slurry Machines).
- 3.9.26 It is also expected that during tunnelling operations there will be a need to implement a dewatering strategy. Should the need arise for any discharge of dewatered groundwater from the sites as a result of construction works, this would be discussed with Thames Water/Environment Agency and any attenuation and treatment requirements agreed depending on the discharge strategy.
- 3.9.27 Depending on the type of TBM selected, different chemicals will be used. General chemicals include, tail sealant, main bearing grease, hydraulic oil. Although generally insoluble in water with good qualities of biodegradation, they must be prevented from discharge into watercourses and on site. Additionally, the annulus of the TBM needs to be grouted to ensure equal loading of the tunnel rings, this is usually done with a bentonite or pea-gravel based grout. With regard to tunnelling through the chalk aquifer, chemicals to be used must be non-toxic, inert and be fast setting to minimise the risk of contamination. An annulus grout that is well suited for the chalk must be chosen and engagement must be taken with the Environment Agency. It is also expected that the Contractor will use good Industry Practice in the operation of the TBM during the tunnelling works. In addition, the tunnel will be concrete lined but using pre-cast concrete blocks delivered to site to avoid the need for a concrete batching plant on site.
- 3.9.28 At immediate risk from sediment laden runoff or chemical spillages are the drains and ditches in and around the two sites. Based on the initial baseline assessment, these water features are likely to be of low importance. The Thames estuary, which is likely to be classed as a high or very high importance water feature, is only at risk indirectly, via these drains and ditches. Connectivity from the Tilbury Site to the Thames is less obvious and there may not in fact be a discharge. This is important as it is the north bank where shaft and tunnel arisings are to be temporarily stored and processed. The Thames also has a high dilution and dispersion potential and is naturally a more turbid aquatic environment where fauna and flora are adapted to higher suspended sediment levels.

- 3.9.29 The key issue is the permanent disposal of the material removed from the tunnel during construction. At present there is no firm proposals for what will be done with this material. However, promising discussions have been held with the RSPB about using excavated material in the formation of wetlands at RSPB Cliffe Pools roughly 5.5km to the north east on the north bank of the Thames estuary. If this is the case, the re-use of the material (assuming suitable for re-use) will potentially contribute to the creation of new habitat, which is likely to be a significant beneficial effect on the water environment. If alternative proposals are made this screening assessment may need to be reviewed.
- 3.9.30 It is estimated that around 200 staff will work on the project in multiple shifts during construction of the tunnel. Welfare facilities for these staff across both sites will need to be provided, included management of foul waste and water supply. It is unknown at this stage whether either compound can connect to a public sewer or mains water supply, although where this is not possible there are alternative options. For foul waste, due to the temporary nature of the works it is assumed that foul waste would be stored in a tank and regularly emptied by a suitable waste management contractor for disposal off-site. The number of staff that will be on site for the Headhouse and SEC construction is currently unknown.
- 3.9.31 At this stage it is assumed that existing site accesses will be used for temporary works and in the long term, and that there will be no construction of new, or widening of existing accesses across watercourses. Should this be required the design of the crossings should be clear-span where possible or any culverting proposed following the hierarchy of least impacting culvert design and incorporating proportionate measures to mitigate impacts. This may include some compensatory enhancement of drainage ditches nearby as it is not possible to mitigate for all the impacts through the design of culverts alone. Any compensatory mitigation should be on a 'like for like' basis. There will be no works along the Thames Estuary including any temporary or permanent works below Mean High Water Spring (other than tunnelling operations below ground).

Potential Operational Effects

- 3.9.32 During operation there will be new impermeable surfaces at both sites and an increase in surface water runoff (refer to dimensions in Table 2-2 in section 2). Runoff from the roofs of new buildings and accesses will contain diffuse urban pollutants. However, the use of sustainable drainage systems (SuDS) or proprietary measures (if well maintained) where SuDS are not possible can be effective in reducing water quality risks from urban runoff. A Drainage Strategy will be required to ensure surface water runoff will be managed so that there is no increase in flood risk as a result of the Proposed Development.
- 3.9.33 There are potential impacts on groundwater flooding to the Proposed Development as a result of the tunnelling. The tunnelling will be designed to prevent water ingress to mitigate this risk.
- 3.9.34 Data will be requested from the Environment Agency to confirm the tidal flood risk from the Thames estuary and the fluvial risk from surrounding watercourses to inform mitigation measures. This will be detailed within the FRA.
- 3.9.35 There is a residual risk of tidal flooding to the Proposed Development if the Thames estuary flood defences are breached. The Environment Agency will be contacted to request breach data as part of the FRA and this will be used to confirm mitigation at the sites.
- 3.9.36 Some new infrastructure on the sites such as electrical switchgear/transformers may contain oil or other environmentally harmful chemicals. This equipment will likely be self banded or banded to a minimum 110% capacity to ensure that should a chemical leak occur it is contained on site where it can be removed in a suitable way.
- 3.9.37 During operation both sites will be unmanned, and although they will have welfare facilities for infrequent site visits, usage will be very low. It is assumed at this stage that any foul waste water will be connected to the nearest public sewer.

Potential Cumulative Effects

- 3.9.38 A number of proposed and consented developments have been identified and are presented on Figure 6a-c (Appendix A – Figures). However, providing all developments adopt and implement best

practice mitigation measures, the risk of significant cumulative effects can be reduced and minimised through standard best practices, to an extent to which they can no longer be considered significant.

Summary

- 3.9.39 The proposed development poses a risk of adverse impacts to surface water features in terms of water quality or resources as well as the potential for flood risk effects to third party receptors. For water features, this is primarily during construction works and linked to the expected large volume of shaft and tunnel arisings that will need to be processed and disposed of. This will require a large area and may involve dewatering operations to dry the sediment prior to transportation from the site to the disposal / reuse site. However, although a significant operation, providing there is adequate space and storage volumes, and with careful planning and the implementation of best practice mitigation measures, significant adverse effects on the water environment should be avoidable.
- 3.9.40 These best practice mitigation measures will be described on the non-statutory Environmental Appraisal Report supported by a WFD assessment to confirm compliance with the Water Environment (WFD) (England and Wales) Regulations 2017. With regards to the potential for flood risk effects, mitigation measures will be informed by a site-specific FRA which will assess flood risk to and from the Proposed Development, and a Drainage Strategy which will detail how surface water from the sites will be managed.

3.10 Materials and Waste

Baseline Environment

- 3.10.1 The study areas (Proposed Development study area and expansive study area) for the materials and waste are defined in line with the Institute of Environmental Management and Assessment (IEMA) Guide to: Materials and Waste in Environment Assessment, Guidance for a Proportionate Approach (referred from herein as the 'IEMA Guidance') (Ref 36).
- 3.10.2 The Proposed Development study area for construction and operational waste generation, use of construction and operational materials (key construction materials only), impacts on safeguarded mineral and waste sites and presence of Mineral Safeguarding Areas comprises the Proposed Development EIA Screening Boundary (Figure 2 in Appendix A – Figures).
- 3.10.3 Impacts on Mineral Safeguarding Areas (MSAs) are not assessed in a materials and waste assessment in accordance with the IEMA Guidance (Ref 36) but are covered in the baseline section to provide context.
- 3.10.4 The expansive study area for non-hazardous waste management (specifically landfill capacity) comprises the East of England and South East regions. The study area includes the following sub-regions as outlined in the Environment Agency's (EA) 2021 Waste Summary Tables for England - Version 3 (Ref 37):
 - Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk;
 - Berkshire, Buckinghamshire, East Sussex, Hampshire, Isle of Wight, Kent, Oxfordshire, Surrey and West Sussex.
- 3.10.5 The expansive study area for non-hazardous and inert waste management is defined based on professional judgement and informed by consideration of the proximity principle (that waste should generally be managed as near as possible to its place of production).
- 3.10.6 The expansive study area for hazardous waste management is England. This study area is also defined based on professional judgement and informed by consideration of the proximity. The proximity principle for hazardous waste in England is outlined in Principle 2 - Infrastructure Provision in the Strategy for Hazardous Waste Management in England (Ref 38) *"We look to the market for the development of hazardous waste infrastructure, which implements the hierarchy for the management of hazardous waste and meets the needs of the UK to ensure that the country as a whole is self-sufficient in hazardous waste disposal, facilities are put in place for hazardous waste recovery in England, and the proximity principle is met"*. Planning for hazardous waste management is also undertaken at national level.
- 3.10.7 The expansive study area for availability of key construction materials (aggregates, asphalt, concrete and steel) is national (United Kingdom or Great Britain dependent on baseline information availability) and the East of England and South East regions.
- 3.10.8 Baseline data relevant to the Proposed Development EIA Screening Boundary and expansive study areas is set out below.

Tilbury

- 3.10.9 The Proposed Development lies within the boundary of one historic landfill (Tilbury B Power Station Fort Road authorised for inert waste with first input in 1978) (Ref 39) and two authorised landfills (R W E n Power plc Tilbury B Power Station Fort Road and Ingrebourne Valley Ltd Tilbury Ash Disposal Tip) (Ref 39). See Figure 3b in Appendix A.
- 3.10.10 There are no other permitted waste sites or waste site applications in the vicinity (within 500m) of the Proposed Development (Ref 40).
- 3.10.11 The Thurrock Council Core Strategy and Policies for Management of Development (Ref 38) safeguards MSAs, mineral and waste sites however, the associated Policies Map (Ref 43) does not show any MSAs or safeguarded mineral or waste sites (policy "CSTP32 Safeguarding Mineral Resources", "CSTP29 Waste Strategy" and "Strategic Spatial Objective SSO15").

3.10.12 Thurrock Council are working on a new Local Plan and the preparation of a Minerals and Waste Local Plan is currently under review (Ref 41). The documents will set out MSAs and safeguarded mineral and waste sites.

Gravesend

3.10.13 There are no historic or authorised landfill, permitted waste sites or waste site applications in the vicinity of the Proposed Development. The closest site is the Shamrock Road historic landfill approximately 480m south west of the works (Ref 39, Ref 40 and Ref 41).

3.10.14 There is a safeguarded wharf (Clubbs Marine Terminal) approximately 420m from the west of the Proposed Development (policies “CS07 Economy, Employment and Skills” and “CS11 Transport” of the Gravesham Council Local Plan and policies map (Ref 45) and policy “CSM 6 Safeguarded Wharves and Rail Depots” of the Kent Minerals and Waste Plan (Ref 47).

3.10.15 There are no safeguarded mineral or waste sites in the vicinity of the Proposed Development. The Proposed Development lies within a MSA for sub-alluvial river terrace deposits (Policy CSM 5 Land-won Mineral Safeguarding) (Ref 47). Whilst MSAs are not considered in a materials and waste assessment further consultation with the Minerals Planning Authority may be required prior to the submission of the planning application later in 2023, and a Minerals Safeguarding Assessment completed if required.

Construction Materials

3.10.16 UK and GB and regional data has been used to establish a quantitative national and regional baseline of the consumption (proxy for availability) for key constructional materials. Table 3-11 summarises national consumption in 2018 for aggregates, asphalt, concrete and steel (the most recent years for which data is available), which are the key construction materials expected to be used during the construction of the Proposed Development. Regional data is presented in Table 3-11. Construction material sales by region are provided for the regions surrounding the Proposed Development. It is assumed that the majority of key construction materials would be sourced locally, taking into account the proximity principle and value for money.

Table 3-11: National Consumption and Demand for Key Construction Materials

Material	National Consumption (Million Tonnes, Year)	Baseline Data Year	Data Description	1% of National Consumption (Tonnes)	5% of National Consumption (Tonnes)
Steel	17	2018	UK total consumption (Ref 48)	170,000	850,000
Aggregates of which:	251	2018	Minerals and mineral products sales in Great Britain (Ref 49)	2,510,000	12,550,000
Crushed rock	117.3			1,173,000	5,865,000
Sand and gravel - land won	48.9			489,000	2,445,000
Sand and gravel - marine	13.7			137,000	685,000
Recycled and secondary	71			710,000	3,550,000
Asphalt	25.4			254,000	1,270,000
Concrete of which:	86.2			862,000	4,310,000

Material	National Consumption (Million Tonnes, Year)	Baseline Data Year	Data Description	1% of National Consumption (Tonnes)	5% of National Consumption (Tonnes)
Ready-mixed concrete	54.2			542,000	2,710,000
Concrete products	32			320,000	1,600,000

Table 3-12: Construction Material Sales by Region (Ref 49)

Construction Material	East of England	South East
Crushed Rock (million tonnes)	0	0
Sand and Gravel (million tonnes)	13.7	16.1
Ready-mixed Concrete (million m ³)	1.5	2.4
Asphalt (million tonnes)	2.5	1.9

3.10.17 There is no publicly available information on any potential long-term changes to this national and regional construction material availability by the time of construction of the Proposed Development. Construction material demand such as ready mixed concrete is closely aligned to both the quantity of construction taking place and the general economy therefore it is deemed inappropriate to forecast future demand as the demand is unlikely to be linear. It is therefore not possible to set a future baseline for resources. Therefore, future consumption is assumed to same as the current baseline as outlined in Table 3-11 and Table 3-12.

Landfill Capacity

3.10.18 Remaining landfill capacity at the end of 2021 as outlined on the EA's 2021 Waste Summary Tables for England – Version 3 (Ref 37) for the non-hazardous and inert waste expansive study area (East of England and South East) and the hazardous waste study area (England) is shown in Table 3-13. Total non-hazardous landfill capacity in the East of England and South East was 99 million m³. Hazardous waste landfill capacity in England was 1.3 million m³.

3.10.19 Merchant landfills are operated for commercial purposes accepting waste from construction projects and operating businesses. Merchant landfills are therefore considered to form the baseline. In contrast, restricted landfills are sites that deal with their own produced waste (i.e. not operating for commercial purposes) and therefore additional capacity is excluded from the baseline. Some non-hazardous landfill have a Stable Non-Reactive Hazardous Waste Cell (SNHRW) e.g. for asbestos. SNHRW cells usually form only a small fraction of the overall capacity therefore for assessment purposes non-hazardous landfills with SNRHW cells are considered in the same way as non-hazardous landfills.

Table 3-13: Landfill Capacity (2021) in East of England, South East and England

Landfill Type	Sub-Region			
	East of England	South East	Total in East of England and South East	England
	Capacity ('000s m ³)			
Hazardous Merchant	-	121	121	12,528
Non-hazardous with SNRHW Cell	4,679	12,556	17,235	54,175
Non-hazardous	18,511	19,184	37,695	160,203
Inert	24,089	20,084	44,173	130,706
Total Non-hazardous and Inert	47,279	51,824	99,103	345,084

- 3.10.20 There is no publicly available information on any potential changes to this landfill capacity by the time of the construction or operation of the Proposed Development.
- 3.10.21 Due the cyclic nature of inert and hazardous landfill capacity, it is not realistic forecast future landfill capacity since this may result in an increase in landfill capacity (due to increases in capacity as new sites are developed). Therefore, inert and hazardous landfill capacity is assumed to remain the same as the current baseline outlined in Table 3-13.
- 3.10.22 For non-hazardous capacity using the current rate of decline of landfill capacity and forecasting into the future would lead to the inevitable conclusion that there would be no void space remaining. However, this is not a credible scenario: if there is still a need for landfill, then the waste planning authority will need to consent new landfill capacity to replace that which has been used up. Therefore, non-hazardous landfill capacity is assumed to remain the same as the current baseline outlined in Table 3-13.

Construction Waste Management

- 3.10.23 The national target for recovery of construction and demolition waste is 70% by weight, as set out in the Waste Framework Directive (FD) (Ref 50) and the Waste Management Plan for England (Ref 51). The target specifically excludes naturally occurring materials with European Waste Catalogue (EWC) Code 17 05 04 (17 05 04 soil and stones other than those mentioned in 17 05 03* (soils and stone containing dangerous substances)). Recovery is deemed to include reuse, recycling and other recovery e.g. energy recovery.
- 3.10.24 A good practice landfill diversion target of 90% has been achieved and exceeded by major UK developments as outlined in the IEMA Guidance (Ref 36). In 2018, the UK generated 67.8 million tonnes of non-hazardous Construction and Demolition (C&D) waste, of which 62.6 million tonnes was recovered. This represents a recovery rate of 92.3% (Ref 52).
- 3.10.25 Standard, good and best practice recovery rates by material are provided by Waste and Resources Action Programme (WRAP) (Ref 53). Recovery rates for key construction materials and other construction wastes relevant to the Proposed Development are provided in Table 3-14.

Table 3-14: Standard, Good and Best Practice Recovery Rates by Material

Material	Standard Recovery (%)	Practice Good Practice Recovery (%)	Best Practice Recovery (%)
Metals	95	100	100
Packaging	60	85	95
Concrete	75	95	100
Inert	75	95	100
Plastics	60	80	95
Miscellaneous	12	50	75
Electrical Equipment	Limited information	70	95
Cement	Limited information	75	95
Liquids and Oils	100	100	100
Hazardous	50	Limited information, cannot be 100% since some hazardous waste e.g. asbestos must be landfilled.	

3.10.26 As set out in the National Grid's 'Our 2021–2026 Environmental Action Plan' dated April 2021 by 2026 National Grid aims to:

- achieve zero-waste to landfill across construction projects;
- reduce the waste intensity of construction projects year on year;
- pilot and implement circular economy principles by aligning the business to internationally recognised standards, e.g. BS 8001– circular economy standards;
- increase construction recycling and composting rates and set a target from a 2021/22 baseline;
- align Procurement Strategy to internationally recognised standards, e.g. ISO20400 Sustainable Sourcing Standard;
- increase operational and office recycling rates from 45% and 46% (respectively) to 60%; and
- maintain high standards of oil containment and pollution management.

Key Receptors

3.10.27 The sensitive receptors for construction and operational impacts are:

- Landfill void capacity in the expansive study areas of the East of England and South East regions (non-hazardous and inert landfill void capacity), and England (hazardous landfill void capacity) – as defined in the IEMA guidance(Ref 36) *“landfill is a finite resource, and hence – through the ongoing disposal of waste – there is a continued need to expand existing and develop new facilities, This requires the depletion of natural and other resources which, in turn, adversely impacts the environment.”*; and
- Materials, national and regional consumption of key construction materials – as outlined in the IEMA guidance (Ref 36) *“materials are, in their own right, sensitive receptors. Consuming materials impacts upon their immediate and (in the case of primary material) long-term availability; this results in the depletion of natural resources and adversely impacts the environment.”*

3.10.28 The IEMA guidance (Ref 36) *“does not consider waste processing and recovery facilities as sensitive receptors, rather: they are part of a system that has the potential to reduce the magnitude of adverse impacts associated with waste generation and disposal. Waste processing and recovery facilities are, hence, different to landfills, in that the latter are finite resources”*.

3.10.29 For landfill void capacity very high receptor sensitivity is selected as a worst case, since across construction and/or operation phases, the baseline/future baseline (i.e. without the Proposed Development) of regional inert and non-hazardous landfill capacity and national hazardous waste landfill capacity is:

- expected to reduce very considerably (by >10% for inert and non-hazardous and >1% for hazardous);
- end during construction or operation;
- is already known to be unavailable; or,
- would require new capacity or infrastructure to be put in place to meet forecast demand.

3.10.30 For construction materials medium receptor sensitivity is conservatively selected since, on balance, the key materials required for the construction of the Proposed Development are forecast (based on professional judgement):

- to suffer from some potential issues regarding supply and stock; and/or
- are available comprising some sustainable features and benefits compared to industry-standard materials.

Summary of Potential Effects

3.10.31 Screening has been undertaken taking into account relevant legislation, planning policy and guidance as set out in national, regional and local planning policy.

Potential Construction Effects

3.10.32 Potential construction effects are considered for the whole of the Proposed Development.

3.10.33 Table 3-15 summarises the likely types of materials that will be used and wastes that are likely to be generated during the construction of the Proposed Development.

Table 3-15: Construction Material Use and Waste Types Arising from the Construction of the Proposed Development

Construction Activity	Materials Used	Waste Types Generated
Site remediation / preparation / earthworks	• Fill material for construction purposes. • Primary / secondary / recycled aggregates for ground stabilisation. • Topsoil and subsoil for landscaping and restoration.	• Surplus excavated materials. • Surplus topsoil and subsoil. • Unsuitable and contaminated soils and excavated materials. • Vegetation from site clearance. • Clearance of other materials. • Tunnel arisings. • TBM slurry (if slurry method used).
Demolition	• Materials are not required for demolition works.	• Waste arisings from the required demolition of the existing M&E building at Tilbury.
Site construction	• Main construction materials including: • Steel • Aggregates • Asphalt and bituminous materials • In-situ cast concrete	• Excess, offcuts and broken / damaged construction materials. • Existing infrastructure removed during works. • Packaging from materials delivered to site.

Construction Activity	Materials Used	Waste Types Generated
	Precast concrete products (structural components, kerbs, drainage pipes, chambers and channels)	- Construction worker wastes from offices and welfare areas / canteens. - Waste oils from construction plant.

3.10.34 The exact types and quantities of materials anticipated to be used during construction of the Proposed Development are not yet known. However, it is anticipated that the quantities of construction materials required will be less than 5% of national and regional construction material demand (the point at which a moderate magnitude of impact is reached and at medium sensitivity would result in a moderate effect which is considered significant and set out in Table 3-11 and Table 3-12). Therefore, significant effects are unlikely.

Excavated Material

3.10.35 The Proposed Development includes a new bored tunnel under the River Thames. The excavation of the tunnel will generate tunnel arisings, however the quantities will be small in the context of regional landfill capacity (currently estimated as approximately 70,000 m³). In a worst-case scenario where all tunnel arisings are sent to landfill this would be less than 1% of regional landfill capacity (993,223 m³) (the point at which a minor magnitude of impact is reached and at very high sensitivity would result in a moderate effect which is considered significant). National Grid aims to achieve zero-waste to landfill across construction projects and promising investigations into opportunities to reuse tunnel arisings are underway. These include:

- the infill and restoration of saline lagoons ponds at RSPB Cliffe Pools or a neighbouring commercial operator;
- use as construction material for the various other large developments that are planned in the Tilbury area; and
- to support other restoration and wetland projects in the Tilbury area.

Demolition and Clearance Waste

3.10.36 Limited demolition (e.g. three pylons and a small building within the Tilbury works and one pylon within the Gravesend works) and clearance will be required for the construction of the Proposed Development. The quantities of demolition waste are anticipated to be small compared to the main construction wastes and less than 1% of regional landfill capacity.

Construction Waste

3.10.37 Based on the estimated construction value and the nature and scale of the works it is anticipated that the overall quantities of non-hazardous and inert construction waste will be less than 1% of regional landfill capacity (993,223 m³) (the point at which a minor magnitude of impact is reached and at very high sensitivity would result in a moderate effect which is considered significant).

3.10.38 Many non-hazardous and inert waste types have well defined waste management routes including recovery and are unlikely to be sent directly to landfill. A landfill diversion rate of at least 70% is likely to be achievable by the Proposed Development for non-hazardous waste excluding excavated materials.

3.10.39 At this stage no estimate of hazardous waste generation during construction has been undertaken. The quantities of hazardous waste e.g. oils, batteries, aerosol cans etc. are anticipated to be small compared to the overall construction waste arisings and anticipated to be less than 0.1% of the hazardous waste landfill capacity (12,528 m³) (the point at which a minor magnitude of impact is reached and at very high sensitivity would result in a moderate effect which is considered significant).

3.10.40 Many hazardous waste types have well defined waste management routes including recovery and are unlikely to be sent directly to landfill. Procedures for the storage and management of these wastes will be set out in the construction contractor's Site Waste Management Plan (SWMP).

3.10.41 Taking into account the above significant waste effects are unlikely.

Potential Operational Effects

- 3.10.42 Potential operational effects are considered for the whole of the Proposed Development.
- 3.10.43 The exact types and quantity of construction material use, and waste generation associated with the operation of the Proposed Development is not yet known.
- 3.10.44 During operation maintenance activities will be required. Waste arising from these maintenance activities during Proposed Development operation is expected to be negligible and less than construction. Materials and waste types will generally be the same to those generated by other National Grid sites; and wastes would be managed using established procedures and facilities. Therefore, significant effects are unlikely.

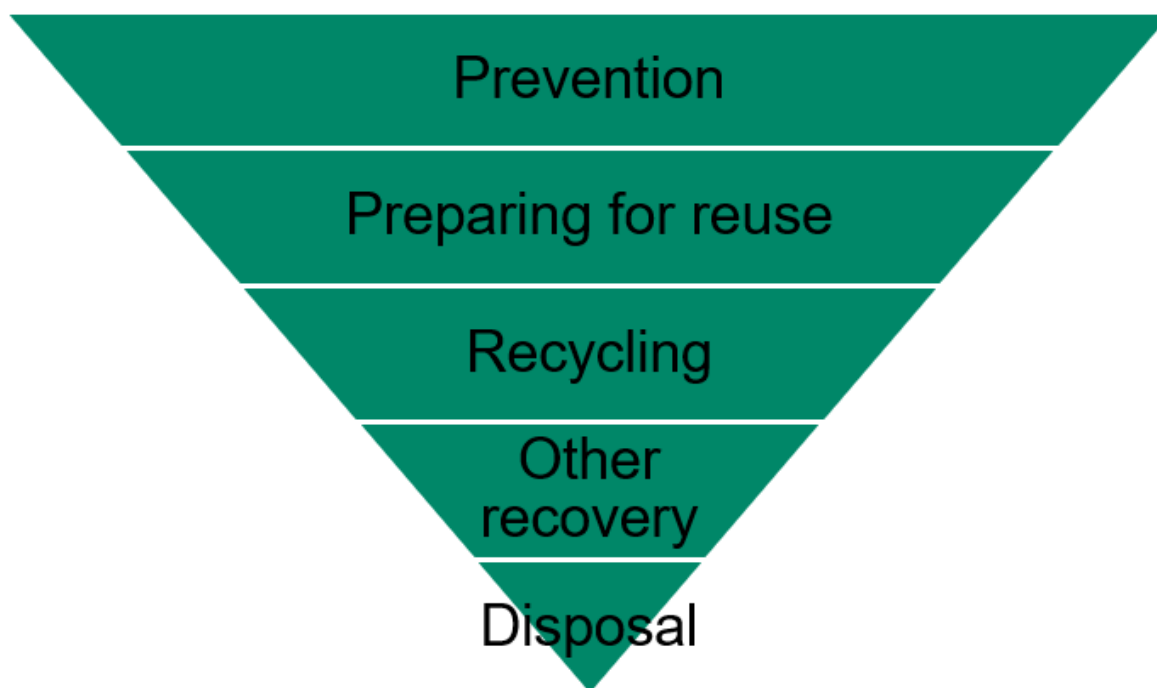
Potential Cumulative Effects

- 3.10.45 In regard to Materials and Waste, a detailed cumulative effects assessment has not been undertaken since:
- As part of their planning function, Waste Planning Authorities (WPAs) are required to ensure that enough land is available to accommodate facilities for the treatment of all waste arising in the area, either within the WPA area, or through export to suitable facilities in other areas; and
 - Minerals Planning Authorities (MPAs) are similarly required to ensure an adequate supply of minerals, sufficient to meet the needs of national and regional supply policies, and local development needs.
- 3.10.46 In preparing their waste management strategies, the WPAs already take into account waste generation at the regional and sub-regional scale, since these are the figures which are then used for determining the need for waste facilities. The landfill void capacity remaining (which is used to evaluate the effects of the Proposed Development) already takes into account the cumulative effects of waste generated by other developments, and hence a separate cumulative impact assessment is not required for waste.
- 3.10.47 It is therefore not necessary or feasible for each development within the region to, in effect, duplicate the function of the WPA as part of the EIA process.

Mitigation

- 3.10.48 Mitigation is considered for the whole of the Proposed Development.
- 3.10.49 The Proposed Development will aim to prioritise waste prevention, followed by preparing for reuse, recycling and recovery and lastly disposal to landfill as per the internationally recognised waste hierarchy (Plate 3-6).

Plate 3-6: The Waste Hierarchy (Ref 54)



3.10.50 The following mitigation measures will be considered and implemented where applicable during the design phases and subsequent construction work:

- **Designing for reuse and recovery:** identifying, securing, and using materials that already exist on site, or can be sourced from other projects.
- **Designing for materials optimisation:** simplifying layout and form to minimise material use, using standard design parameters, balancing cut and fill, maximising the use of renewable materials and materials with recycled content.
- **Designing for off-site construction:** maximising the use of pre-fabricated structure and components, encouraging a process of assembly rather than construction.
- **Designing for the future (deconstruction and flexibility):** identify how materials can be designed to be more easily adapted over an asset lifetime and how deconstructability and demountability of elements can be maximised at end of first life.
- **Designing for waste and material efficient procurement:** identify and specify materials that can be acquired responsibly, in accordance with a recognised industry standard.
- The construction contractor would be required to implement a CEMP and a SWMP would be prepared as part of the CEMP.
- The construction contractor would be required to implement a Materials Management Plan if one is required under the CL:AIRE Definition of Waste: Development Industry Code of Practice by the construction contractor to support the re-use of excavated materials, minimize off-site disposal; and to demonstrate the necessary lines of evidence to support the proper reuse/offsite disposal of materials and ensure compliance with regulatory guidance.
- Incorporation of “*appropriate facilities for the storage and recycling of waste*” as required by Gravesham Council (Ref 46) policy “*CS19: Development and Design Principles*”.
- Application of National Grid’s materials and waste targets as outlined in Paragraph 3.10.26.

Summary

3.10.51 Taking into account the baseline conditions, information available to date on the Proposed Development, the size and scale of the Proposed Development and the mitigation outlined above, significant effects in relation to materials and waste are unlikely.

3.11 Climate Change

Baseline Environment

- 3.11.1 According to the UK Climate Projections (2018), the average temperature over the most recent decade (2009-2018) for the UK has been 0.3 °C warmer than the 1981-2010 average and 0.9 °C warmer than the 1961-1990 average. All the top ten warmest years for the UK, in the series from 1884, have occurred since 2002.
- 3.11.2 The average hottest day of the year, in the decade (2008-2017), was on average 0.1 °C warmer than the 1981-2010 average and 0.8°C warmer than the 1961-1990 average hottest day of 26°C.
- 3.11.3 It is predicted that climate change would increase the frequency and severity of some types of extreme weather events in England. UK Climate Projections, 2018 generally show that warmer, drier summers are more likely along with warmer, wetter winters.

Summary of Potential Effects

Potential Construction Effects

- 3.11.4 In order to construct the Proposed Development, a relatively small quantity of natural resources associated with the construction materials would be required, which would contribute towards Greenhouse Gas (GHG) emissions and therefore climate change. The construction phase would also have the potential to increase GHG emissions due to emissions from energy used by construction plant and equipment onsite, water consumption and emissions from construction phase (workers commute and transportation of material resources and waste).
- 3.11.5 However, it is estimated that additional vehicle movements and emissions associated with the construction of the Proposed Development would be a very small percentage of the total emissions from the industrial, commercial, domestic and transport activities in Greater London of 30,300,000 tonnes CO₂/year in 2017 (Ref 55), and thus would have no significant effect on regional climate change.
- 3.11.6 The vulnerability of the Proposed Development to climate change and extreme weather events is being considered as part of the design process with appropriate adaptation measures incorporated into the design of the Proposed Development. Good industry construction practices would be used, and a detailed description of all surface water runoff control measures will be incorporated into the Drainage Strategy and Outline CEMP. A Flood Risk Assessment will be undertaken. Therefore, no significant effects are considered likely during construction.

Potential Operational Effects

- 3.11.7 During normal operation of the Proposed Development, it is anticipated that there would be no significant GHG emissions and therefore no likely significant environmental effects.
- 3.11.8 The vulnerability of the Proposed Development to climate change and incorporation of appropriate adaptation measures would be part of the iterative design process. For example, a Drainage Strategy would be prepared as part of the non-statutory EAR and implemented during the operation phase of the Proposed Development. This would be consistent with Thurrock Council and Gravesham Borough Council planning policy requirements, which should lead to a reduction in runoff from the site. The Drainage Strategy would ensure that any surface water run-off is safely directed away from the Tunnel Headhouses and SECs, without increasing flood risk elsewhere.
- 3.11.9 The Proposed Development is part of the Ofgem's new ASTI framework (published December 2022). National Grid is responsible for delivering the extensive onshore transmission system enhancements that are required to achieve the government's 2030 power sector decarbonisation target.

Potential Cumulative Effects

- 3.11.10 A number of other current and potential development activities have been identified in the vicinity of the Proposed Development and are presented on Figures 6a-6c in Appendix A – Figures and listed in Appendix B – Cumulative Developments of this report. Whilst there is the potential for some overlap during construction, no significant cumulative effects for climate are anticipated if appropriate adaptation measures described in this section are implemented.
- 3.11.11 Potential cumulative effects between the Proposed Development and the other current and potential development activities are also not considered to be significant if appropriate adaptation measures are implemented.

Summary

- 3.11.12 It is considered that the Proposed Development's potential GHG emissions and vulnerability can be managed through the application of appropriate adaptation measures, as outlined above. There is not likely to be a significant environmental effect on climate during construction and operation of the Proposed Development.

3.12 Agricultural Land

3.12.1 Government policies and legislation on agricultural land and soils aim to protect:

- the best and most versatile (BMV) agricultural land from significant, inappropriate or unsustainable development proposals; and
- all soils by managing them in a sustainable way.

Baseline Environment

Tilbury

3.12.2 From review of the Natural England 1:250,000 scale Agricultural Land Classification (ALC) East Region mapping (Ref 60), the Proposed Development is within an area of “Other” land primarily in non-agricultural use. From review of MAGIC interactive map (Ref 1) there are no further records for this area post 1988. The land is in industrial use and largely comprises of existing hard standing.

Gravesend

3.12.3 From review of the Natural England 1:250,000 scale ALC London and South East Region mapping (Ref 61), the Proposed Development is within an area of Grade 4, Poor agricultural land. From review of MAGIC interactive map there are no further records for this area post 1988.

Summary of Potential Effects

3.12.4 There would be no loss of agricultural land associated with the Proposed Development in Tilbury. In Gravesend, as Grade 4 is not classed as BMV, there would be no loss of BMV land. Soil resources would be protected against damage and loss by the adoption of industry standard methods for the handling and storage of soils appropriate to the soil types identified which would be detailed in a CEMP.

3.13 Health, Population and Socio-economics

Baseline Environment

Tilbury

- 3.13.1 A 350m study area was identified for Health, Population and Socio-Economics.
- 3.13.2 The Proposed Development is located adjacent to P&O Tilbury2 PORT Terminal to the west. The River Thames is approximately 300m to the south. There are no residential properties within the study area but the land in the surrounding area is used for industrial use associated with the port. The England Coastal Path / PRoW – Footpath 146 which is classified as a public National Trail / Long Distance Route; Recreational Route is located between the Proposed Development and the River Thames.
- 3.13.3 Within the study area there are no listed buildings or places of worship or social infrastructure (for example healthcare, housing or educational services).
- 3.13.4 In Thurrock, the population size has increased by 11.6%, from around 157,700 in 2011 to 176,000 in 2021. This is higher than the overall increase for England (6.6%), where the population grew by nearly 3.5 million to 56,489,800 (Ref 56).
- 3.13.5 The health of people in Thurrock is varied compared with the England average. About 17.7% (6,590) children live in low income families. Life expectancy for both men and women is lower than the England average. Life expectancy is 8.4 years lower for men and 7.4 years lower for women in the most deprived areas of Thurrock than in the least deprived areas.
- 3.13.6 In Year 6 at school, 22.5% (538) of children are classified as obese, worse than the average for England. In adults, the rate for alcohol-related harm hospital admissions is 65 (per 100,000 of the population). This represents 1,010 admissions per year. The rate for self-harm hospital admissions is 142 (per 100,000 of the population), better than the average for England. This represents 240 admissions per year. Estimated levels of excess weight in adults (aged 18+), smoking prevalence in adults (aged 18+) and physically active adults (aged 19+) are worse than the England average. The rate of new sexually transmitted infections is better than the England average. The rate of killed and seriously injured on roads is worse than the England average. The rate of violent crime (hospital admissions for violence) is worse than the England average (Ref 58).

Gravesend

- 3.13.7 A 350m study area was identified for Health, Population and Socio-Economics.
- 3.13.8 The site is located adjacent to Milton Rife range to the east, currently used by the MPSTC, with Thames and Medway Canal approximately 60m to the south, just beyond the Thames and Medway Canal is the railway line that runs between Higham and Gravesend train stations. There are no residential properties within the study area but there is a mixed use industrial/ office space to the west comprising of, but not limited to, the Thameside Campus (National Maritime Training Centre), MPSTC and Thames and the Medway Canal Association.
- 3.13.9 Between the Proposed Development and the River Thames, runs the Saxon Shore Way which is classified as a public National Trail / Long Distance Route; Recreational Route. The route is 257 km in length and runs from the port of Gravesend to the town of Hastings in East Sussex.
- 3.13.10 The surrounding area is a mixture of agricultural, industrial and business use with heavier industrial usage further west beyond the 350m study area, including a sand and gravel site, Port of London Authority and a sewage treatment works.
- 3.13.11 There are no listed buildings or places of worship within the 350m study area. The proposed development is however located on an area of land allocated within the Gravesham Local Plan as a local wildlife site.
- 3.13.12 In Gravesham, the population size has increased by 5.1%, from around 101,700 in 2011 to 106,900 in 2021. This is lower than the overall increase for England (6.6%), where the population grew by nearly 3.5 million to 56,489,800 (Ref 57).

- 3.13.13 The health profile for the Gravesham is generally similar to the England average. About 17.4% (3,680) children live in low-income families. Life expectancy for both men and women is similar to the England average. Life expectancy is 11.7 years lower for men and 4.9 years lower for women in the most deprived areas of Gravesham than in the least deprived areas.
- 3.13.14 In Year 6 at school, 20.4% (261) of children are classified as obese. In adults, the rate for alcohol-related harm hospital admissions is 685 per 100,000 of the population. This represents 685 admissions per year. The rate for self-harm hospital admissions is 179 per 100,000 of the population. This represents 185 admissions per year. Estimated levels of excess weight in adults (aged 18+) and physically active adults (aged 19+) are worse than the England average. The rate of new sexually transmitted infections is better than the England average. The rate of new cases of tuberculosis is worse than the England average. The rate of employment (aged 16-64) is better than the England average (Ref 59).

Summary of Potential Effects

Construction

Tilbury & Gravesend

- 3.13.15 The potential likely Socio-Economic effects during construction would include:
- Positive effects on the local labour market in relation to the number of jobs created, together with potential skills and training opportunities. There may also be indirect beneficial effects in relation to the use of local suppliers and spend in the wider economy;
 - Adverse effects on local communities, for example effects on access to PRow's; and
 - Adverse effects on local businesses.
- 3.13.16 There are sensitive receptors in close proximity to both the Gravesend site and the Tilbury site (users of PRow and industrial/ office space) and as such, there may be potential construction impacts as a result of noise and other effects arising from construction activities.
- 3.13.17 With the implementation of appropriate control measures, the impacts at the site are not considered to be significant. These measures would be adopted during construction in order to minimise impacts on the amenity of local businesses and users of PRow's. These include:
- Use of appropriate hoarding / visual screens;
 - Dust control measures such as use of wheel-washing systems and use of a road sweeper on access / local roads;
 - Temporary diversion of PRow 146 if the public footpath is directly impacted by the Proposed Development; and
 - The preparation of a CEMP, which will incorporate the measures outlined in sections 3.3 Landscape and Visual, 3.5 Traffic and Transport, 3.6 Noise and Vibration and 3.7 Air Quality of this report.
- 3.13.18 The potential Health effects during construction include:
- Impacts on local employees, users of the MPSTC (Gravesend) and users of the nearby PRow's arising from environmental change – for example noise generated by construction activities, changes in air quality (for example dust emissions), impacts associated with road safety as a result of the presence of construction vehicles, and visual impacts arising from construction activities;
 - Impacts relating to changes in access to the training centres; and
 - Impacts on health arising from displacement of users of PRow's, as a result of changes in journey length or perceived journey quality.
- 3.13.19 Appropriate mitigation as noted in the CLP would ensure the effects of construction activities would be kept to a minimum. As above, with the control measures in place as outlined in sections 3.3

Landscape and Visual, 3.5 Traffic and Transport, 3.6 Noise and Vibration and 3.7 Air Quality and secured through the Outline CEMP, effects on Health, Population and Socio-Economics are unlikely to be significant.

Operation

Tilbury & Gravesend

- 3.13.20 As is the case for all National Grid assets and operations, assets are designed to comply with relevant exposure guidelines for EMFs. These are set out in UK policy to comply with guidelines set out by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) which were incorporated into an EU Council Recommendation in 1999 (1999/519/EC). The Proposed Development will comply with such guidelines and as such, it is unlikely there will be any significant effects from EMFs.
- 3.13.21 During normal operation noise emissions would be limited to the operation of the tunnel ventilation systems, the SGTs proposed and low levels attributable to general maintenance visits. Ventilation systems would be designed to accord with appropriate noise and vibration limits. With appropriate design and considered specification of plant, it is not anticipated there would be any significant effects on amenity from noise or vibration caused by operating ventilation systems.
- 3.13.22 During operation of the Proposed Development it is not anticipated there will be any significant effects on sensitive receptors.

Summary

- 3.13.23 It is considered that each of the potential impacts relating to Health, Population and Socio-Economics associated with the works can be managed through the application of accepted good practice and compliance with the measures outlined above. There is not likely to be a significant environmental effect on Health, Population and Socio-Economics.

3.14 Cumulative Effects

- 3.14.1 This chapter of the report provides a summary of the proposed assessment of cumulative and combined effects arising from the Proposed Development.
- 3.14.2 The EIA Regulations 2017 state that an EIA should include consideration of both the interaction between the different aspects of the environment likely to be affected by the development and the likely significant environmental effects of the development resulting from the cumulation of effects with other existing or approved projects. The EIA Regulations require the potential direct and indirect cumulative effects during construction and operation of a proposed development to be considered.
- 3.14.3 Combined effects are assessed as the effects resulting from several different impacts from a single project (in this case the Proposed Development) on a single receptor, for example, a single receptor, such as a property or habitat, being subject to noise, air quality and visual impacts associated with the scheme.
- 3.14.4 Cumulative effects are assessed as the effect resulting from impacts of the Proposed Development acting together with an impact or impacts associated with other proposed development schemes on a single receptor. This can be two similar impacts acting on a single receptor (such as increases in air quality emissions as a result of the Proposed Development and another development), or two different impacts acting on a single receptor (such as an increase in air quality emissions from the scheme and an increase in noise levels from another development).

Combined effects

- 3.14.5 As per the conclusions of this report that there are unlikely to be any significant environmental effects associated with the environmental topics assessed above and given the nature of the Proposed Development (the industrious nature of the surrounding area and the fact that the Proposed Development is replacing existing infrastructure), as well as the mitigation measures to be implemented as identified through the environmental assessments it is determined that the combined impacts are of a scale that no significant combined impacts would arise.

Cumulative effects

- 3.14.6 A search of Thurrock Council and Gravesham Borough Council's planning portals and the Planning Inspectorate's website was undertaken to determine the other proposed developments within the area that could have a cumulative impact with the Proposed Development.
- 3.14.7 The following criteria has been used to identify developments that are of sufficient scale to have the potential to result in cumulative effects in association with the Proposed Development:
- All residential applications proposing 10 units or more submitted in the last 5 years within 1km of the Proposed Development;
 - All mixed-use and employment applications proposing 1ha of development or more submitted in the last 5 years within 1km of the Proposed Development; and
 - All nationally significant infrastructure projects submitted in the last 5 years within 1km of the Proposed Development. Some developments have been included that are over 5 years old where activity has been recorded on the applications, for example reserved matters applications.
- 3.14.8 The other planned developments identified using the search criteria above are contained within Appendix B – Cumulative Developments.
- 3.14.9 During the construction of the Proposed Development, it is reasonable to assume there will be some disruption, but the disruption associated with the construction phase will be temporary and short term in nature and would not result in any significant cumulative effects.
- 3.14.10 This report concludes that there are unlikely to be any significant environmental effects, and, given the nature of the Proposed Development (the location, construction methods, and the standard mitigation measures to be secured via the Outline CEMP, and the fact that the Proposed Development is replacing existing infrastructure), it is determined that the Proposed Development

would not result in any significant cumulative effects with the other proposed developments (listed in Appendix B – Cumulative Developments) during both the construction and/ or the operational phase of the Proposed Development. This will be confirmed and reviewed as part of the non-statutory Environmental Appraisal Report submitted with the planning application.

- 3.14.11 The potential for cumulative traffic and transport impacts due to other developments has been considered within section 3.5 of this report.

Summary

- 3.14.12 It is concluded that no significant cumulative or combined effects will arise as a result of the Proposed Development.

4 Information to Support Planning Applications

- 4.1.1 National Grid will continue to liaise closely with stakeholders and statutory bodies in the preparation of outline planning application to Thurrock Council. This section sets out what documentation National Grid propose to include with the planning applications.

4.2 Environmental Appraisal Report

- 4.2.1 Subject to the agreement that the Proposed Development is not EIA Development, National Grid proposes to produce a Non-Statutory Environmental Appraisal Report (EAR) comprising the results of an assessment of the Proposed Development's potential effects on:

- Ecology;
- Landscape and Visual;
- Historic Environment;
- Traffic and Transport;
- Noise and Vibration;
- Air Quality;
- Geology and Hydrogeology;
- Water Environment; including a Flood Risk Assessment and WFDa;
- Materials and Waste; and
- Cumulative Effects Assessment.

- 4.2.2 National Grid will also prepare an Outline CEMP to set out and secure the proposed mitigation and control measures which are identified through the non-statutory environmental appraisal, to minimise environmental impacts during the construction of the Proposed Development.

Scope of EAR and Planned Surveys

Ecology

- 4.2.3 The scope of the ecological appraisal would comprise an assessment of potential effects on the following key receptors arising from construction:
- Thames Estuary & Marshes Ramsar Site and SPA, and functionally linked habitat;
 - Tilbury Power Station LWS/proposed SSSI;
 - Canal and Grazing Marsh, Higham Local Wildlife Site LWS; and
 - Protected and/or notable habitats and species.
- 4.2.4 The effects of operational lighting would also be appraised, as well as the additional permanent increase in human activity associated with ongoing operation of the head houses and SECs, which could reduce the suitability of adjacent habitat for use by nesting and foraging birds. All other appraisal of operational activity has been scoped out as it is not expected that it would exceed that of the current levels at the existing headhouses and sealing end compounds.
- 4.2.5 A PEA has been undertaken to identify habitat features, protected and notable plants, hedgerow, invasive species as well as determine which targeted habitat/species specific surveys are required. This can be found in Appendix C – Preliminary Ecological Appraisal, noting that the PEA covers a larger area than will be impacted by the proposals.

- 4.2.6 The ecological baseline for Tilbury will also be supplemented through a review of publicly available survey information from other infrastructure projects in the vicinity including Lower Thames Crossing and Thurrock Flexible Generation Plant.
- 4.2.7 Wintering bird surveys commenced in 2022 and concluded in March 2023. The remainder of the ecological surveys will be undertaken up to September 2023. The scope of the planned (and ongoing) ecology surveys is set out in Table 4-1. These surveys follow Natural England standing advice and CIEEM best practice guidance (Ref 64) for protected species and habitats.

Table 4-1: Ongoing and Proposed Ecology Surveys

Survey Type	Scope and Method	Timing
Wintering Birds	The Thames Estuary and Marshes Special Protection Area (SPA) is immediately to the east of the Proposed Development on the south banks of the River Thames, along with the Thames Estuary and Marshes Ramsar, and SSSI. The intertidal mudflats within and adjacent to the Proposed Development are likely to support qualifying species associated with these designated sites. Surveys of the intertidal area will be required to identify the temporal and spatial distribution of waterbirds. The following intertidal waterbird survey methodology has been followed. Spatial data had been collected between October 2022 and March 2023, with two types of count data collected: ii) high water roost counts; and ii) low water feeding counts. At high water all areas were visited sequentially, and a single count of all species present undertaken within the two hour period either side of high water. At low water all areas were visited sequentially and counts of waterbirds feeding on the intertidal mud undertaken, with birds and their numbers recorded on both the rising and falling tide, where possible. Tide tables were used to confirm the start and end times of these counts. Both high and low water counts were undertaken once a month. Observations were undertaken from the sea wall and on each visit individuals of all waterbird species were counted and mapped. The survey area extended beyond the application site boundary to record waterbird species occurring in areas that may be at risk from noise and visual disturbance during construction and operation. In additional to the surveys of the intertidal areas, surveys of terrestrial areas within the Proposed Development boundary will be undertaken for wintering (non-breeding) bird species and assemblages. The survey will be based on methods following Bibby et al. (2000) and Gilbert et al. (1998), with all areas of the proposed scheme walked to within 50m, including a 50m buffer of the Site boundary. A route was selected to include the whole area to be surveyed with all field boundaries walked. Surveys were undertaken on a monthly basis between October 2022 and March 2023, with six monthly survey visits undertaken. Surveys alternated between early in the morning, commencing just after sunrise and late afternoon, finishing after dusk to help establish the overall use of the survey area by different species groups, particularly any species which may arrive at or after dusk to forage within the survey area at night. On each visit the route was walked at a slow pace with start and finish times noted. All birds seen and heard were recorded directly onto an ArcGIS base map using ESRI software on hand-held PDA devices, with a 1:10,000 scale Ordnance Survey base map of the survey area. Registrations of birds was recorded using standard British Trust for Ornithology (BTO) two letter species codes.	October 2022 – March 2023 (complete)
Breeding Birds	High water and low water counts will continue to be undertaken once per month during the period April to September 2023 for both the Gravesend and Tilbury sites, utilising the intertidal waterbird survey methodology identified above. In addition, within the areas of terrestrial habitat at and surrounding the proposed works areas at the Tilbury and Gravesend site a standard territory mapping methodology for surveying breeding birds as detailed in Bibby et al. (2000) and Gilbert et al. (1998) will be implemented. Regular stopping points will be included along the survey route to record any species that may be passing through the survey area. Survey routes will be mapped, and the direction walked alternated on each visit, to ensure that all areas are covered at various times of day across the duration of the survey. Surveys will be undertaken early in the morning, commencing just after sunrise and finishing before midday. A total of 5	April - September 2023

Survey Type	Scope and Method	Timing
	well-spaced survey visits will be undertaken between April and June 2023. During the initial site visits consideration will be given to the requirement for additional surveys for specific species/species groups. Registrations of birds will be recorded using two letter species codes. Specific codes will be used to record bird behaviour, including singing, calling, flights and movements between areas, carrying food, nest building, aggressive encounters and other bird behaviour. The expected outcome from the surveys is that registrations will be mapped to identify spatially distinct groups of registrations that represent the activity of not more than one pair, such that territory boundaries can be derived.	
Intertidal Bird Surveys	One high tide and one low tide count will be undertaken each month between April and September. The survey will involve lone working and the lone working protocol will be implemented. Surveys will be undertaken from the public right of way which runs along the river wall. No access will be made to the foreshore or within 2m of water. Jetties will not be accessed. During each survey visit, the ornithologist will walk the pre-determined transect route through the survey area. Transect routes are interspersed with stops at viewing points during which the survey area was scanned for birds using binoculars. Visual counts of all bird species encountered will be made, with birds that could not be located visually identified through calls or songs. The species present and their behaviours will be recorded on field maps using standard BTO species codes and behaviour notation.	April - September 2023
Botanical Surveys	Areas of grassland within the Sites will be subject to National Vegetation Classification (NVC) survey in order to characterise the habitats present and identify the extent of homogenous habitats. Within each homogenous stand between three and five 2m x 2m quadrats will be undertaken. All vegetation present will be identified to species level wherever possible and the abundance recorded utilising the Domin scale. These results will then be utilised to identify closest affinities to the communities described in the NVC manuals. Where protected and/or notable species are found, or are expected based on the outcomes of previous surveys then the NVC survey will be supplemented by the addition of a structure walk through the area were works are proposed, which will be utilised to assess the overall abundance and distribution of any such species.	May - June 2023
Invertebrates	The habitats in the vicinity of both sites, in particular at Tilbury are known to be of high value for invertebrates populations. In particular species associated with brownfield habitats (e.g. the Bombadier beetle, six-belted clearwing, Shrill carder beetle). It is expected that those areas of highest quality invertebrate habitat at Tilbury (E.g. areas of habitat creation on PFA) will now be avoided, however given proximity it is possible these species and others protected and/or notable may also utilise the sites. As such invertebrate appraisal and assessment will be undertaken. In the first instance a specialist ornithologist will visit the site in order to undertake a scoping survey and appraise the habitats present. This visit will consist in the first instance of a general site walkover (April/May 2023). The focus will not be species identification or sample collection, however both may be undertaken as necessary to inform the appraisal. Based on the result of the first survey and a review of previous surveys undertaken in the vicinity the specification for further surveys will be devised in order to ensure the best appraisal of key species./species groups. The final number of visits and requirement for other specialist surveys (e.g. butterfly transect), will be confirmed after the initial visit. As a minimum three collecting visits would be undertaken (May/June; July/August; and September). During each visit a range of techniques would be used as appropriate to ensure a representative sample of the species and	April/May 2023 - September 2023

Survey Type	Scope and Method	Timing
	species/groups utilising the Site. Methods would be in accordance with Natural England Research Report NERR005 (Ref 5) and would include (but not limited to) the following as appropriate: ground searching, pitfall trapping, sweep netting, suction sampling; beating and direct observation. No aquatic invertebrate survey is proposed as no impacts on existing watercourses are expected.	
Great Crested Newt	Habitat Suitability Index (HSI) surveys of the ditches adjoining works areas and eDNA samples are to be taken of waterbodies on both sites. The survey will involve working at the margins of watercourses and therefore both surveyors will wear lifejackets. Environmental DNA (eDNA) involves the taking of water samples from at least twenty points around the waterbody margin. The samples are mixed together and are then pipetted into an alcohol solution to preserve the material. The sample will then sent to a laboratory for further analysis.	April - May 2023
Bats - Roost Suitability Surveys	One bat roost suitability walkover survey is required for each site, consisting of a walkover search for bat roost potential features in trees and buildings present within the sites.	April - May 2023
Bats - Activity Surveys	Three bat transect surveys are required for both the Tilbury and Gravesend sites, with one in each season (spring, summer, autumn). A team of two surveyors will walk a pre-defined transect route around the site, keeping at least 2m from watercourses. Surveyors will carry bat detectors (BatLoggers) starting at 15 minutes before sunset and continuing until 2 hours past sunset. Prior to each walked transect a static bat detector will be deployed. This device will be left in-situ for a minimum of 5 nights after each transect survey. Subsequently a surveyor will return to site during daylight hours to retrieve the detector and/or download the collected data.	April - September 2023
Bats – Emergence Surveys	One bat emergence or re-entry survey is required for the low suitability building within the Tilbury Site. This will consist of two surveyors positioned to observe the building (maintaining line of sight between surveyors) with BatLoggers from 15 minutes before sunset to 1.5-2 hours after sunset depending on bat activity, or 2 hours before sunrise to 15 minutes after sunrise. Three bat emergence or re-entry surveys (at least one of each) are required for the high suitability tree TN14 within the Gravesend Site. This will also consist of two surveyors positioned to observe the building with BatLoggers from 15 minutes before sunset to 1.5-2 hours after sunset depending on bat activity, or 2 hours before sunrise to 15 minutes after sunrise. All emergence/re-entry surveys will include the use of an IR camera in line in accordance with BCT's interim guidance note and developing BCT guidelines.	May - August 2023
Badger	A single walkover visit will be undertaken per site. The aim of the survey is to provide robust evidence for the presence or likely absence of badgers on the proposed scheme. The survey will be conducted using best practice guidance based on: - Harris S, Cresswell P and Jefferies D (1989) Surveying Badgers, Mammal Society. - Scottish Badgers (2018) Surveying for Badgers Good Practice Guidelines. Version 1.	April - May 2023

Survey Type	Scope and Method	Timing
	The badger surveys will include the footprint of the EIA Screening Boundary (including all temporary and permanent works) and an additional 30m buffer area (if possible). If habitat within the study area is in any way suitable for badger, even if it is considered suboptimal, the habitat will be subject to a detailed search for badger field signs. The survey would include recording the location of any sett, the number of sett entrances and recording signs of badger activity within the Site. Field signs will be searched for, which include setts, day beds (above ground areas where badgers sleep, characterised by flattened vegetation or bundles of grass), badger faeces in dung pits, a concentration of which is termed a latrine, diggings or snuffle holes (where badgers have inserted their snouts into the ground to search for earthworms and insects), paths linking setts and foraging areas, scratching posts, hair and footprints.	
Reptile	Artificial refugia are to be placed within working areas and their immediate surrounds on both sites. Seven survey checks are to be undertaken at each site, with the refugia collected on the seventh survey. The surveys will be conducted using best practice guidance based on Froglife Advice Sheet 10[1] and the Herpetofauna Workers' Manual[2]. Artificial refugia will be selectively placed across the EIA Screening Boundary (in six survey locations) from April 2023 in sun-exposed areas of suitable habitat with the potential to support reptiles. The artificial refugia will comprise a combination of corrugated metal-based roofing material sheets and roofing felt (measuring approximately 50cm x 50cm in size). These will be placed in areas of suitable habitat across the site. A period of 10 days will be given to allow any reptiles present to habituate to the presence of the refugia. Following this, seven survey visits will be conducted between April and September 2023 in suitable conditions. All surveys will be undertaken during this period to avoid the warmest periods of the summer months (typically July and August) in which reptiles are usually harder to observe. All survey visits will be conducted under the guidance set out in Froglife Advice Sheet 10 when the air temperature is between 9°C and 18°C and avoiding heavy rain or wind where possible. All refugia will be checked and any reptile species will be recorded.	April - September 2023
Water Vole	A water vole survey will be undertaken on each site. The survey will involve checking any suitable ditches or watercourses within the site to search for signs of water voles on the banks. Two survey visits will be undertaken. The first in May and the second in September.	May - September 2023

- 4.2.8 Following these relevant surveys, protected species and habitat survey reports will be produced which would feed into the appraisal and help develop mitigation measures, opportunities for ecological enhancement and Biodiversity Net Gain.
- 4.2.9 Existing desk study data for the area is considered likely to be sufficient to assess potential for impacts on marine ecological features, when further scheme detail has been developed.
- 4.2.10 The ecological appraisal would follow the Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (CIEEM, 2018) (Ref 4). Mitigation measures would be developed and outlined within the Outline CEMP (and inform required protected species licences). Following this each key ecological receptor would be evaluated to determine whether there are any effects and whether mitigation is required to reduce the significance of the effect.
- 4.2.11 Residual effects on key ecological receptor would be identified and characterised through their magnitude and include positive or negative, extent, magnitude, duration, frequency and timing and reversibility.

Landscape and Visual

- 4.2.12 The scope of the landscape and visual appraisal would comprise an assessment of effects on landscape character during construction and visual amenity during construction.
- 4.2.13 All baseline data and ZTV would be updated where required, as more design information becomes available. This would provide an overview of the potential visibility of the construction works. It would also inform the identification and appraisal of landscape and visual receptors.
- 4.2.14 After ZTV analysis and following a discussion of viewpoints with the Local Planning Authorities, baseline photography would be undertaken (winter or summer subject to project timescales). The viewpoints would be discussed in advance with the LPAs. A site survey and baseline analysis would also be undertaken alongside the photography and would inform and support in the refinement of the design and in the development of appropriate mitigation (which would be included within the CEMP). The appraisal methodology would follow guidance set out in the following:
- Guidelines for Landscape and Visual Impact Assessment: Third Edition' (Landscape Institute and Institute of Environmental Management and Assessment, 2013) (GLVIA); and
 - Visual Representation of Development Proposals Technical Guidance Note 06/19 (Landscape Institute TGN 06/19) documents.
- 4.2.15 Landscape and visual effects are related but distinct topics so would be considered and appraised separately. Residual effects as a result of the proposals on landscape character and visual amenity could include:
- Construction: temporary effects from the movement of construction plant, vehicle haul routes, excavations, temporary construction compounds, material stockpiles and the removal of vegetation
- 4.2.16 An appraisal of operational effects is scoped out as once operational, the Proposed Development including headhouses and OHL infrastructure would result in a very low magnitude of change in the view for the majority of potential viewers and would be perceived as part of, and an extension to, this existing industrial landscape.

Historic Environment

- 4.2.17 The scope of the cultural heritage appraisal would comprise:
- Effects to below ground / unknown heritage assets during construction; and
 - Changes to the setting of designated heritage assets during construction.
- 4.2.18 Operational effects have been scoped out of the appraisal as during operation of the Proposed Development there would be no effects to the setting of the Tilbury Fort Scheduled Monument or the Grade II listed buildings in Gravesend. Operation of the Proposed Development would also not affect any buried archaeological remains.

- 4.2.19 A desk-based assessment (which also includes the results of a site walkover) has been prepared, which includes a detailed appraisal of the NHLE, Essex and Kent Historic Environment Record (HER), a review of available historic mapping and aerial imagery and a review of all previous archaeological investigations carried out within the study area in order to draw conclusions on the known heritage resource within the study area and the known and potential archaeological resource within the impact area. Following this, if required, a programme of archaeological investigations i.e. geoarchaeological borehole surveys and potentially trial trenching would be specified in consultation with Historic Environment Officers at Essex and Kent County Councils and implemented to further define the nature, extent, state of preservation and significance of the archaeological resource and inform any future mitigation strategy. This would be programmed in appropriately prior to construction.
- 4.2.20 The appraisal would be carried out broadly in accordance with the methodology set out in DMRB LA 106 Cultural Heritage (Highways England, 2020) (Ref 62), DMRB LA 104 Environmental Assessment and Monitoring (Highways England, 2020) (Ref 63), Historic England: Historic Environment Good Practice Advice in Planning Note Three: The Setting of Heritage Assets (2017), Historic England: Historic Environment Good Practice Advice in Planning (GPA2): Managing Significance in Decision-Taking in the Historic Environment (2015) and Historic England: Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (2008) and the Chartered Institute for Archaeologists' Code of Conduct (CIfA 2022).
- 4.2.21 Potential construction effects would be identified by comparing the current condition and nature of heritage assets to that predicted to occur during construction. The degree of change would be reflected in the appraisal. This nature of change would be based on design information and other appraisals undertaken including noise and vibration and landscape and visual appraisals.

Traffic and Transport

- 4.2.22 The scope of the traffic and transport appraisal would comprise of:
- Construction traffic including any management and mitigation measures;
 - Access route review and swept path analysis; and
 - Cumulative effects with other developments in the vicinity.
- 4.2.23 Baseline data would be gathered for the proposed construction routes using online sources for existing traffic data (where available) and supplemented within additional traffic count surveys if required (to be discussed with the relevant Local Highway Authority). Mitigation measures would then be developed and outlined within a CLP.
- 4.2.24 The appraisal and criteria for defining the sensitivity of receptors would draw on best practice guidance produced by the IEMA and professional judgement.
- 4.2.25 Operational effects have been scoped out as the only operational traffic generated by the works would be associated with infrequent repair and routine maintenance works similar to the existing baseline.

Noise and Vibration

- 4.2.26 The noise appraisal would comprise of an assessment of:
- Construction noise (Gravesend only);
 - Construction traffic noise;
 - Operational noise (associated with the operation of the tunnel ventilation systems within the headhouses)
- 4.2.27 An assessment of construction noise on the Tilbury side has been scoped out as there are no sensitive noise receptors within 300m.

- 4.2.28 An assessment of construction and operational vibration has been scoped out as it is unlikely that there will be significant effects due to the tunnel depth of approximately 50m and the distance to sensitive receptors.
- 4.2.29 The baseline noise monitoring methodology will be discussed with the relevant LPA prior to any monitoring taking place. It is proposed to undertake long-term baseline monitoring within the site and at positions representative of closest sensitive receptors to include weekend and weekdays times. Ideally, and subject to adequate security, a minimum five-day unattended monitoring period is preferred (Thursday – Monday suggested) but if the site is not secure this may not be possible and a shortened, attended monitoring regime will be undertaken. The monitoring procedures will conform to BS 7445: 1991 'Description and Measurement of Environmental Noise' and BS 4142:2014+A1:2019 'Methods for Rating and Assessing Industrial and Commercial Sound'.
- 4.2.30 The assessment of residual effects would be undertaken in accordance with the guidance and recommendations in BS5228-1 and BS5228-2. These Standards include methods for the calculation and assessment of construction noise. Residual operational noise effects will be assessed following guidance in BS 4142.

Air Quality

- 4.2.31 The scope of the air quality appraisal would comprise:
- Construction dust emissions;
 - Construction traffic emissions; and
 - Construction energy plant emissions.
- 4.2.32 The methodology for the construction dust emissions appraisal would be in line with the guidance on the assessment of dust from demolition and construction (Institute of Air Quality Management, 2014).
- 4.2.33 Construction traffic emissions will only need to be considered where the development increases daily average two-way HGV movements by 25 or more within or adjacent to an AQMA, or 100 or more away from an AQMA (in accordance with Institute of Air Quality Management guidance). Table 2-5 shows that the anticipated two-way HGV movements generated by the southern site will not exceed 25 per day. Table 2-4 shows that the anticipated two-way HGV movements generated by the northern site will exceed 25 per day, but not 100 per day. Construction traffic emissions only have the potential to contribute to a significant effect if construction vehicles related to the northern site cannot be routed away from roads that are within or adjacent to an AQMA. Should an assessment of construction phase road traffic emissions be required, it would be undertaken in line with relevant Defra guidance (Local Air Quality Management Technical Guidance (2022)) and the Institute of Air Quality Management and Environmental Protection UK's air quality planning guidance.
- 4.2.34 Construction energy plant emissions will only need to be considered if the TBMs have to be powered by onsite energy generation plant. Should this be the case, the combustion emissions associated with the energy generation plant will be assessed in line with appropriate guidance, including that published by the Environment Agency for the consideration of point source emission sources. The assessment will be used to determine a suitable stack height to ensure that the energy generation plant does not contribute to a significant effect, including the effect on nearby nature conservation sites.
- 4.2.35 Once operational there are no processes that may lead to an effect on local air quality. It is not expected that operational activity would exceed that of the current levels at the existing headhouses and sealing end compounds. Therefore, operational effects have been scoped out.

Geology and Hydrogeology

- 4.2.36 The Geology and Hydrogeology appraisal will be within the Phase 1 PRA report. The scope of the Geology and Hydrogeology appraisal would comprise effects on ground conditions, including contaminated land during construction. It is proposed to scope out ground stability issues, as this would be addressed as part of the engineering design. The appraisal would consider the two sites

(i.e. areas of tunnel headhouses/ cable sealing end compounds). Tunnelled section would not be considered, as no effects are anticipated from contaminated land in this part of the Site.

- 4.2.37 It is proposed to scope out of the assessment effects from land contamination on construction and maintenance workers during construction (and during future operation), as these workers will be protected under Health and Safety legislation. Any potential effect is considered to be temporary and will be avoided, prevented and reduced through the implementation of standard mitigation measures to be incorporated into a CEMP.
- 4.2.38 It is proposed to scope out operational effects, as it is not expected that the proposed development would introduce sources of contamination. It is considered that the Project will use materials that are appropriate for the identified ground conditions. As such, it is proposed to scope out of the assessment the effects of land contamination on construction materials.
- 4.2.39 In line with the Environment Agency's LCRM (Ref 25), assessment of land contamination will take the form of a tiered, risk-based approach, as summarised below.
- Tier 1: preliminary risk assessment based on a desktop study of available information to identify potential sources of contamination, receptors to contamination and potential pathways between them. The identified sources, pathways and receptors are presented in the form of an initial CSM showing the PCL;
 - Tier 2: If PCL are identified, this means there is a theoretical risk to receptors from contamination. Therefore, intrusive investigation should be used to provide data to inform a GQRA. The GQRA involves comparison of site-specific, laboratory analytical data against appropriate GAC for human health and/or controlled waters which represent minimal or tolerable risk; and
 - Tier 3: detailed quantitative risk assessment to identify whether contamination identified above minimal or tolerable risk levels represents an unacceptable risk and therefore requires remediation.
- 4.2.40 As a first step, a Phase 1 PRA report, to be completed in accordance with the Environment Agency's LCRM guidance (Ref 25) and the NPPF, will be undertaken for both of the sites and submitted with the planning applications.
- 4.2.41 The Phase 1 PRA report will provide mitigation measures for ground conditions which will be outlined within a CEMP; and any further actions, which may include further Phase 2 Ground Investigations (GI) and interpretative reporting. Mitigation measures, in addition to the standard environmental design and management measures, may be employed during the construction phase of the Proposed Development to minimise impacts to human health, controlled waters and properties.
- 4.2.42 There is no published guidance for transposing a risk-based contaminated land assessment into significance criteria for the purposes of an appraisal. The likelihood of ground contamination on the sites, and its potential effect (consequence) on sensitive receptors, will be assessed using a conceptual model and risk-based framework, using a combination of knowledge of the characteristics and extent of the contamination identified. The assumption is that both areas of the Site would be subject to disturbance as part of the works required for the Proposed Development. Accordingly, an assessment of the potential for impact on human health, controlled waters, properties or consequent impacts on other environmental receptors will be undertaken.
- 4.2.43 The assessment of significance will be determined using relevant guidance such as CIRIA Report C552 'Contaminated Land Risk Assessment: A Guide to Good Practice' (Ref 65), LCRM (Ref 25) and professional judgement.

Surface Water Environment and Flood Risk

- 4.2.44 The scope of the water environment and flood risk appraisal would comprise effects on:
- Water quality during construction; and
 - Flood risk and existing land drainage regimes during construction
- 4.2.45 Operational effects that will tend to be permanent and long term have been scoped out of the assessment as it is not expected that operational activity would exceed that of the current levels at

the existing headhouses and sealing end compounds, or likely lead to significant effects. Drainage from the above ground installations will need to be managed accordingly in terms of rate, volumes and quality, but these matters can be readily managed by standard drainage systems. This will be defined by production of a Drainage Strategy.

- 4.2.46 Baseline data would be reviewed and updated. A combined water quality and hydromorphology site walkover will then be undertaken. It will seek to augment the desk study by ground truthing the location, characteristics and flow direction of water features (excluding ponds that will be assessed under 'Ecology'). The morphology of water features will be described and olfactory observations regarding their water quality noted, but no sampling is proposed.
- 4.2.47 Based on the desk study and site visit, and details of the proposed development, potential impacts will be assessed qualitatively following a source-pathway-receptor model. Following this mitigation measures for water quality and flood risk would be developed (and outlined within a CEMP). This will focus on construction issues associated with tunnelling operations including dewatering, the use of chemicals (including oils, grouts and cement), and the management and disposal of large volumes of spoil. Assuming that material removed from the tunnel is re-used as part of habitat enhancement initiatives in the lower Thames Estuary, the Proposed Development may contribute to long term beneficial effects. However, alternative options may be more impacting and would require a review of the scope of assessment.
- 4.2.48 The appraisal methodology would follow relevant guidance including Environment Agency publications and consider the requirements of local policy. The appraisal of residual effects would also consider the importance and impact magnitude criteria, drawing from relevant sections of DMRB LA 113 (Highways England, 2020) (Ref 66) and professional judgement.
- 4.2.49 Additional separate assessments would also be prepared and submitted with the Planning Application which would support the appraisal of the surface water environment and flood risk. These separate assessments include:
- an FRA (informed by a Drainage Strategy); and
 - a WFD Assessment.
- 4.2.50 A Flood Warning and Evacuation Plan will also be prepared and submitted with the Planning Application.

Materials and Waste

- 4.2.51 The scope of the appraisal would consider effects on:
- Landfill void capacity in the expansive study areas of the East of England and South East regions (non-hazardous and inert landfill void capacity), and England (hazardous landfill void capacity) during construction; and
 - National and regional consumption of key construction materials during construction.
- 4.2.52 The appraisal methodology would follow the IEMA Guide to: Materials and Waste in Environment Assessment, Guidance for a Proportionate Approach (referred from herein as the 'IEMA Guidance').
- 4.2.53 Baseline data would be reviewed and updated. Following this mitigation measures for materials and waste would be developed (and outlined within the Outline CEMP).
- 4.2.54 The following matters will be scoped out of the appraisal of materials and waste:
- Waste arising from extraction, processing and manufacture of construction components and products. This is based on the assumption that these products and materials are being developed in a manufacturing environment with their own waste management plans, facilities, and supply chain, which are potentially in different regions of the UK or the world and therefore outside of the geographical scope of this study. Such matters cannot be accurately predicted and assessed as they relate to procurement decisions that cannot be assured;
 - Other environmental impacts associated with the management of waste from the Proposed Development e.g., on water resources, air quality, noise or traffic resulting from the generation,

handling, on-site temporary storage or off-site transport of materials and waste are addressed separately in other relevant chapters;

- Direct impacts on safeguarded/allocated mineral sites. The EIA Screening Boundary does not pass through any such sites therefore this aspect is scoped out of the assessment;
- Direct impacts on safeguarded/allocated waste sites. The EIA Screening Boundary does not pass through any such sites therefore this aspect is scoped out of the assessment;
- Direct impacts on MSAs. Whilst MSAs are not considered in a materials and waste assessment further consultation with the Minerals Planning Authority may be required prior to the submission of the planning application later in 2023;
- Effects on the availability of materials during operation: forecast effects are (using professional judgement) considered negligible in relation to the scale and nature of the development;
- Effects of the Proposed Development on regional inert and non-hazardous waste landfill capacity and national hazardous waste landfill capacity during operation. Effects associated with the operational phase are proposed to be scoped out due to the nature of the Proposed Development, and knowledge of similar projects limited operation material usage and waste disposal requirements; and
- Effects associated with decommissioning as the Proposed Development has a long design life and as such it is not considered possible to reliably forecast decommissioning requirements and infrastructure far in the future.

Cumulative Effects Assessment

- 4.2.55 The cumulative effects during construction would be considered, namely the combined action of a number of different projects, in combination with the project being assessed, on a single resource/receptor.
- 4.2.56 Operational effects have been scoped out it is not expected that operational activity would exceed that of the current levels at the existing headhouses and sealing end compounds.
- 4.2.57 A review of Nationally Significant Infrastructure Projects, Thurrock Council and Gravesham Borough Council planning applications and local plan documents would be undertaken to update the list of existing or approved developments likely to result in cumulative effects presented in Appendix B – Cumulative Developments. Following this mitigation measures would be developed where necessary (and included within the Outline CEMP / TMP).
- 4.2.58 Residual effects would be assessed in the spirit of guidance within the Planning Inspectorate's Advice Note 17: Cumulative Effects Assessment recognising this is a robust means of appraisal but that the scale of this scheme is significantly smaller in scale and scope than the schemes that typically follow this guidance.

Appraisal Methodology (for all topics)

- 4.2.59 The EAR will identify potentially significant adverse environmental effects and, if any, propose project specific mitigation measures to avoid, reduce or offset adverse environmental effects or maximise environmental benefits.

Characterisation of the Baseline Environment

- 4.2.60 In order to assess the potential impacts resulting from the Proposed Development it is necessary to first establish the environmental conditions that currently exist within the vicinity of the Proposed Development as well as the likely evolution of the baseline without the development of the Proposed Development.
- 4.2.61 Appropriate understanding of the baseline for each environmental receptor will be collated through some or all of the following:
- Review of primary baseline studies (field);

- Review of secondary sources (desk-based, i.e. review of existing documentation and literature); and
- Stakeholder consultation.

4.2.62 The key data sources used to establish the baseline will be described in each technical assessment chapter.

Assessment of Impacts

4.2.63 The IEMA guidelines (2004, p11/2) state: “The assessment stage of the EIA should follow a clear progression; from the characterisation of ‘impact’ to the assessment of the significance of the effects taking into account the evaluation of the sensitivity and value of the receptors.”

4.2.64 The prediction of potential impacts will be undertaken to determine what could happen to each environmental receptor as a consequence of the Proposed Development and its associated activities. The definitions used to describe impacts are explained in Table 4-2.

Table 4-2: Impact Definition

Terms	Definition
Direct impact	Impacts that result from a direct interaction between the Proposed Development activities and the receiving environment.
Indirect impact	Impacts on the environment, which are not a direct result of the Proposed Development / Proposed Development activities, often produced away from the activity or as a result of a complex pathway.
Cumulative impact	Impacts that result from incremental changes caused by other present or reasonably foreseeable actions together with the Proposed Development (European Commission 1999). Generally considered to be the same impact but from different projects e.g. noise generated from two separate projects combining to affect residential amenity.
Beneficial impact	An impact that is considered to represent an improvement on the baseline condition or introduces a new desirable factor (IEEM 2010).
Adverse impact	An impact that is considered to represent an adverse change from the baseline condition or introduces a new undesirable factor (IEEM 2010).

Magnitude of Change

4.2.65 General criteria for defining the magnitude of an impact are set out in Table 4-3. Key factors that influence this include:

- **Scale of change** – The scale of change refers to the degree of change to or from the baseline environment caused by the impact being described;
- **Spatial extent** – The extent of an impact is the full area over which the impact occurs; and
- **Duration and frequency** – The duration is the period within which the impact is expected to last prior to recovery or replacement of the feature. Frequency refers to how often the impact will occur.

Table 4-3: Impact Magnitude Criteria

Magnitude	Criteria
High	Long term and/or regional level loss; or major alteration to key elements/features of the baseline condition such that post development character/composition of the baseline will be fundamentally changed.
Medium	Medium term loss and/or local level change (greater than the Proposed Development footprint) or alteration to one or more key elements/features of the baseline conditions such that post development character/composition of the baseline condition will be materially changed.
Low	Short term, site specific and/or a minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/composition of the baseline condition will be similar to the pre-development situation.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a “no change” situation.

Sensitivity of the Receptor

4.2.66 The sensitivity of a receptor or feature is characterised by the vulnerability to change, recoverability and importance of the receptor or feature (Table 4-4). Characterisation of the receptor is achieved by balancing out these three considerations to determine the receptor’s sensitivity.

- **Vulnerability** – The vulnerability of the receptor relates to its capacity to accommodate change i.e. the tolerance/intolerance of the receptor to change;
- **Recoverability** – The ability of the receptor to return to the baseline state before the Project impact caused the change; and
- **Importance** – The importance of the receptor or feature is a measure of the value assigned to that receptor based on biodiversity and ecosystem services, social value and economic value. Importance of the receptor is also defined within a geographical context, whether it is important internationally, nationally or locally.

Table 4-4: Sensitivity Criteria

Sensitivity	Description
High	Receptor has little or no ability to absorb change without fundamentally altering its character. For example: • Receptor has low/no capacity to return to baseline conditions within the Proposed Development life, e.g. low tolerance to change and low recoverability such as a physical feature formed over a geological time scale, or loss of access with no alternatives. • Receptor is economically valuable.
Medium	Receptor has moderate capacity to absorb change without significantly altering its character, however some damage to the receptor will occur. For example: • Receptor has intermediate tolerance to change. • Medium capacity to return to baseline condition, e.g. >5 of up to 10 years. • The receptor is valued but not protected.
Low	The receptor is tolerant to change without significant detriment to its character. Some minor damage to the receptor may occur. For example: • Receptor has high tolerance to change. • High capacity to return to baseline condition, e.g. within 1 year or up to 5 years. • May affect socio-economic behaviour but is not a nuisance to users. • The receptor is common and/or widespread.
Negligible	The receptor is tolerant to change with no effect on its character. The Project activity does not have a detectable effect on survival or viability.

Evaluating the Significance of Effect

- 4.2.67 Having established the magnitude of change and the sensitivity of the receptor the significance of the effect can be assessed. The identification of significance typically requires the application of professional judgement, however a significance matrix (Table 4-5) may also be used as a guide to help identify the likely significance of effects. Each of the specialist disciplines undertaking the environmental appraisal may have a variation of the table below that aligns with magnitude and sensitivity criteria that best suits their topic area, which may also be defined in industry guidelines. These criteria and determination of significance are outlined in the specialist chapters (Chapters 5-17) below.

Table 4-5: Significance Matrix

		Magnitude of Change			
		Negligible	Low	Medium	High
Sensitivity of Receptor	High	Negligible/ Minor	Moderate	Major	Major
	Medium	Negligible	Minor	Moderate	Major
	Low	Negligible	Negligible	Minor	Moderate
	Negligible	Negligible	Negligible	Negligible	Negligible/ Minor

- 4.2.68 Further explanation of these significance levels is provided in Table 4-6.

Table 4-6: Significance Category Descriptions

Significance Category	Typical Description
Major	A large and detrimental change to a valuable/sensitive receptor; likely or apparent exceeding of accepted (often legal) threshold. A large and beneficial change, whereby the improvements to the baseline were previously poor conditions is replaced by new legal compliance or a major contribution is made to national targets. These effects may represent key factors in the decision-making process. Potentially associated with sites and features of national importance or likely to be important considerations at a regional or district scale. Major effects may relate to resources or features which are unique and which, if lost, cannot be replaced or relocated.
Moderate	A medium scale change which, although not beyond an accepted threshold, is still considered to be generally unacceptable, unless balanced out by other significant positive benefits of a project. Likely to be in breach of planning policy, rather than legal statute. These effects, if adverse, are likely to be important at a local scale and on their own could have a material influence on decision making. A positive moderate effect is a medium scale change that is significant in that the baseline conditions are improved to the extent that guideline targets are contributed to.
Minor	A small change that, whilst adverse, does not exceed legal or guideline standards. Unlikely to breach of planning policy. A small positive change, but not one that is likely to be a key factor in the overall balance of issues. These effects may be raised as local issues and may be of relevance in the detailed design of the project but are unlikely to be critical in the decision making process.
Negligible	A very small change that is so small and unimportant that it is considered acceptable to disregard. Effects which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error, these effects are unlikely to influence decision making, irrespective of other effects.

- 4.2.69 The result of the interpretation of this matrix in line with the approach defined by each discipline is the assignment of the level of significance of the effect for all potential impacts. This is done prior to any mitigation and re-evaluated following the incorporation of appropriate mitigation measures.

Approach to Mitigation

- 4.2.70 A standard hierarchical approach to identifying mitigation requirements should be used:
- **Avoid or Prevent:** In the first instance, mitigation should seek to avoid or prevent the adverse effect at source for example, by routeing the cables away from a sensitive receptor.
 - **Reduce:** If the effect is unavoidable, mitigation measures should be implemented which seek to reduce the significance of the effect.
 - **Offset:** If the effect can neither be avoided nor reduced, mitigation should seek to offset the effect through the implementation of compensatory mitigation.
- 4.2.71 Mitigation measures fall into two categories: 'Mitigation by Design' which form part of the Proposed Development; and 'Project Specific Mitigation' which is in addition to design commitments and which are identified as a result of the assessment the Proposed Development :
- **Mitigation by Design:** The Proposed Development is being developed through an iterative process which involves seeking to avoid or reduce potential environmental effects through the appropriate siting of the Proposed Development infrastructure; and
 - **Project Specific Mitigation:** Project Specific Mitigation refers to measures which will be identified and proposed as a result of the assessment. These will be presented within each of the topic chapters. These will be identified to further avoid or reduce identified potentially adverse environmental effects where they cannot be in the design of the Proposed Development.

Evaluate and Assess Residual Significance

- 4.2.72 Following the identification of Project Specific Mitigation measures, the significance assessment will then be re-evaluated to determine whether there is likely to be a residual impact. When applied after mitigation, the resulting significance level is referred to as the residual significant effect.
- 4.2.73 Residual effects assessed as Moderate or Major after consideration of proposed mitigation measures would be classified as a Significant Effect. None are foreseen at this stage in the Proposed Development.

4.3 Habitats Regulations Assessment

- 4.3.1 It is necessary to consider whether the Proposed Development is likely to have a significant effect on areas that have been designated for their international nature conservation value. Known as European sites, these include SACs, SPAs and, as a matter of government policy, Ramsar sites.
- 4.3.2 European sites are protected under the Conservation of Habitats and Species Regulations 2017 (as amended; relevant to England and Wales) (Ref 67). The UK left the EU on 31 January 2020 under the terms set out in the European Union (Withdrawal Agreement) Act 2020 ("the Withdrawal Act"). However, the most recent amendments to the Habitats Regulations – the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 – make it clear that the need for HRA continues to apply.
- 4.3.3 The Screening Boundary is located within 10 km of the following international sites:
- Thames Estuary and Marshes SPA; and
 - Thames Estuary and Marshes Ramsar.
- 4.3.4 A Report to inform a Habitats Regulations Assessment (HRA) will therefore be included with the planning application, to assist the competent authority in completing its HRA.

- 4.3.5 Stage 1 of the HRA process (Test of Likely Significant Effects) will consider the potential pathways of effect between the Proposed Development and the European designated sites within 10 km of the Screening Boundary (on the basis that it is unlikely that a project such as this will affect sites further afield), and whether there is potential to have a significant adverse effect on the integrity of the European designated sites, either alone or in combination with other plans or projects. Potential pathways of effect currently include noise, light and visual disturbance during construction, pollution (via hydrological links to the designated sites) and dust emissions and loss / disturbance of functionally linked land used by qualifying bird species. Information used to support the HRA process will include desk study data and the suite of bird surveys outlined in section 4.2, Table 4-1 above.
- 4.3.6 Where there is potential for the Proposed Development to have a likely significant effect upon the qualifying features of the European designated sites, the pathway will be taken forward to Stage 2 - Appropriate Assessment. At Appropriate Assessment, the measures that will be implemented to either avoid the impact in the first place, or to mitigate the ecological effect to such an extent that it is no longer significant, will be set out and discussed with Natural England.
- 4.3.7 Assuming appropriate mitigation is implemented, no significant impact on designated bird species of the SPA and Ramsar is expected.

4.4 Other Supporting Documents

- 4.4.1 In line with the relevant authorities Planning Validation Checklists, the following will also be prepared to accompany the planning applications:
- Application drawings including a location plan, sections and elevations of the proposed tunnel headhouses and SECs;
 - Planning Statement; and
 - Design and Access Statement.

5 Summary

5.1 Conclusion

- 5.1.1 As set out within this report, it is considered that the Proposed Development is not development of a type that explicitly falls within Schedule 1 or Schedule 2 of The Town and Country Planning (Environmental Impact Assessment) Regulations 2017. Category 10(b) 'urban development' is the closest Schedule 2 category of the Town and Country Planning EIA Regulations 2017 that the Proposed Development could fall under, if the wider scope and purpose of the EIA Directive is followed.
- 5.1.2 It is also the case that the development area threshold of the Proposed Development exceeds 1ha. Therefore, having regard to Schedule 3 of the EIA Regulations and in the spirit of the EIA Directive, a screening assessment has been undertaken to establish whether the Proposed Development is likely to give rise to any significant effects on the environment.
- 5.1.3 It is also considered that the boring of a new tunnel does not fall under Schedule A1 or Schedule A2 of The Marine Works (Environmental Impact Assessment) Regulations 2007.
- 5.1.4 Table 5-1 provides a summary of the screening assessment and identifies whether significant effects on the environment are considered likely.

Table 5-1: Summary of Screening Assessment

Topic	Summary of Assessment	Conclusion
Ecology	Existing baseline information shows that both the Tilbury and Gravesend site are located in ecologically sensitive locations, either within or adjoining designated sites for nature conservation. Direct impacts will include land take from non-statutory designated sites, with the design avoiding any permanent physical footprint within the existing or proposed statutory designations. At this stage of data collection and design development, it is not currently possible to rule out the potential for likely significant effects on ecological receptors prior to mitigation. However, based on implementation of the avoidance and mitigation measures proposed (including design assumptions set out in Section 2) it is considered likely that significant adverse residual effects will not occur. An ecological appraisal will be undertaken, proportionate to that of a full EIA, to support the consenting application(s)	No Likely Significant Effect
Landscape and Visual	It is considered that as construction would be short-term, reversible and occur in a wholly industrialised context. No landscape elements of value would be lost as a result of the construction, with effects being temporary and of negligible magnitude on the low value landscape. Construction of above ground infrastructure/overhead cables would result in a very low magnitude of change in the view for the majority of potential viewers, including the most sensitive groups of residents in Tilbury/Gravesend, and recreational receptors. Viewers in proximity to the sites at Tilbury and Gravesend would be limited in number and experience the additional infrastructure in the context of more prominent industrial elements, limiting the magnitude of change.	No Likely Significant Effect

Topic	Summary of Assessment	Conclusion
	Once operational the Proposed Development including headhouses and OHL infrastructure would result in a very low magnitude of change in the view for the majority of potential viewers and would be perceived as part of, and an extension to, this existing industrial landscape	
Historic Environment	Construction and operation of the Proposed Development will not affect the setting of the Tilbury Fort Scheduled Monument or the four grade II listed buildings, four grade II listed buildings. There is potential for adverse effects on any surviving non-designated archaeological remains associated with the medieval sea wall (MEX6629) at Tilbury and the Milton Rifle Range (TQ 67 SE 1185) at Gravesend, in addition to previously unknown buried archaeological and palaeoenvironmental remains within the buried alluvial deposits at each tunnel shaft site. It is concluded that the potential adverse effects arising from the loss or disturbance of these remains arising from construction of the Proposed Development could be mitigated by an appropriate programme of archaeological investigation, sampling and recording developed in consultation with the Historic Environment Officers at Essex and Kent County Councils.	No Likely Significant Effect
Traffic and Transport	It is considered that each of the potential impacts and environmental risks relating to Traffic and Transport associated with the works can be managed through the application of accepted good practice and compliance with the measures outlined above. As a result, the Proposed Development is not expected to result in any significant environmental effects in terms of Traffic and Transport.	No Likely Significant Effect
Noise and Vibration	Due to the distance between the Tilbury Site and sensitive receptors, no significant noise or vibration effects are expected during the construction or operational phases. At Gravesend, it is considered that the potential for significant noise and vibration effects appropriate mitigation measures such as the 'best practicable means' as defined in Section 72 of the Control of Pollution Act and the use of attenuators and acoustic louvers will be incorporated into the design and construction such that residual effects are unlikely to be significant. It is proposed that more detail on potential effects and mitigation requirements will be set out in an Environmental Report which accompanies the relevant consent application.	No Likely Significant Effect
Air Quality	It is considered that the Proposed Development's potential to impact on local air quality through construction can be affectively mitigated through standard and best practice mitigation and reduce effects such that they are unlikely to be significant.	No Likely Significant Effect
Geology and Hydrogeology	It is anticipated that the results and recommendations of the Phase 1 PRA, once incorporated into the CEMP, along with the environmental design and management measures for the construction, operation and decommissioning phases, will negate the need for a statutory geology and hydrogeology assessment.	No Likely Significant Effect

Topic	Summary of Assessment	Conclusion
Surface Water Environment and Flood Risk	It is not considered that significant effects in relation to surface water environment and flood risk are likely. Mitigation measures will be informed by a site-specific FRA and non -statutory Environmental Appraisal Report supported by a WFD assessment to confirm compliance with the Water Environment (WFD) (England and Wales) Regulations 2017.	No Likely Significant Effect
Materials and Waste	It is considered that significant effects in relation to materials and waste are unlikely, taking into account the baseline conditions, information available to date on the Proposed Development, the size and scale of the Proposed Development and the mitigation outlined.	No Likely Significant Effect
Climate Change	It is considered that the Proposed Development's potential GHG emissions and vulnerability can be managed through the application of appropriate adaptation measures. There is not likely to be a significant environmental effect on Climate during construction and operation.	No Likely Significant Effect
Agricultural land	The Tilbury site is primarily in non-agricultural use and the Gravesend site is within an area of Grade 4, Poor agricultural land. As Grade 4 is not classed as Best and Most Versatile Land (BMV), there would be no loss of BMV land.	No Likely Significant Effect
Health Population and Socioeconomics	It is considered that each of the potential impacts relating to Health, Population and Socio-Economics associated with the works can be managed through the application of accepted good practice and compliance with mitigation measures. Therefore, there is not likely to be any significant environmental effects on Health, Population and Socio-Economics.	No Likely Significant Effect
Cumulative Effects	Given the nature of the Proposed Development, the location, construction methods, standard mitigation measures to be implemented and the fact that the Proposed Development is replacing existing infrastructure, it is determined that the Proposed Development would not result in any significant cumulative or combined effects.	No Likely Significant Effect

5.2 Next Steps

- 5.2.1 National Grid will continue to liaise closely with stakeholders and statutory bodies in the preparation of the EAR and consenting applications as required.

Abbreviations

Abbreviation	Meaning
AC	Alternating Current
AIL	Abnormal indivisible Loads
AILs	Abnormal Indivisible Loads
ALC	Agricultural Land Classification
AOD	Above Ordnance Datum
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AONB	Area of Outstanding Natural Beauty
ASTI	Accelerated Strategic Transmission Investment
BMV	Best and Most Versatile
BTO	British Trust for Ornithology
C&D	Construction and Demolition
CDE	Catchment Data Explorer
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
CIEEM	Chartered Institute of Ecology and Environmental Management
CLP	Construction Logistics Plan
CRoW	Countryside and Rights of Way
CSM	Conceptual Site Model
DC	Direct Current
Defra	Department for Environment, Food and Rural Affairs
DESNZ	Department for Energy Security and Net Zero
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EAR	Environmental Appraisal Report
ECOW	Ecological Clerk of Works
eDNA	Environmental DNA
EIA	Environmental Impact Assessment
EISD	Earliest in Service Date
EMFs	Electric and Magnetic Fields
EPB	Earth Pressure Balance
ES	Environmental Statement
ESO	Electricity System Operator
ESR	Environmental Screening Report
ETYS	Electricity Ten Year Station
EWC	European Waste Catalogue
FES	Future Energy Scenarios

Abbreviation	Meaning
FRA	Flood Risk Assessment
GHG	Greenhouse Gas emissions
GI	Ground Investigations
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GPDO	Town and Country Planning (General Permitted Development) (England) Order 2015
GQRA	Generic Quantitative Risk Assessment
HDD	Horizontal Direction Drilling
HER	Historic Environment Record
HGV	Heavy Goods Vehicles
HIS	Habitat Suitability Index
HRA	Habitat Regulations Assessment
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEMA	Institute Environmental Management and Assessment
CNIRP	International Commission on Non-Ionizing Radiation Protection
kV	Kilovolt
LAGB	London Area Green Belt
LCA	Landscape Character Area
LCRM	Land Contamination Risk Management
LNR	Local Nature Reserve
LWS	Local Wildlife Site
MAGIC	Multi-Agency Geographic Information for the Countryside
MCA	Marine Character Area
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MPA	Minerals Planning Authorities
MPSTC	Metropolitan Police Specialist Training Centre
MPSTC	Metropolitan Police Specialist Training Centre
MSA	Mineral Safeguarding Areas
MW	Megawatts
NCA	National Character Area
NCN	National Cycle Network
NERC	Natural Environment and Rural Communities
NFI	National Forestry Inventory
NGLE	National Heritage List for England
NH	National Highways
NMTC	National Maritime Training Centre
NO ₂	Nitrogen dioxide
NOA	Network Options Assessment
NO _x	Nitrogen oxides
NPPF	National Planning Policy Framework
NSIP	Nationally Significant Infrastructure Projects

Abbreviation	Meaning
NVC	National Vegetation Classification
NVZ	Nitrate Vulnerable Zone
OHL	Overhead Line
PM	Particulate Matter
PCL	Potential Contaminant Linkages
PEA	Preliminary Ecological Appraisal
PRA	Preliminary Risk Assessment
PRoW	Public Rights of Way
PRR	Portable Relay Room
RBMP	Thames River Basin Management Plan
RNAG	Reasons for Not Achieving Good
RSPB	Royal Society for the Protection of Birds
SECs	Sealing End Compounds
SNHRW	Stable Non-Reactive Hazardous Waste Cell
SPA	Special Protection Area
SPZ	Source Protection Zone
SRN	Strategic Road Network
SSC	Suspended Sediment Concentrations
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TA	Transport Assessment
TBM	Tunnel Boring Machine
TKRE	Tilbury to Grain and Tilbury to Kingsnorth
TRaC	Transitional and Coastal Waters
UCA	Urban Character Areas
UKHSA	UK Health Security Agency
UPS	Uninterrupted Power Supplies
UXO	Unexploded Ordnance
WC	Water Closet
WFD	Water Framework Directive
WFD	Water Framework Directive
WPA	Waste Planning Authorities
WRAP	Waste and Resources Action Programme
WW	World War
XLPE	Cross Linked Polyethylene
ZSL	Zoological Society of London
ZTV	Zone of Theoretical Visibility

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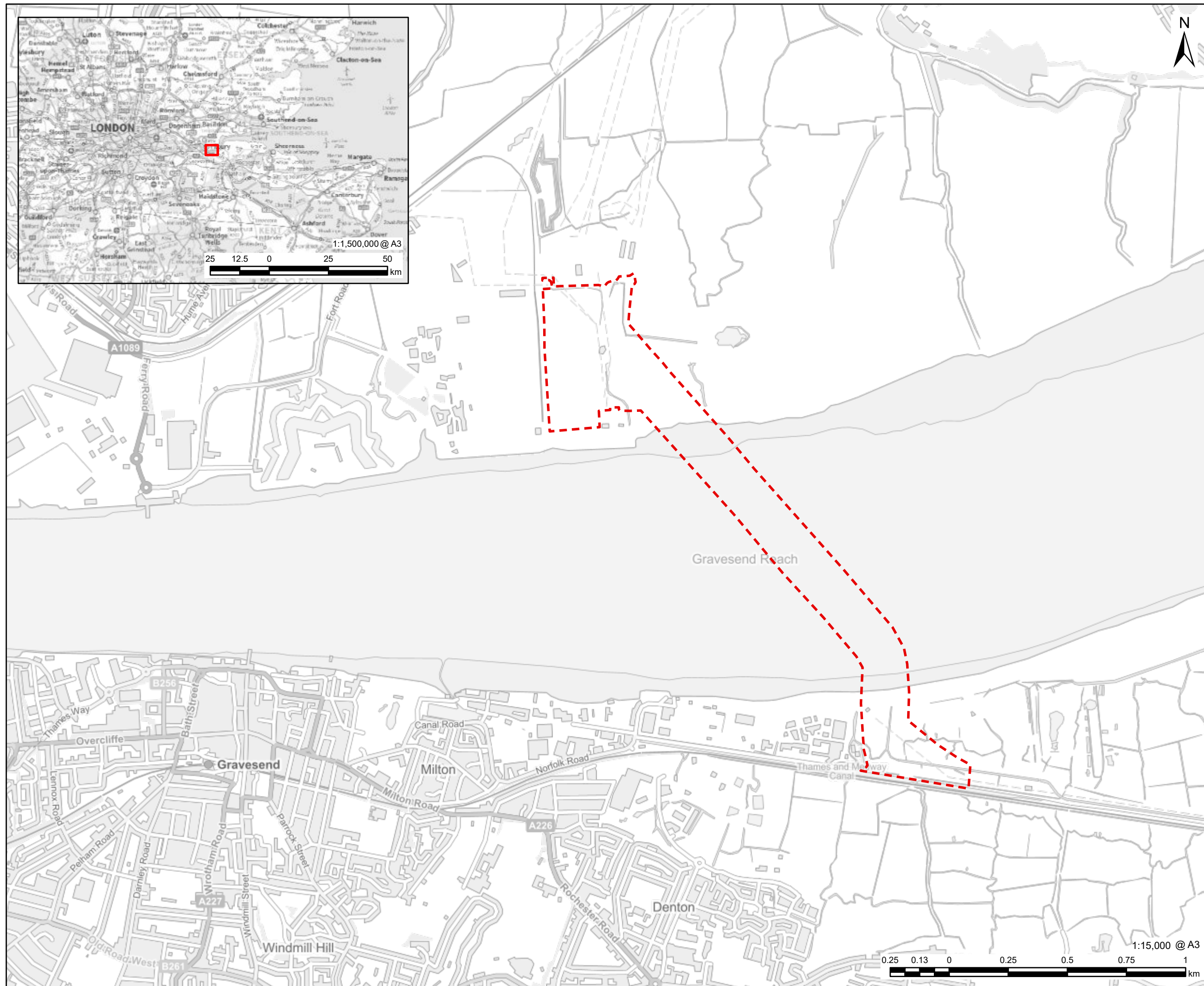
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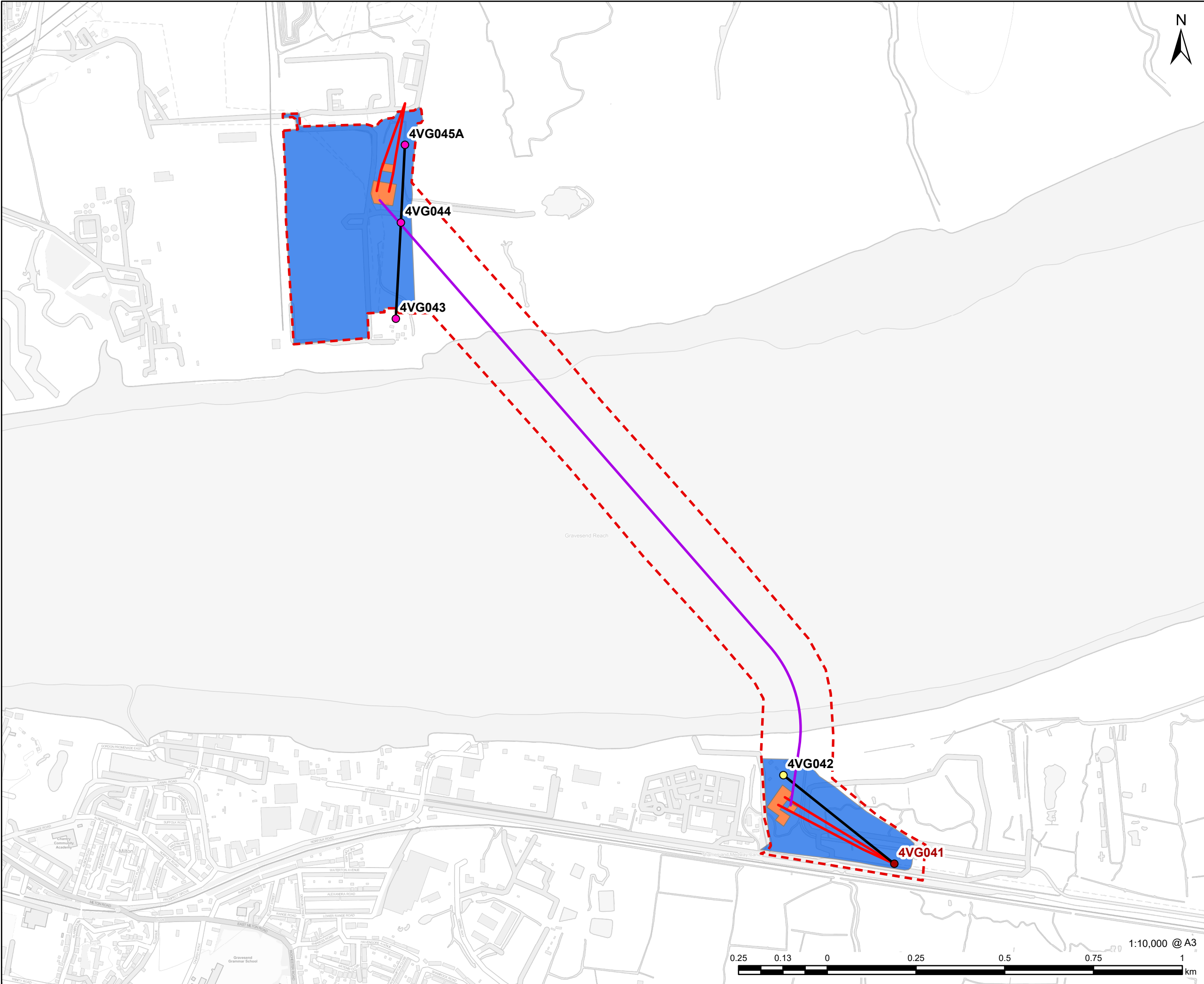
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Appendix A – Figures



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LEGEND	
 EIA Screening Boundary	
NOTES	
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ISSUE PURPOSE	
EIA SCREENING REPORT	
PROJECT NUMBER	
60677311	
FIGURE TITLE	
Site Location Plan	
FIGURE NUMBER	
Figure 1	



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LEGEND

- EIA Screening Boundary
- Existing Pylons to be Removed
- Existing Pylons to be Removed / Refurbished / Replaced
- Existing Pylons to be Retained
- Indicative Tunnel Alignment
- Existing Overhead Line to be Permanently Diverted
- New Overhead Line
- Permanent Development
- Temporary Working Area

NOTES

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ISSUE PURPOSE

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FIGURE TITLE

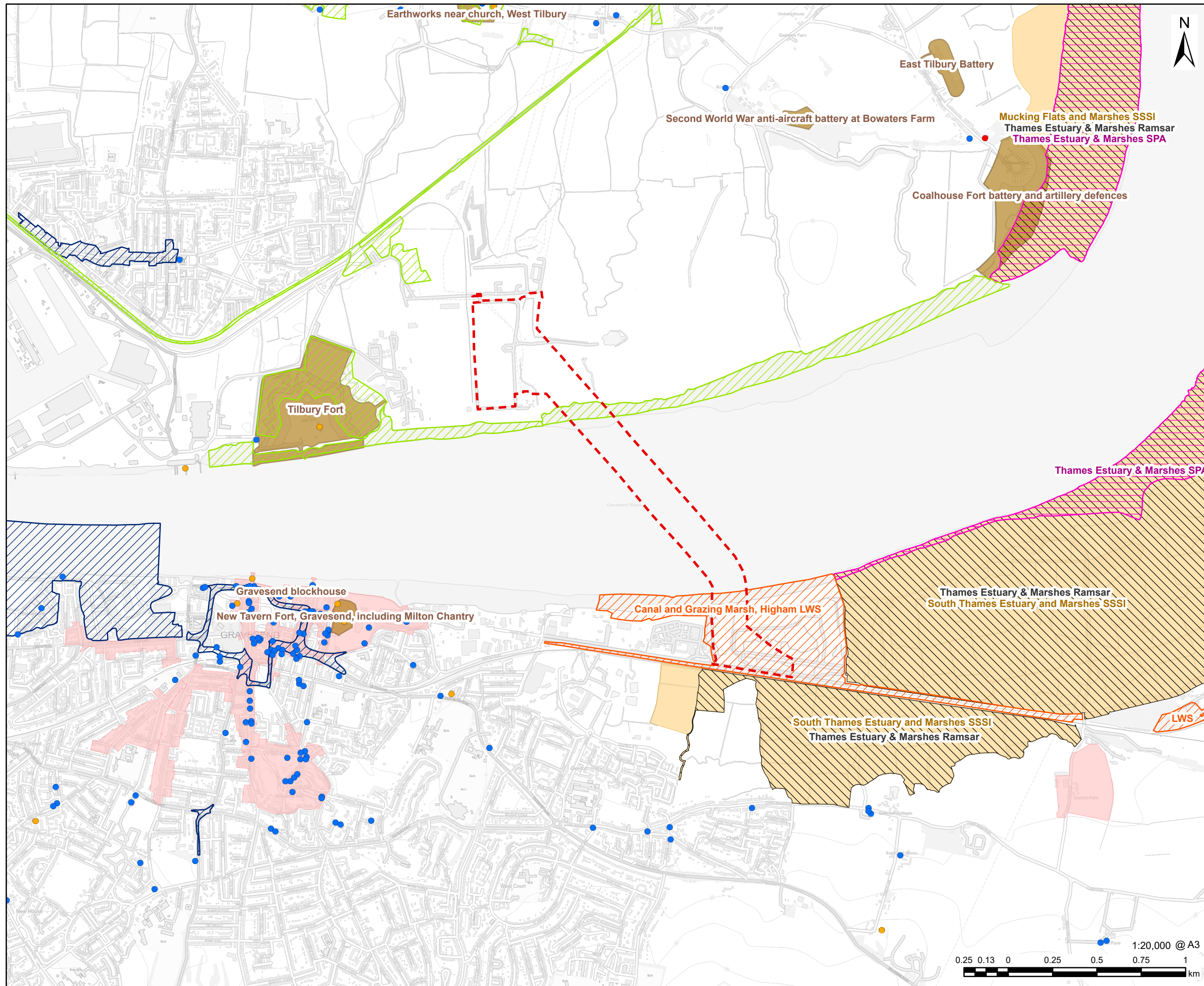
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FIGURE NUMBER

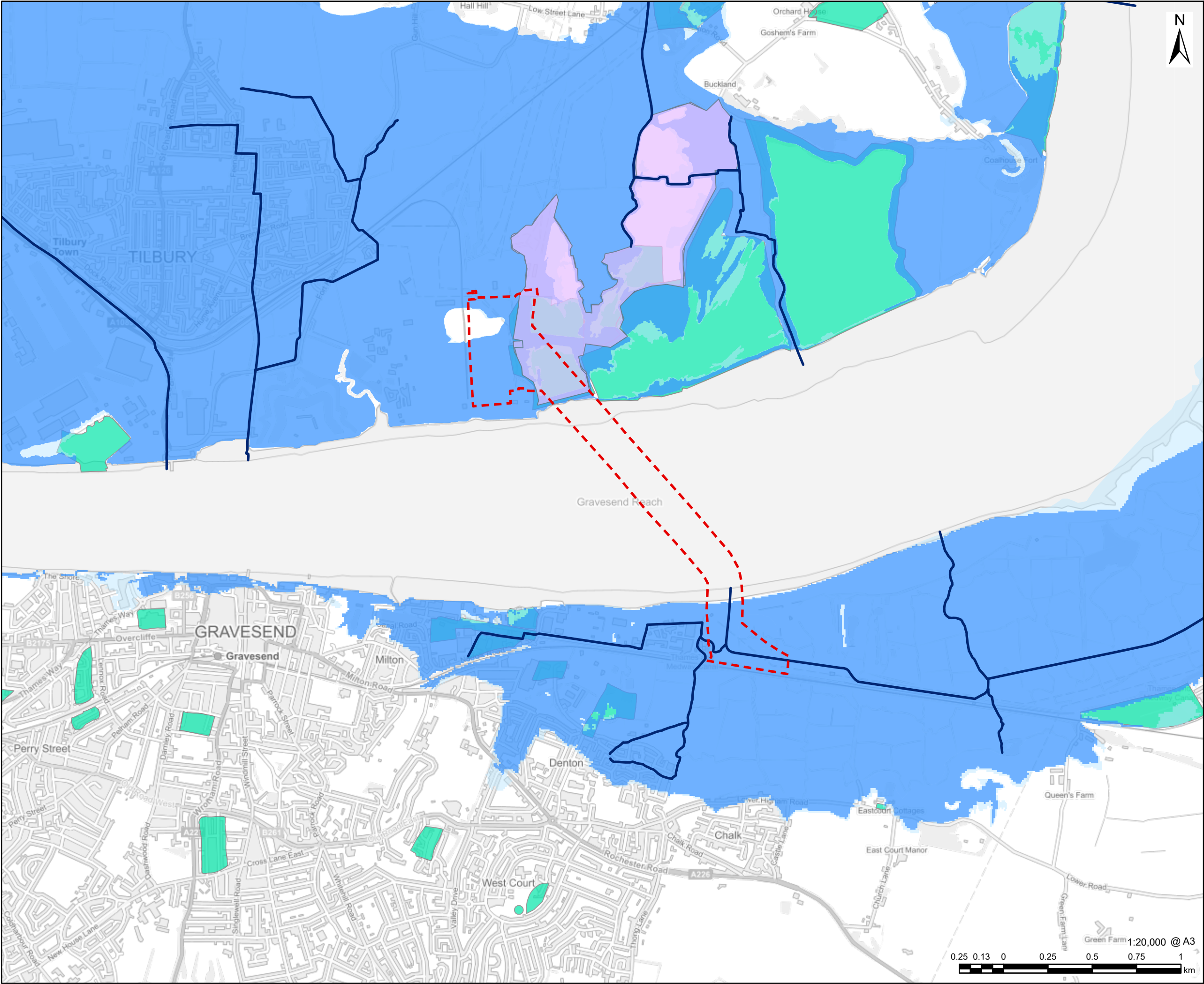
Figure 2



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LEGEND

- EIA Screening Boundary
- Main River
- Flood Zone 2
- Flood Zone 3
- Authorised Landfill Site
- Historic Landfill Site

NOTES

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FIGURE TITLE

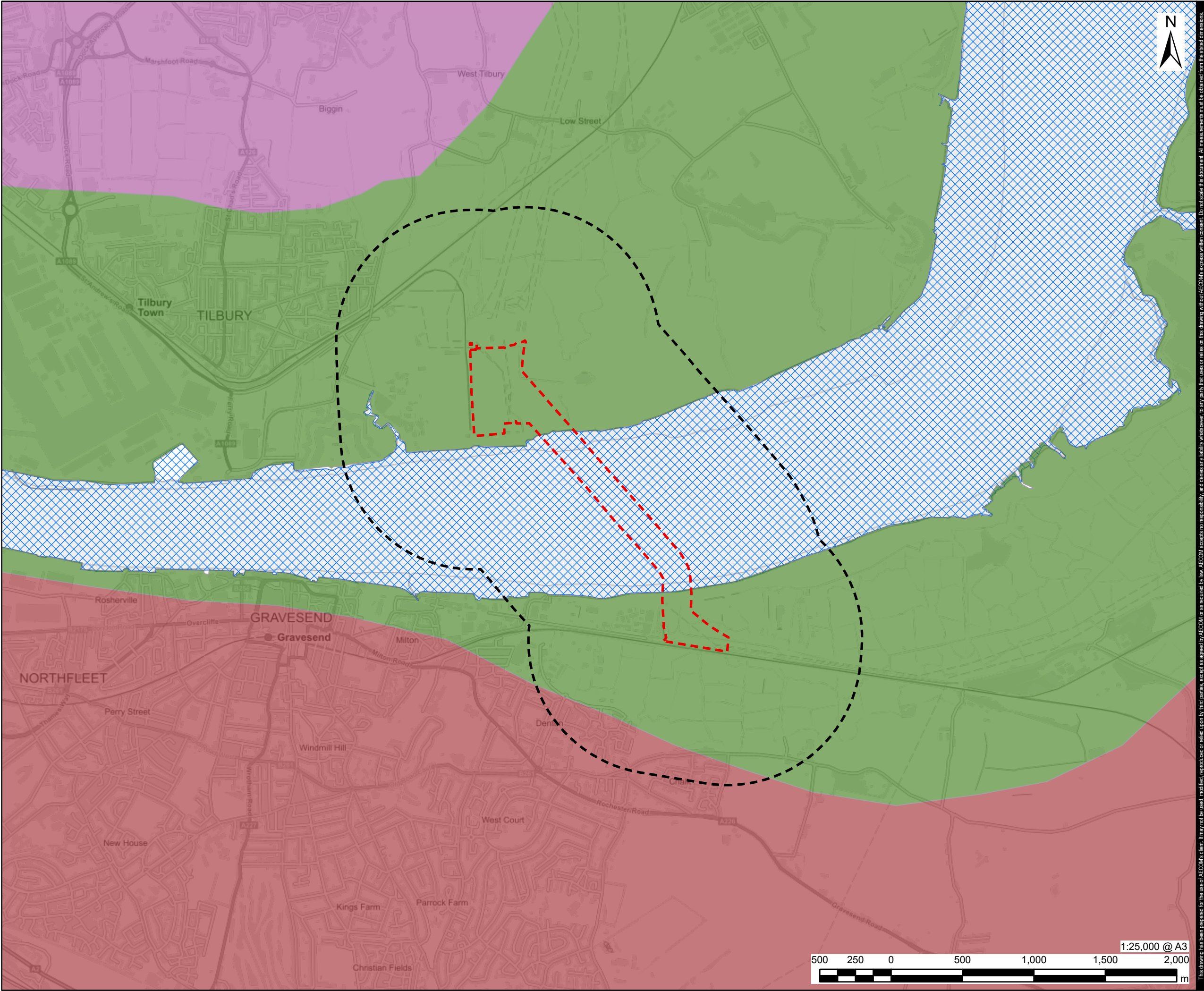
Environmental Constraints - Sheet 2 of 2

FIGURE NUMBER

Figure 3b

0.25 0.13 0 0.25 0.5 0.75 1
km 1:20,000 @ A3

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LEGEND

EIA Screening Boundary

1.5km Study Area

Marine Character Area

18 Thames and Medway Estuaries

National Character Area

Greater Thames Estuary

North Kent Plain

Northern Thames Basin

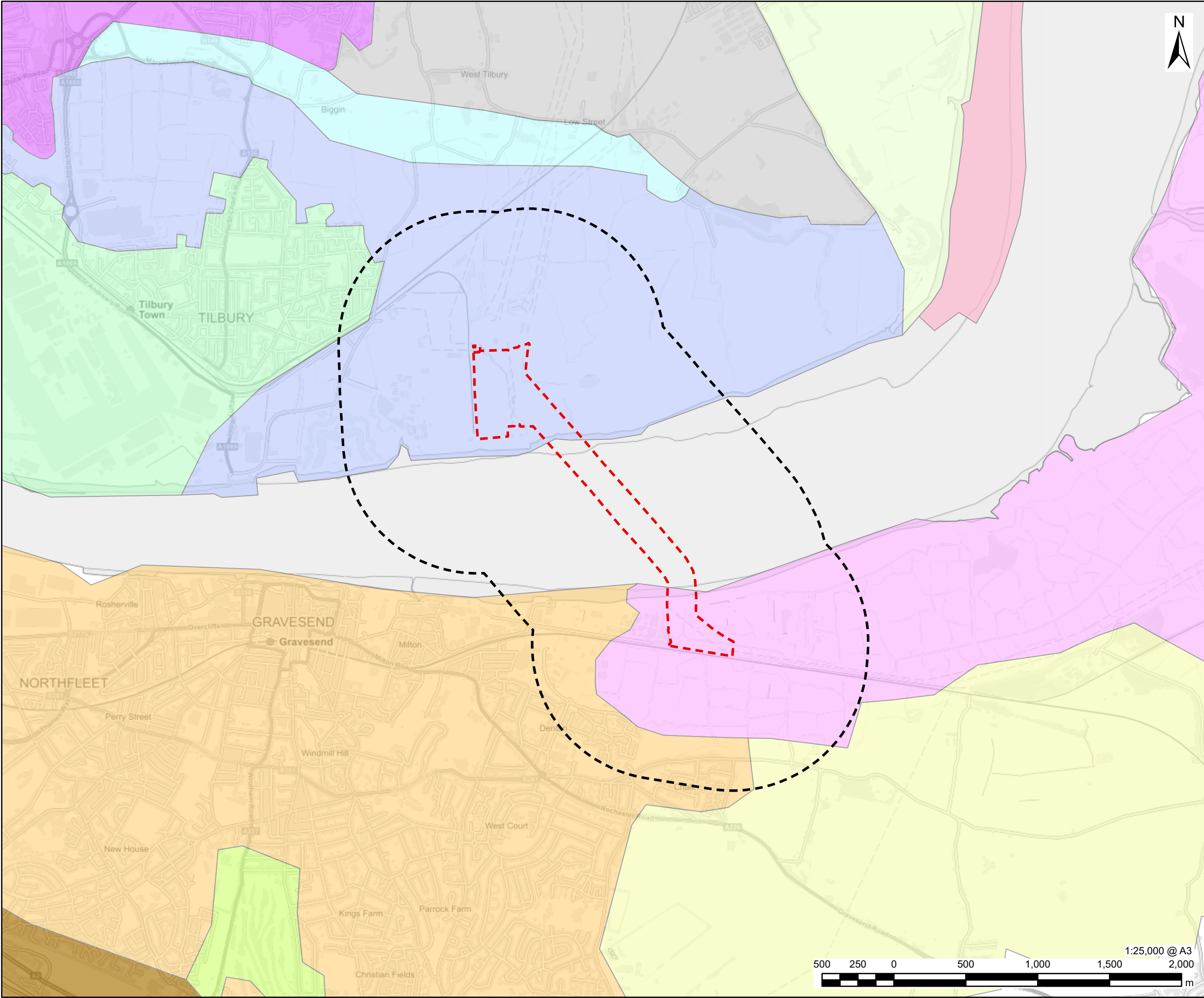
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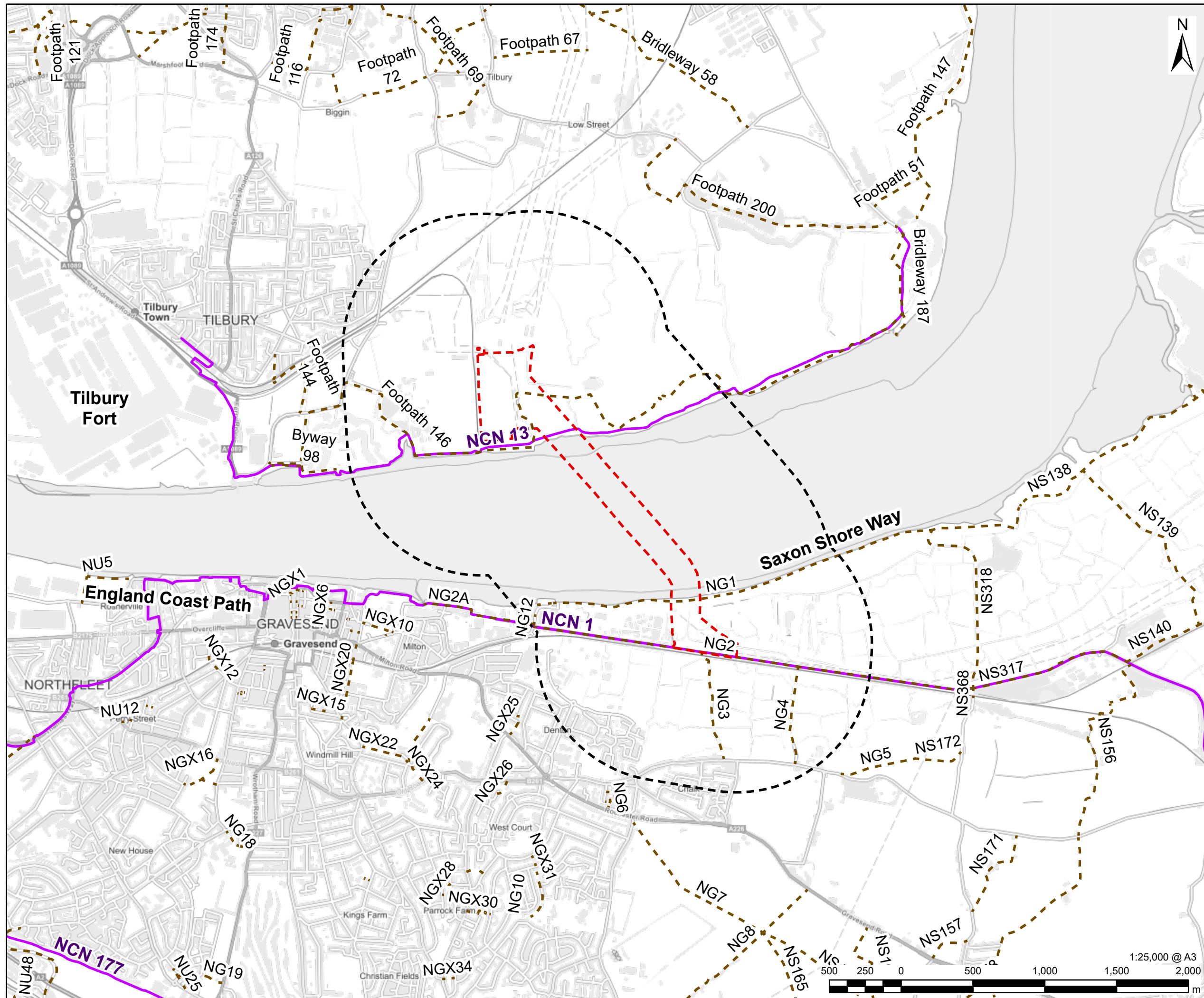
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EIA SCREENING REPORT

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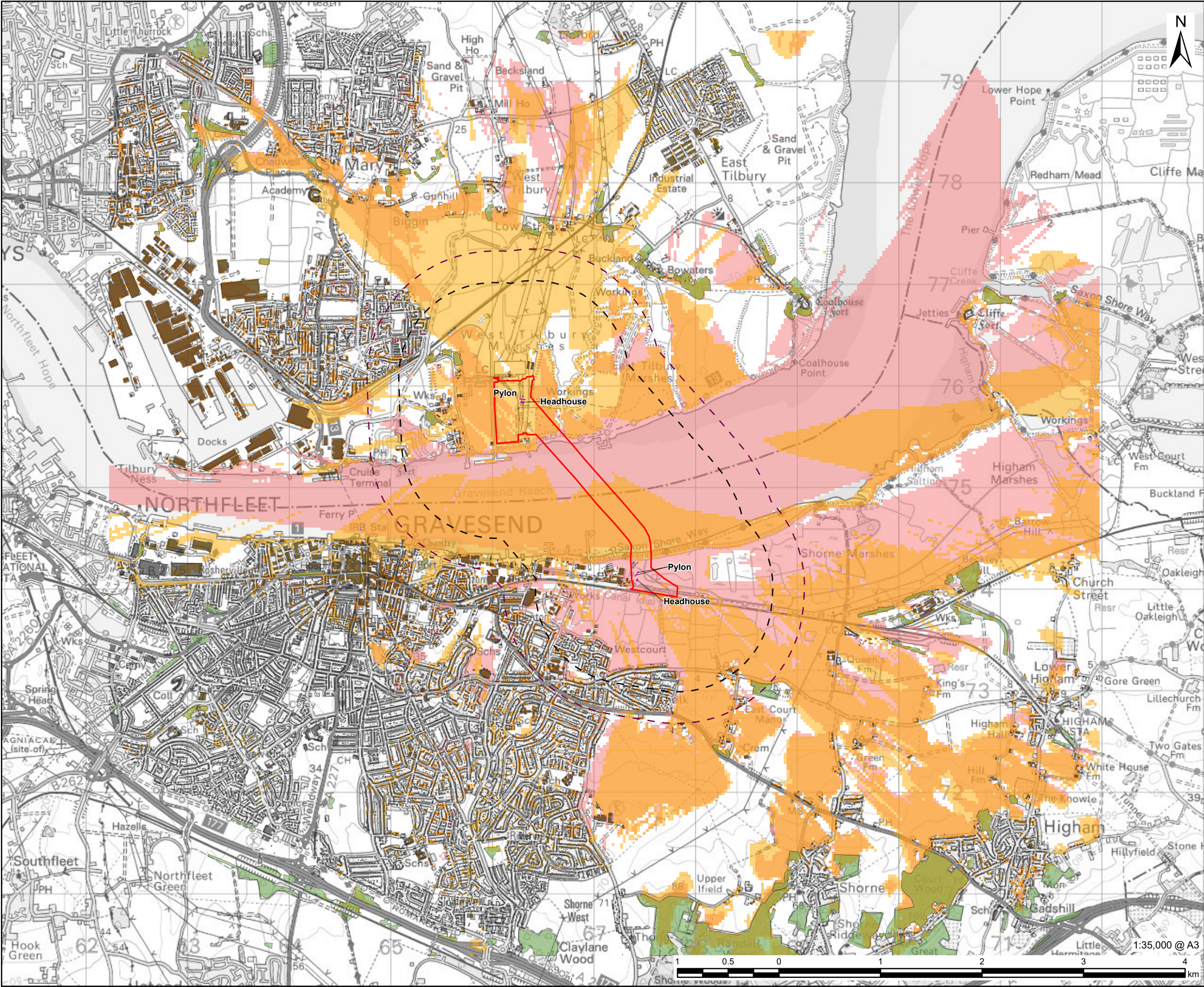
FIGURE TITLE
National Character Areas

FIGURE NUMBER
Figure 4a





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LEGEND

- EIA Screening Boundary
- 1km Study Area
- 1.5km Study Area
- 2km Study Area
- Modelled Footprint
- Existing OS Open Building - 7.5m
- National Forest Inventory - Woodland - 10m
- Zone of Theoretical Visibility - Tilbury
- Zone of Theoretical Visibility - Gravesend

NOTES

Zone of Theoretical Visibility (ZTV) has been generated using Ordnance Survey Terrain 5 digital terrain model which does not take into account the screening effects of vegetation, buildings or other structures. Existing Buildings have been incorporated into the DTM using OS Open Map Local with an assumed height of 7.5m. Woodland from the National Forest Inventory was also incorporated into the DTM with an assumed height of 10m. ZTV is based upon a series of points around the sealing end compound tower structures with a height of 12m, a grid of points 3m apart within the headhouse building at a height of 10m and an observer eye height of 1.6m. All heights mentioned above are above ground level (AGL).

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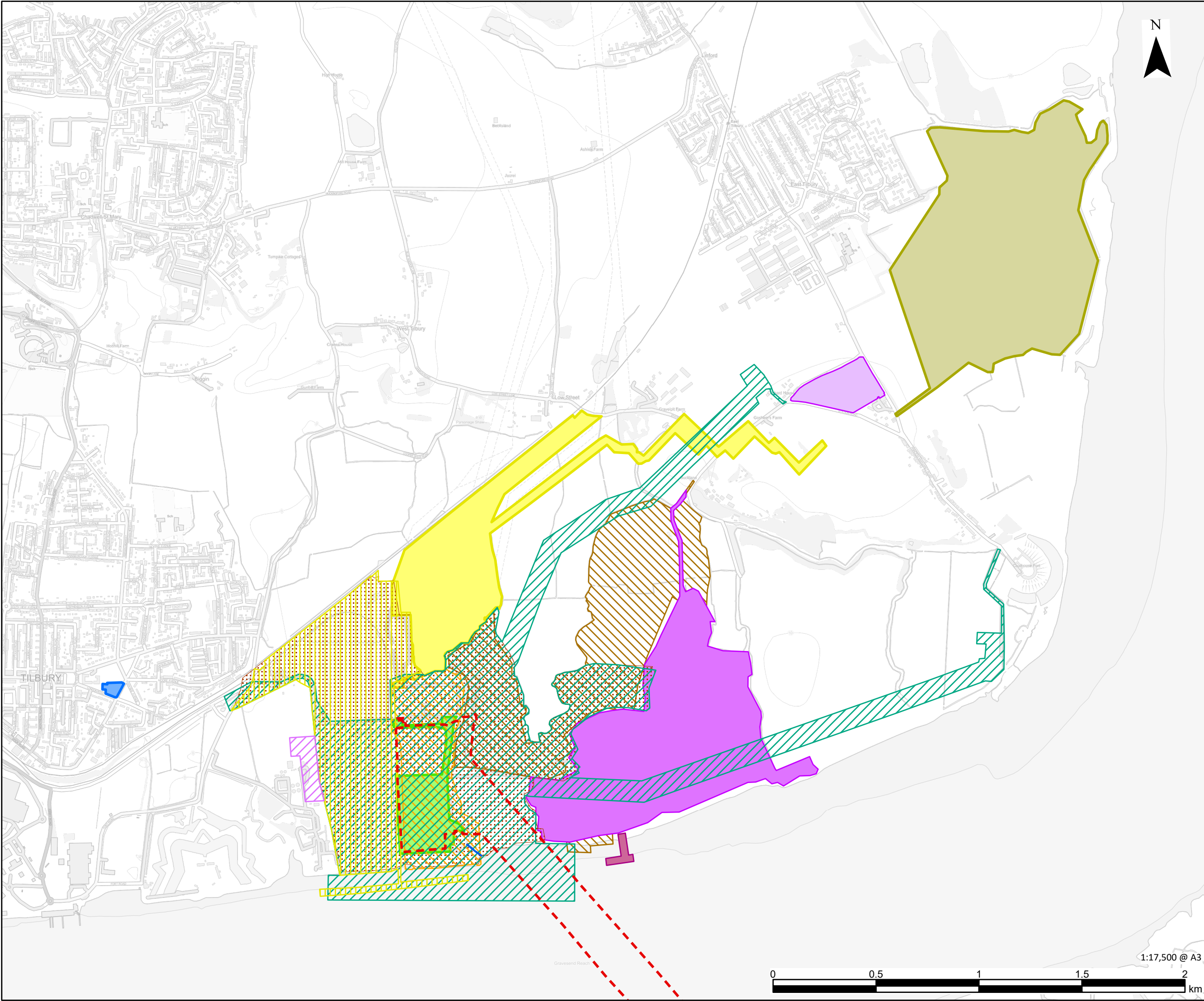
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FIGURE TITLE

Tilbury and Gravesend - Screened
Zones of Theoretical Visibility

FIGURE NUMBER

Figure 5



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LEGEND

EIA Screening Boundary

Development Application References

- 15/00288/FUL - Solar Farm
- 15/00576/FUL - Extension to Substation Compound
- 17/00412/FUL - Ingrebourne Continued Re-profiling
- 19/00052/CV - Recovery for Beneficial Use of Pulverised Fuel Ash
- 21/01108/SCO - East Tilbury Quarry Continuation of Use of Land for Inert Waste
- 21/00947/FUL - Replacement Surface Water Outfall at Tilbury Power Station
- 21/01927/FUL - Tilbury2 Temporary Storage Area
- 22/00812/SCR - Thurrock Hydrogen Plant
- 98/00773/MIN - Restoration of Former Waste Disposal Site
- 18/00549/SCO - New Combined Cycle Gas Power Station
- 19/01278/DCOAPP - Details of the External Materials to be Used in the Construction of Tilbury2
- 23/00220/SCR - Proposed Youth Zone Development (EIA Screening)
- 22/01461/FUL - Re-grading of the Land for Storage of New Motor Vehicles/Port-related Product
- 22/01541/FUL - Continued Use of the Jetty (Goshems Farm)

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ISSUE PURPOSE

Cumulative Effects EIA

PROJECT NUMBER

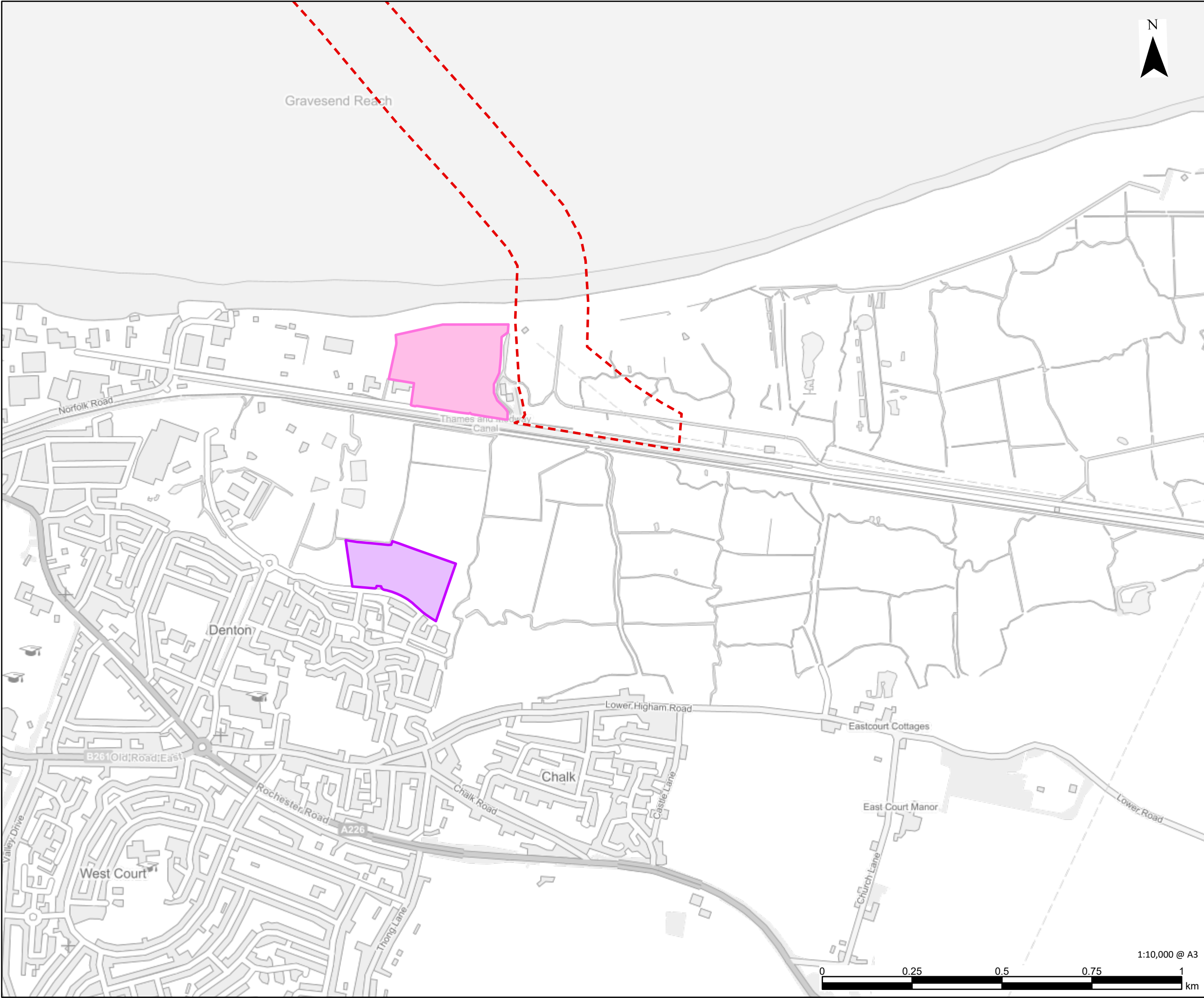
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FIGURE TITLE

Other Proposed Developments within 1km of EIA Screening Boundary (Thurrock)

FIGURE NUMBER

Figure 6a



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LEGEND
 EIA Screening Boundary
 Development Application References
 20160314 - New Industrial Units
 20211541 - New Training Building

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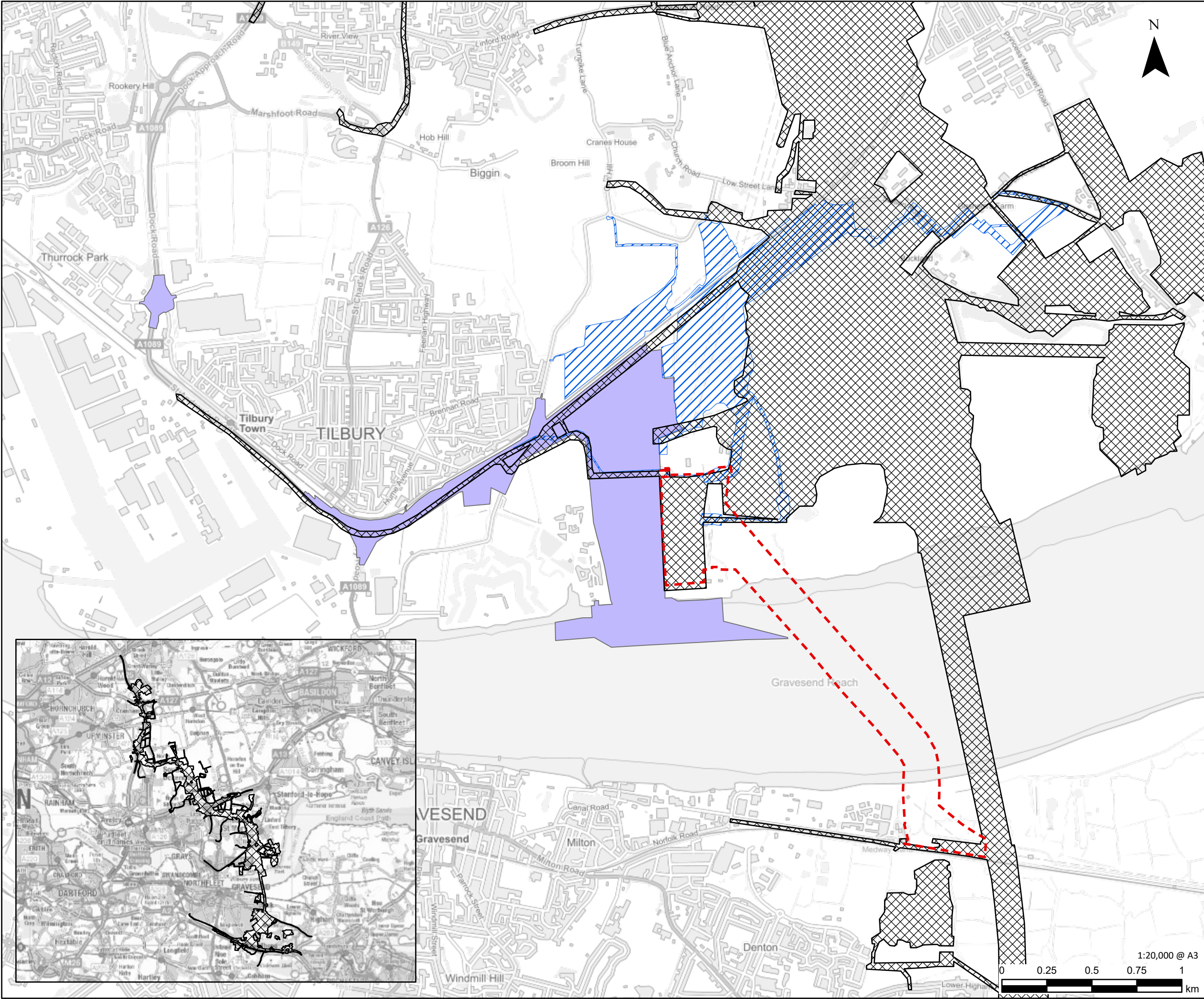
ISSUE PURPOSE
Cumulative Effects EIA

PROJECT NUMBER
60677311

FIGURE TITLE
Other Proposed Developments within 1km of EIA Screening Boundary (Gravesend)

FIGURE NUMBER
Figure 6b

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LEGEND

- EIA Screening Boundary
- Development Application References
 - EN010092 - Thurrock Flexible Generation Plant
 - TR010032 - Lower Thames Crossing
 - TR030003 - Tilbury2

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ISSUE PURPOSE

Cumulative Effects EIA

PROJECT NUMBER

60677311

FIGURE TITLE

NSIPs within 1km of EIA Screening Boundary

FIGURE NUMBER

Figure 6c

Appendix B – Cumulative Developments

Cumulative Effects Assessment Criteria

Cumulative developments are listed on the following page and include:

- All residential applications proposing 10 units or more submitted in the last 5 years within 1km of the Proposed Development;
- All mixed-use and employment applications proposing 1ha of development or more submitted in the last 5 years within 1km of the Proposed Development;
- All nationally significant infrastructure projects submitted in the last 5 years within 1km of the Proposed Development. Some developments have been included that are over 5 years old however it is noted that activity has been recorded on the applications within the last 5 years and therefore they have been included.

Application Number	Development Description	Application Status and Programme	Date Validated / Granted	Distance from Screening Boundary (m)
Nationally Significant Infrastructure Projects				
EN010092	Thurrock Flexible Generation Plant The Proposed Development comprises the construction and operation of Gas Reciprocating engines with up to 600 MW electrical capacity and Battery Storage with up to 150 MW electrical capacity	DCO granted. The construction includes a 15 month programme which may commence in summer 2023.	16 February 2022 Non-material amendment granted 8 March 2023	0
TR010032	Lower Thames Crossing (National Highways). The Lower Thames Crossing will be a new road crossing connecting Kent, Thurrock and Essex.	In the pre- examination phase. If consented, construction would commence in early 2025, however there have been recent delays to the examination timetable.	11 November 2022	0
TR030003	Tilbury2 A new port facility acting alongside the existing Port of Tilbury. This will involve the extension of existing jetty facilities and the dredging of berth pockets in the River Thames, and land works and facilities for: a "Roll-On / Roll-Off" (Ro-Ro) terminal for importing and exporting containers on road trailers; a facility for importing and processing bulk construction materials; and areas of external storage for a variety of goods such as imported cars. The project also involves the construction of road and rail links to the site from adjacent networks.	DCO granted and development has been built and has been officially opened.	20 February 2019	0
Thurrock Council				
18/00549/SCO	Planning Inspectorate Consultation to the Local Planning Authority for an EIA Scoping opinion for a future Development Consent Order to develop a new Combined Cycle Gas Power Station with a generating capacity up to 2500 megawatts (MW), Open Cycle Gas Turbines with a generating capacity up to 300MW and an energy storage facility, all on the Tilbury Power Station site	EIA Required	Mon 14 May 2018	0

Application Number	Development Description	Application Status and Programme	Date Validated / Granted	Distance from Screening Boundary (m)
15/00288/FUL	Application for the approval of details reserved by condition no. 17 (Community Benefit Fund) of planning permission ref. 15/00288/FUL (Proposed development of solar photovoltaic panels (solar farm) and associated works including string inverters, access tracks, security fencing and CCTV.).	Approved	Thu 09 Aug 2018	2163
19/00051/CV (Variation) 17/00412/FUL (original application)	Application for the variation of conditions no 9 (Timescales) [to Extend time period for completion from 31.12.2019 to 31.12.2032] and no 11 (Plans) [To alter phasing of restoration] of planning permission ref 17/00412/FUL (Continued re-profiling of the site to 9 metres AOD using inert reclamation material imported by river, in place of Pulverised Fuel Ash from the adjacent now redundant Power Station) Original Application: Continued re-profiling of the site to 9 metres AOD using inert reclamation material imported by river, in place of Pulverised Fuel Ash from the adjacent now redundant Power Station.	Awaiting decision	Fri 11 Jan 2019 Original Application approved Fri 23 Feb 2018	0
19/00052/CV (variation of condition to allow extension of time to complete works) 13/00497/FUL (original application)	Application for the variation of conditions No. 3 (Restoration Date) to allow extension of time to complete works, 4 (Phasing Strategy Area A2) and 5 (Phasing Strategy Area B) of Application Reference Number: 13/00497/FUL (Recovery for beneficial use of pulverised fuel ash deposited on Tilbury Power Station ash disposal site areas A2, A3 and B) Original Application: Recovery for beneficial use of pulverised fuel ash deposited on Tilbury Power Station ash disposal site areas A2, A3 and B.	Awaiting decision	Fri 11 Jan 2019 Original application approved Fri 25 Oct 2013	0
19/01278/DCOAPP	Application by Port of Tilbury London Limited pursuant to Schedule 2, Part 1 (3) of the Port of Tilbury (Expansion) Order 2019 for the approval of details of the external materials to be used in the construction of (a) the proposed ancillary buildings constructed as part of Work No. 3 (d) and (b) the proposed ancillary buildings constructed as part of Work No. 5 (c).	Approved and development has been built and has been officially opened.	Wed 09 Oct 2019	0

Application Number	Development Description	Application Status and Programme	Date Validated / Granted	Distance from Screening Boundary (m)
18/01564/CV (variation of conditions) Original Application: 98/00773/MIN	Application for the variation of conditions nos 2 (Approved Plans), 6 (Timescale) and 15 (Adhering to contours outlined in plan) of planning permission ref 11/50352/TTGCND [Section 73 Application - Modify the conditions attached to planning permission ref: 98/00773/MIN 'Restoration of former waste disposal site by spreading soil from civil engineering works transported to site via the River Thames and the diversion of footpath no 146 along a new route to be constructed beside river (ESS/20/97THU); Condition 2 - change to the approved Phasing plan; Condition 5 - amendment to the sequencing of works; Condition 6 - change to the timescale for completing importing of material (to 31st October 2017) and completing restoration (to 31st October 2018); Condition 9 - change to include unloading of barges within the definition of operations not subject to hours control] to allow change to approved landforms and increased length of time for restoration. Original Application: Restoration of former waste disposal site by spreading spoil from civil engineering works transported to site via the River Thames and the diversion of footpath no 146 along a new route to be constructed beside river (ESS/20/97/THU).	Approved	Fri 02 Oct 2020 Original application approved Tue 25 Nov 2003	3
21/01108/SCO	Environmental Impact Assessment Screening Opinion pursuant to Part 3 (8) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017. Application for the variation of condition No 2 and No 34 of planning permission ref 08/00958/TTGMIN. (Continuation use of land for inert waste and soils recycling, primary aggregates extraction, processing and sale together with ancillary facilities and access. Phased restoration to nature conservation and public amenity after uses by the permanent deposit of inert waste)	Advice Given	Thu 29 Jul 2021	2510

Application Number	Development Description	Application Status and Programme	Date Validated / Granted	Distance from Screening Boundary (m)
21/02098/CONDC (reserved matters) 15/00576/FUL (original)	Application for the approval of details reserved by condition no 4 (Flood Evacuation and Emergency Response Plan) of planning permission ref. 15/00576/FUL (Extension to substation compound to incorporate new 11kv transformer and new emergency water storage tank, with amended palisade fencing). Original Application: Extension to substation compound to incorporate new 11kv transformer and new emergency water storage tank, with amended palisade fencing	Approved	Tue 08 Feb 2022 Original application approved Fri 11 Sep 2015	0
21/01927/FUL	Use of the land for external storage for a temporary period of no more than 5 years including the storage of HGVs, new motor vehicles and miscellaneous port-related product (Area 1) with associated minor filling of existing concrete slab voids and installation of ramps at kerb edges where necessary using on-site inert material.	Approved – Port of Tilbury appear to the using land for external storage of HGVs and various other vehicles.	Fri 18 Mar 2022	0
21/01928/FUL	Use of the land for external storage for a temporary period of no more than 5 years including the storage of new motor vehicles and miscellaneous port-related product (Area 2) with associated minor regrading of land using on-site inert material and importation of inert capping material.	Approved – Port of Tilbury appear to the using land for external storage of HGVs and various other vehicles.	Fri 18 Mar 2022	0
22/00812/SCR	Request for EIA Screening Opinion with regard to the proposed development of Thurrock Hydrogen Plant, a facility for the production of hydrogen by electrolysis, on land south west of Station Road in Tilbury, Thurrock.	EIA Not Required	Fri 01 Jul 2022	149
21/00947/FUL	Replacement surface water outfall at Tilbury Power Station.	Approved	Fri 04 Nov 2022	50
22/01541/FUL	Application to allow the continued use of the jetty comprising pontoon and access bridge located offshore of Goshems Farm.	Awaiting decision	Wed 16 Nov 2022	160
23/00220/SCR	Request for Environmental Impact Assessment (EIA) Screening Opinion: Proposed Youth Zone development	Awaiting decision	Thu 23 Feb 2023	1328
22/01461/FUL	Removal of existing structures and buildings, re-grading of the land, laying of a concrete pavement, installation of upgraded drainage, lighting and security fencing and use of the land for port-related storage including haulier parking and/or storage of new motor vehicles and/or storage or port-related product with access from Tilbury2 port.	Approved	Thu 30 March 2023	359

Application Number	Development Description	Application Status and Programme	Date Validated / Granted	Distance from Screening Boundary (m)
Gravesham Borough Council				
20160314 20180960 (condition approval)	Erection of 3 industrial units (Use Class B1/B2 and B8) with site access, related parking and circulation space.	Permitted	Wed 14 Sep 2016	424
20211541	Erection of a new concrete live fire skills house training building (plus abseil frame) with new ancillary support building and associated works.	Permitted	Fri 11 Feb 2022	17

Appendix C – Preliminary Ecological Appraisal

TKRE Cable Tunnel Replacement Project

Appendix C - Preliminary Ecological Appraisal

nationalgrid

National Grid Electricity Transmission

June 2023

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1. Executive Summary

Site Details	Name: National Grid TKRE Location: Tilbury Power Station, Tilbury (RM18 8UL) and Metropolitan Training Grounds, Gravesend (DA12 2HN) Size: Gravesend Site (32.3ha), Tilbury Site (40.84ha) Both Sites are in close proximity to the River Thames, with the Tilbury Site on the north bank of the River and the Gravesend site on the south bank. Both Sites primarily comprised of tussocky semi improved grassland, with areas of scrub. The Tilbury Site has a large gravel lake to the north east of Site, and has a large, elevated plateau which features a combination of short ephemeral, bare ground and grassland habitats. The Gravesend Site has a central strip of amenity grassland which is used as part of the rifle range. Strips of marshy grassland are located to the north of this block of amenity grassland and a large block of scrub vegetation is located in the north east corner of the Site.
Scheme Details	The National Grid TKRE 400kV circuits are currently predominantly overhead line, with a cable section installed within a deep tunnel crossing beneath the River Thames. As the Transmission Licence Holder with responsibility for the TKRE circuits, National Grid Electricity Transmission is assessing approaches to upgrade the existing circuits. The preferred option is understood to be a new cable tunnel parallel to the existing. However, the scope of the PEA covered a larger area in order to provide an indication of the ecological constraints and opportunities associated with the wider local area. It is understood that ground investigation may be required in advance of the main works.
Ecological Features that may be affected by the Scheme	Both of the sites are located in close proximity to the Thames Estuary and Marshes Ramsar/Special Protection Area (SPA) designated for floodplain and coastal habitats, as well as the associated assemblage of waterfowl and wading birds that use the area. The Gravesend site is located within the Canal and Grazing Marsh, Higham Local Wildlife Site which is designated for its grassland habitats. The Tilbury Site is located within parts of the Tilbury Power Station Local Wildlife Site, which is designated for its invertebrate and vegetation assemblage. This Local Wildlife Site is understood to be currently in the process of being notified as a Site of Special Scientific Interest (SSSI). The Tilbury Site contains a mixture of scrubland, grassland and short ephemeral vegetation, concentrated on the western side of the Site. A large plateau sits within the centre of the Site and supports an open mosaic habitat consisting of bare ground and short ephemeral vegetation. Three ditches; one located on the west of the Site, one running adjacent to the haul road and one running up the centre of the Site are present, as is a large former gravel pit that currently supports a shallow lake. The Gravesend Site contains a single ditch running along the southern edge of the Site with a line of trees running alongside it. Most of the Site consists of semi improved grassland, but a small lane of amenity grassland is maintained as part of the function of the rifle range. Strips of scrub and marshy grassland are present in the northern areas of the Site, and a bare ground path runs through the centre of the Site.

Recommendations for further survey and assessment		
Feature	Recommendation	Timing
Thames Estuary & Marshes (Ramsar Site and Special Protection Area)	Habitat Regulations Assessment will be required to consider potential for effects on the nearby Thames Estuary and Marshes SPA and Ramsar. This should include consideration of ground investigation works. Wintering bird surveys are being undertaken to inform the assessment and it is possible noise modelling will also be required.	Initial HRA to be undertaken prior to commencement of ground investigation works.
Tilbury Power Station LWS (and proposed SSSI)	Further consultation is required with Natural England to determine the proposed boundary of the proposed SSSI, and potential impact on features for which this site is to be designated. The area to be covered by the SSSI designation should be avoided, or if not possible impacts minimised and appropriate reinstatement specified.	Undertake as soon as possible to inform design process.
Canal and Grazing Marsh, Higham LWS	Minimise extent and duration of works within the LWS.	Undertake as soon as possible to inform design process.
Habitats	National Vegetation Classification (NVC) survey of both sites is recommended to fully characterise the grassland communities on Site	Single visit between May and September
Badger	Undertake further badger survey at Tilbury to characterise the setts at Tilbury. Seek to avoid works within 30m of identified setts.	No seasonal constraint
Bats	Undertake bat activity transects across both Sites concentrating on the areas of grassland, scrubland and marginal vegetation should be carried out on both the Gravesend and Tilbury Sites. Emergence/re-entry surveys on the substation building (Tilbury) and the high potential bat roost tree (Gravesend).	One survey per month at each site between April and September Late April to September Three emergence/re-entry surveys on the bat roost tree. A single emergence/re-entry on the substation building.
Water Voles and Otters	Water vole and otter surveys on both Sites looking for field signs such as latrines, holts/burrows, feeding remains, footprints as well as sightings and soundings along the four ditches on Site (three on Tilbury and one in Gravesend).	Two visits between April and September
Wintering Birds	Surveys are already taking place to determine the use of habitats and surrounding habitats by overwinter species of bird.	November to March
Breeding Birds	A series of five visits should be undertaken at monthly intervals to allow the value of the site for breeding birds to be established and confirm requirements for mitigation/compensation	March to July
Great Crested Newt	An eDNA survey and single survey using traditional survey techniques (e.g. torch light survey) should be carried out on each of the suitable waterbodies within 250m of the Site. A series of six great crested newt surveys should be carried out if presence is confirmed within the waterbodies to determine the presence or absence of breeding great crested newts. These surveys should include a mixture of torch surveys, egg searches, bottle trapping and netting to help determine the presence of the species.	Late April to end June. Mid-March to mid-June.
Reptiles	A series of seven reptile surveys should be carried on both sites to determine the presence or absence of reptiles. Should reptiles be found on Site then further surveys (up to 20) may be required to determine population size.	April/May or September/October
Terrestrial Invertebrates	Two or three survey visits to be carried out by suitably qualified entomologists after liaison with Natural England to determine the makeup of the invertebrate assemblage, and identify any species that need additional protection during works.	April to September
Fish	No further surveys required assuming that no works within watercourses.	-

Marine Mammals	Marine ecologist to review proposals for any marine GI to identify any requirement for further survey, mitigation or monitoring	Prior to commencement of marine GI works.
Invasive non-native plant species	Walkover survey to check if any invasive non-native species are present.	April to September
Construction and Environment Management Plan (CEMP)	A CEMP informed by the surveys carried out as well as the Habitat Regulations Assessment will cover protection of ecological features and sensitive working methods.	Prior to construction
Biodiversity Net Gain Calculation	When an initial scheme design is available it is recommended that a biodiversity net gain calculation is undertaken to establish the likely change in biodiversity units and establish the requirements for compensation	Prior to planning/consenting
Recommendations for Mitigation	Further liaison with Natural England and other relevant stakeholders should be undertaken in order to minimise impacts of the work on the existing Ramsar/SPA. Wherever possible works should aim to avoid direct impacts on the areas of the Tilbury Site which are to be designated as a SSSI. The results of the surveys and liaison mentioned above will help determine what, if any, European Protected Species Licence are needed to commence activities associated the proposed development. These surveys will also inform any compensation, enhancements and mitigation required on Site. A Precautionary Method of Working (PMoW) will be produced that details methods to protect protected and notable species during ground investigation works and while the works are being carried out.	
Opportunities for Biodiversity Enhancement	Opportunities for biodiversity enhancement will be explored further in liaison with Natural England and other relevant stakeholders once further baseline surveys have been undertaken. This may include natural revegetation, or seed harvesting from retained habitat to aid revegetation of impacted areas. In addition opportunities will be explored for enhancing retained habitats through sensitive ongoing management. The proposed new cable tunnel is likely to generate a significant volume of arisings, and the potential for this material to be utilised for habitat creation in the wider local area should be explored	

2. Introduction

2.1 Background

This Preliminary Ecological Appraisal report (PEAR) has been prepared by AECOM on behalf of National Grid, to assess the ecological constraints in connection with the proposed 400kv cable tunnel upgrade from Tilbury to Grain and Tilbury to Kingsnorth (TKRE) (hereafter referred to as the Scheme). The Scheme is for an upgrade for the TKRE circuits crossing the River Thames located between Tilbury, Essex, and Gravesend, Kent, as shown by the red line boundary in Figure 1 and Figure 2.

The assessment of ecological constraints has been undertaken with reference to current good practice¹ and forms part of the technical information commissioned by National Grid in connection with the Scheme. The PEAR addresses relevant wildlife legislation and planning policy as summarised in Annex B and is consistent with the requirements of *British Standard 42020:2013 Biodiversity. Code of Practice for Planning and Development*.

This PEAR is intended for advice in respect of Scheme design, site layout and / or site investigation. Further ecological surveys and / or ecological impact assessment (including detailed mitigation measures) may be required in connection with a planning application or to contribute to an Environmental Impact Assessment once the Scheme proposals have been finalised and any required surveys have been completed.

2.2 The Site

The PEAR covers two distinct works sites located on opposite banks of the River Thames as follows (see Figure 1 and Figure 2):

2.2.1 Tilbury Site

The area north of the river (hereafter referred to as the Tilbury Site) is located in Tilbury in the borough of Thurrock, Essex at grid reference TQ 66397 75618 and is approximately 40.84 ha in size. The land on the Tilbury Site is a mixture of in-use and disused industrial grounds. The western parts of the Site include grassland, scrubland, bare ground, ditches and short ephemeral vegetation. The eastern parts of the Site consist of bare ground with no vegetation and large areas of unconsolidated sandy/silty soils.

The Site is surrounded by an industrial and agricultural landscape with the River Thames adjacent to the south. The wider landscape includes Tilbury town to the north-west of the Site.

2.2.2 Gravesend Site

The area to the south of the river (hereafter referred to as the Gravesend Site) is located in Gravesend, in the borough of Gravesham, Kent at grid reference TQ 67659 74153. The habitats on Site include grassland, scrubland, bare ground, ditches and marshy grassland. The majority of the Site is within Milton Rifle Range, with the wider landscape consisting of agricultural fields, and an industrial area. The main town is located to the west. The River Thames adjoins the northern boundary and the Thames and Medway Canal runs along the south boundary.

2.3 The Scheme

The National Grid TKRE 400kV circuits are currently predominantly overhead line, with a cable section installed within a deep tunnel crossing beneath the River Thames. As the Transmission Licence Holder with responsibility for the TKRE circuits, National Grid Electricity Transmission is assessing approaches to upgrade the existing circuits.

It is understood that the current proposal is for the installation of new cables within a new tunnel and associated infrastructure installed adjacent to the existing tunnel. However, the PEAR covers a larger area both north and south of the River Thames in order to provide ongoing flexibility in design.

¹ CIEEM (2017). *Guidelines for Preliminary Ecological Appraisal, 2nd edition*. Chartered Institute of Ecology and Environmental Management, Winchester.

2.4 Purpose of the Preliminary Ecological Appraisal

This PEAR presents ecological information obtained during the following:

- A desk-study undertaken on 30th November 2022 to obtain records of designated sites, notable habitats² and protected and notable species³ within 2 km of the Site (the area covered by the desk study is hereafter referred to as the Study Area); and,
- A walkover survey of accessible land within and adjacent to the Site (the area covered by the survey is hereafter referred to as the Survey Area) over several days in November 2022.

The purpose of the PEAR is to provide a high-level ecological appraisal of the Site, specifically to:

- establish baseline conditions and determine the presence of Important Ecological Features (IEF)⁴ (or those that could be present), as far as is possible;
- to identify potential ecological constraints to the Scheme and make initial recommendations to avoid impacts on IEFs, where possible;
- to identify requirements for mitigation, where possible, including mitigation measures that will be required and those that may be required (depending on results of further surveys or final scheme design);
- to establish any requirements for more detailed surveys; and,
- to identify any opportunities offered by the Scheme to deliver biodiversity enhancements.

The methodology followed for undertaking the desk study and field surveys is detailed in Annex C, including any limitations to the assessment.

²Notable habitats are taken as principal habitats for the conservation of biodiversity listed under Section 41 of the *Natural Environment and Rural Communities Act 2006*; habitats listed under the Essex Biodiversity Action Plan and the Kent Biodiversity Strategy; hedgerows identified as being 'important' under the wildlife criteria of the *Hedgerow Regulations 1997*, ancient woodlands and veteran trees.

³Notable species are taken as principal species for the conservation of biodiversity listed under Section 41 of the *Natural Environment and Rural Communities Act 2006*; any species listed in an IUCN Red Data Book; and any other species listed under the Essex Biodiversity Action Plan and the Kent Biodiversity Strategy.

⁴ Important Ecological Features are habitats, species, ecosystems and their functions and processes that are of conservation importance and could potentially be affected by the Scheme.

3. Ecological Baseline, Constraints and Recommendations

The following sections detail the results of the desk and field-based studies undertaken to inform this PEAR. Where necessary, recommendations for mitigation measures to protect known IEFs, or further surveys to determine the presence or likely absence of likely IEFs, are provided.

With regard to background data, 'recent' records are considered to be those no older than 10 years from the date of the desk study. Records outside of this period are historical and have only been reported where more recent records for a feature do not exist. Exceptions to this are detailed in the appropriate sections below. Designated Sites

3.1 Designated Sites

3.1.1 Desk Study

There are 3 sites with an international designation based on their importance for nature conservation within 10km of the Site and two sites with a statutory designation within 2km of the Site. There are six non-statutory-designated sites within 1km of the Tilbury and Gravesend sites.

Table 1 summarises the statutory and internationally designated sites situated within the Study Area while Table 2 summaries the non-statutory sites within the Study Area.

Table 1. International and Statutory Designated Sites for Nature Conservation

Designated Site	Reason for Designation	Distance from Tilbury Site ⁵	Distance from Gravesend Site
Internationally Designated Sites			
Thames Estuary & Marshes (Ramsar Site and Special Protection Area)	The site consists of coastal, estuary, floodplain, and intertidal habitats, hosting a range of internationally significant overwintering birds such as pied avocet (<i>Recurvirostra avosetta</i>).	1.9km east	0km east (adjacent)
North Downs Woodlands (Special Areas of Conservation)	The site consists of mature Asperulo-Fagetum beech forests and yew (<i>Taxus baccata</i>) woods within a mosaic of scrub and other woodland types. The site also contains semi-natural dry grasslands and scrubland facies on calcareous substrates which is an important orchid site.	10km South	8.5km South
Medway Estuary & Marshes (Ramsar Site and Special Protection Area)	The site is a wetland of international importance comprising grazing marshes, intertidal flats and saltmarshes, providing breeding and wintering habitats for important assemblages of wetland bird species.	11.4km south-east	9.8km south-east
Statutory Designated Sites			
South Thames Estuary and Marshes Site of Special Scientific Interest (SSSI)	The site consists of an extensive mosaic of grazing marsh, saltmarsh, mudflats and shingle characteristic of the estuarine habitats of the north Kent marshes.	1.6km south	0.5km south
Mucking Flats and Marshes SSSI	The site comprises an extensive stretch of Thames mudflats and saltmarsh together with sea wall grassland. Wintering wildfowl and waders reach nationally and internationally important numbers here, roosting and feeding on adjacent saltmarsh and disused silt lagoons.	1.9km east	2.0km north-east

⁵Where designated sites are situated outside of the Site boundary, the distance and direction is given at the closest point of the designated site from the Site

Table 2. Non-Statutory Designated Sites for Nature Conservation

Designated Site	Reason for Designation	Distance from Tilbury Site ⁶	Distance from Gravesend Site
Canal and Grazing Marsh, Higham Local Wildlife Site (LWS) (60.57ha)	Coastal and floodplain grazing marsh is found on low-lying coasts and along slow-flowing rivers and estuaries. Some 500 plants have been recorded from the most diverse grazing marshes, but these comprise just 5% of grazing marshes - most have been agriculturally 'improved' and are of limited botanical interest. Perennial rye-grass (<i>Lolium perenne</i>), Yorkshire fog (<i>Holcus lanatus</i>) and rushes tend to dominate the sward, enlivened by damper patches of floating sweet-grass (<i>Glyceria fluitans</i>), creeping bent (<i>Agrostis stolonifera</i>) and silverweed (<i>Argentina anserina</i>).	1.3km south-south east	On site
Low Street Pit LWS (3.6ha)	A site that lies on regionally important Thames terrace gravel. Remnants of old grassland with a diverse invertebrate community associated with the site, including hornet robberfly (<i>Asilus crabroniformis</i>) a national BAP species.	1.6km north-east	3.0km north
Tilbury Marshes LWS(40.5ha)	Relict grazing-marsh, brackish ditches, outer moats and grasslands at Tilbury Fort. The Site supports many Nationally Scarce plant species and important invertebrate communities.	0.5km west	2.0km north-west
Tilbury Power Station LWS (48.8ha)	A large, multi-site designation that encompasses a number of previously designated sites including Lytag Brownfield, Tilbury Centre and Goshems Farm. The sites are of importance for their coastal grazing marshes, post-industrial sites and hotspots for reptile diversity. The habitat also supports key invertebrate communities.	On site	1.3km north
West Tilbury Church LWS (0.5ha)	Ancient grassland beyond a privately owned church with nationally restricted plant assemblages including Wild Clary (<i>Salvia verbenaca</i>) and Lesser Calamint (<i>Clinopodium calamintha</i>).	1.6km north	3.7km north-west
West Tilbury Hall LWS (1.6ha)	A river terrace slope site selected for the lowland dry acid grassland habitat of principal importance and diverse invertebrate fauna including nationally rare Bryony Mining Bee (<i>Andrena florea</i>)	1.6km north	3.7km north-west

The Tilbury Site includes part of the Tilbury Power Station LWS, which is designated for its invertebrate and vegetation assemblage. This LWS is understood to be currently in the process of being notified as a Site of Special Scientific Interest (SSSI).

3.1.2 Field Survey

Summary descriptions of the designated sites within the Survey Area are provided below and shown in Figure 1 and Figure 2, with specific features highlighted by target notes (TN). TN descriptions and photographs are provided in Annex D Further habitat descriptions are provided in Section 3.2.

3.1.2.1 Tilbury Site

Part of Tilbury Power Station LWS is located within the Tilbury Site. In 2003 planning consent was granted for the restoration of the former waste disposal site. The habitat on Site is a mixture of grassland, short ephemeral vegetation and scrub.

⁶Where designated sites are situated outside of the Site boundary, the distance and direction is given at the closest point of the designated site from the Site

3.1.2.2 Gravesend Site

The Gravesend Site is within Canal and Grazing Marsh, Higham LWS and is directly adjacent to the South Thames Estuary and Marshes SSSI and Thames Estuary and Marshes Ramsar Site. The habitat on Site consists of tussocky semi improved grassland and areas of scrub, with marshy grassland present along the ditches as per the descriptions of the designated Site provided by the Kent Biological Records Centre and Natural England.

3.1.3 Constraints and Recommendations

Due to the proximity of both sites to the Thames Estuary and Marshes Ramsar and SPA, both proposed ground investigation works and the proposed construction of the new cable tunnel will require the 'competent authority' to carry out a Habitats Regulations Assessment (HRA) to test if the project could significant harm the features for which these sites are designated.

The areas of foreshore habitat along the banks of the River Thames which directly adjoin the Tilbury and Gravesend sites are potentially suitable to support the overwintering assemblage of waders and waterfowls for which the Ramsar and SPA are designated. Because of the suitability and linkage of habitats the works associated with the construction on Site may potentially impact these bird populations and by extension the Ramsar and SPA sites. On that basis there is a need for further winter bird surveys and subsequent assessment to quantify the potential effect of the works (including GI) on the Ramsar/SPA and associated populations. Modelling of noise data may be required to establish the extent of any disturbance impacts on birds when works are undertaken.

As a statutory undertaker National Grid will be considered the 'competent authority' for the Likely Significant Effects Test stage of HRA. However, it is recommended that Natural England are allowed to comment on the outcomes of the assessment. In the event that a likely significant effect is expected (in the absence of mitigation) and the HRA process progresses to an Appropriate Assessment then there would be a formal requirement to consult with Natural England.

Part of Tilbury Power Station LWS is scheduled to be notified as a SSSI. It is understood the main reason for its designation will be the importance of the invertebrate populations it supports. While the boundary of the proposed SSSI has not been confirmed it is understood the areas of greatest invertebrate interest are within the restored plateau area to the west of the Site. Liaison with Natural England and the Port of Tilbury (landowners) will be required to assess the potential impact of the works on the area covered by the pending SSSI designation. The design should aim to avoid direct impacts in the area proposed for SSSI designation where possible, and where that cannot be achieved the extent and duration of works should be minimised and working areas reinstated after works.

Planning permission has already been approved for the restoration of the area of Goshems Farm that is within the eastern section of the Tilbury Site. The consented development has an approved environmental method statement⁷. The Client should liaise with Thurrock Council to ensure that works undertaken within the Local Wildlife Site follow the approved environmental method statement.

Canal and Grazing Marsh, Higham LWS is covered under the Gravesend Local Plan⁸ Policy CS12: Green Infrastructure. This states that there will be no net loss of biodiversity in the borough and opportunities to enhance, restore, recreate and maintain habitats should be sought. Surveys for Biodiversity Net Gain should be undertaken prior to works commencing to ensure the Scheme does not result in a net loss of biodiversity. The works should be undertaken under an environmental method statement or similar which details replanting to improve biodiversity.

Methods of reducing impacts to the designated sites (e.g. noise disturbance, light and dust pollution) should be detailed in a Construction and Environmental Management Plan.

⁷ Goshems Farm. <https://www.ingrebournevalley.com/site/> [Accessed 19/12/2022]

⁸ <https://www.gravesend.gov.uk/local-plan-policy>

3.2 Habitats

3.2.1 Desk Study

3.2.1.1 Tilbury Site

The desk study returned records of coastal saltmarsh and mudflats adjacent to the south boundary of the Tilbury Site along the south of the Site adjacent to the River Thames. Both of these are identified as habitats of principal importance listed in Section 41 of the Natural Environment and Rural Communities (NERC) Act, 2006.

3.2.1.2 Gravesend Site

The Gravesend Site was recorded as being part of an area of Coastal and Floodplain Grazing Marsh, with intertidal mudflats present along the north of the Site along the River Thames. Both of these are identified as habitats of principal importance listed in Section 41 of the Natural Environment and Rural Communities (NERC) Act, 2006.

3.2.2 Field Survey

Summary descriptions of the habitats within the Survey Area are provided below in Table 3 and Table 4, and shown in Figure 1 and Figure 2, with specific features highlighted by TNs. TN descriptions and photographs are provided in Annex D.

3.2.2.1 Tilbury Site

Table 3. Description of habitats on the Tilbury Site

Habitat	Brief Description	Area (hectares)	% area of the Site
Bare ground	A strip of western block of bare ground runs along the western ditch on Site. The eastern half of the Site consists of bare ground currently under construction.	13.2	32.5%
Scrub	Three blocks of scrub; one within the western grassland, one in the south west corner of Site, and one running along the western and southern slopes of the plateau, were recorded on Site.	11.56	29%
Semi-improved Grassland	Three blocks of semi-improved grassland; one running along the west of the Site, one running along the southern section of Site, and one located on the northern edge of the plateau, were recorded on Site.	9.63	23.5%
Hardstanding	Hard standing area consisting of a former car park and the haul road runs from east to west across the centre of the Site.	3.19	7.5%
Ephemeral/short perennial	Small patches of ephemeral and short perennial vegetation growing through areas of previously bare ground	2.04	5%
Standing water	Gravel lake within the construction site, fenced off. Additionally, several ditches within the grassland containing standing water with areas of tall fen species.	0.87	2%
Introduced Shrub	A block of buddleia (<i>Buddleia davidii</i>) dominated scrub was present on the western edge of the Site north of the car park	0.34	0.5%

Semi-improved grassland

Three blocks of semi-improved grassland; one running along the west of the Site, one running along the southern section of Site, and one located on the northern edge of the plateau in the centre of the Site, were recorded on Site.

All three grasslands contained a mix of false oat grass (*Arrhenatherum elatius*), red fescue (*Festuca rubra*) and cock's foot grass (*Dactylis glomerata*). The western grassland contained frequent cow parsley (*Anthriscus sylvestris*) and scentless mayweed (*Tripleurospermum inodorum*) with occasional hawkbit (*Leontodon* species) and fennel (*Foeniculum vulgare*) also present. The grassland running along the south of the Site featured frequent red clover (*Trifolium pratense*) and occasional hawkbit and tufted vetch (*Vicia caracca*). The grassland on the north side of the plateau featured occasional fennel, red clover and hawkbit.

Bare ground

The eastern half of the Site consisted of bare ground that was subject to major earth works to reprofile the area. No vegetation was present on this block of habitat.

The bare ground located along the edge of the ditch in the west of the Site consisted of 85% of bare ground, with the remaining 15% consisting of occasional mugwort (*Artemisia vulgaris*) and rare examples of sea beet (*Beta vulgaris*).

Dense scrub

Three blocks of scrub; one running along the west of the Site, one running along the southern section of Site, and one located on the northern edge of the plateau in the centre of the Site, were recorded on Site.

All three blocks of scrub were dominated by a thick covering of bramble (*Rubus fruticosus* agg.). The block of scrub featured frequent mugwort and occasional fennel and hogweed (*Heracleum spondylium*). The scrub within the south west corner of the Site included frequent blackthorn (*Prunus spinosa*) and occasional hawthorn (*Crataegus monogyna*). The scrub running along the base of plateau included occasional dog rose (*Rosa canina*), dogwood (*Coronus sanguinea*) and hawthorn.

Ephemeral/short perennial

A block of short ephemeral vegetation was present within the southern half of the plateau. Approximately 60% of the habitat consisted of bare ground. The remaining 40% of vegetation consisted of frequent scentless mayweed and occasional dandelion (*Taraxacum officinale* agg.) and narrow leaved ragwort (*Senecio inaequidens*). Rare specimens of non-native pampas grass (*Cortaderia stelloana*) were present within this habitat.

Standing water

A flooded gravel pit was located in the north-east corner of the site, and is mostly outside the Site boundary, within the construction site. This body of water is currently fenced off to avoid it being damaged from the adjacent construction work and is being used by a population of wildfowl including moorhen (*Callinua chloropus*), mute swan (*Cygnus olor*) and little egret (*Egretta gazetta*) as well as birds associated with wetlands such as marsh harrier (*Circus aeruginosus*).

Hardstanding

An area of hard standing area, previously used as a car park, and a haul road with a thin layer of discarded ceramic, rocks and other building debris ran from east to west of the centre of the Site. This area also contained the disused single storey sub-station building.

3.2.2.2 Gravesend Site

Table 4. Description of habitats on the Gravesend Site

Habitat	Brief Description	Area (hectares)	% area of the Site
Semi-Improved Grassland	The majority of the site consists of semi-improved grassland that is managed infrequently.	26.8	82.5%
Amenity Grassland	A strip of improved grassland managed frequently to keep the sward height short year-round for shooting.	2.61	8.5%
Scattered scrub	Scattered scrub is present in the north-east corner of the site with small clusters of shrubs throughout the semi-improved grassland.	1.35	4.5%
Hard Standing	Hard standing area consists of paths running across the south and centre of the Site.	1.12	3.5%
Marshy Grassland	A damp strip of grassland is present to the north of the block of amenity grassland.	0.39	1%
Buildings	A substation is already present in the south-south west of the Site	N/A	N/A
Running water	Ditch with flowing water running along the southern edge of the site.	N/A	N/A
Line of Trees	A line of trees runs along the southern bank of the ditch on Site.	N/A	N/A

Semi-Improved grassland

A block of grassland dominated by red fescue with frequent false oat grass was present across the majority of the Site. This grassland also featured occasional instance of creeping cinquefoil (*Potentilla reptans*), marsh thistle (*Cirsium palustre*) and Alexanders (*Smyrnium olusatrum*).

Marshy Grassland

A strips of marshy grassland dominated by common reed (*Phragmites australis*) with occasional immature willow (*Salix* sp.) and rare dog rose and hawthorn was present within this block of habitat.

Amenity Grassland

A large rectangular strip of grass is heavily managed for the site's use as a shooting range. The grass is kept low by being frequently mown. This area of grassland has minimal diversity and is dominated by perennial rye grass (*Lolium perenne*)

Scattered scrub

The scrub is dominated by bramble with occasional dog rose (*Rosa canina*) , common reed and hawthorn growing within this block of vegetation.

Buildings

An existing sub-station is located into the south western corner of the Site. This sub-station is surrounded by a metal fence to prevent trespass.

Line of Trees

A line of tees that included blackthorn (*Prunus spinosa*), willow, apple (*Malus domestica*) and hawthorn was present growing along the southern edge of the ditch.

Running water

A ditch runs along the southern and western end of the site and curves round past the western extent of the Site where it joins the River Thames. The ditch is well sheltered and full of vegetation dominated by common reed.

3.2.3 Constraints and Recommendations

National Vegetation Classification (NVC) survey of both sites is recommended to fully characterise the grassland communities on Site, including the presence/distribution of any rare or protected/notable species. The NVC surveys should be carried out between April and September during the main growing season of plants. These surveys will help to inform the ongoing design and promote avoidance and mitigation in order to minimise the impact of the works.

A Construction and Environmental Management Plan (CEMP), or similar, should be produced to detail this, as well as methods of working required to prevent contamination of nearby waterbodies.

When a preliminary design for the Proposed Development has been developed, an initial Biodiversity Net Gain (BNG) calculation should be undertaken to quantify any losses in biodiversity that may occur as a consequence of the scheme, and identify any requirements for compensation in order to secure BNG.

The CEMP, or similar, should include working methods to minimise impacts and damage to the surrounding habitats such as controls for noise, air/dust pollution and light spill and the use of hard standing pathways and track matting for vehicles and machinery to avoid damage to grassland and topsoil. The document should also include details for reinstatement of effected habitat upon completion of the works.

3.3 Badger

3.3.1 Desk Study

There is one recent record of badger within 1km of the Tilbury Site from over the last 10 years. Badgers were recorded approximately 200m east of the Site. In addition there are two anecdotal records of setts within the Tilbury site provided by Port of Tilbury.

No other recent records of badger were returned within the Study Area. This data was returned from the Kent & Medway Biological Records Centre who note that more recent records may be held by the East Kent Badger Group and West Kent Badger Group. No badger records have been requested directly from either group.

3.3.2 Field Survey

Table 5 summarises the evidence of badger presence recorded within the Survey Area.

Two subsidiary setts were located within the Tilbury Site along the southern edge of the banks of the plateau in the centre of the Site. No signs of badgers were recorded on the Gravesend Site.

The target note locations can be found in Figure 1 and Figure 2 in Annex A. Photographs are provided in Annex D.

Table 5. Summary of Badger presence/ potential presence within the Survey Area

Feature	Site Location	Description of Feature and Location ⁹	Relevant Target Notes
Subsidiary Sett	Tilbury Site	Subsidiary sett consisting of 4 active entrances, all south facing. Fresh spoil was present at the sett entrances with distorted footprints. The sett is currently being monitored using camera traps by another consultancy.	TN1
Subsidiary Sett	Tilbury Site	Subsidiary sett consisting of 2 entrances, one of which may have been made by rabbits. Both entrances are clear of vegetation with recent spoil nearby.	TN2

3.3.3 Constraints and Recommendations

Badgers and their setts are protected from disturbance, damage and destruction by the Protection of Badgers Act (1992)¹⁰.

Badger surveys are recommended to provide additional detail on the setts found on Site. This can be used to inform the works and may also be used to support a Natural England mitigation licence (if required). Natural England has advice for local planning authorities who need to assess the impacts of development on badgers which related to survey effort, mitigation and licencing requirements (DEFRA, 2015)¹¹. Licences for sett closures are only issued for works between July and November to avoid destruction of setts containing breeding females and dependent cubs.

Excavation can impact badgers, with close proximity excavations able to collapse badger setts, and also disturb badgers in their setts. The works occurring within the Site may also alter the foraging areas badgers use, as well as force them to build setts in other locations. The excavations present on Site may also trap badgers, if they are not probably covered, or an escape route isn't provided.

No badger records were reported in the desk study and field survey on the Gravesend Site. No further surveys for badger are recommended on this part of the Site.

Both the desk study and field study returned evidence of badger presence on the Tilbury Site. It is recommended that a 30m buffer zone is established and retained around these setts to avoid disturbance and damage to the setts.

It is recommended that precautionary measures to protect badgers and their habitat are included in a Construction and Environment Management Plan or equivalent. Measures should include:

- ensuring fencing/hoarding allows gaps so badgers can enter and exit the site safely whilst foraging at night;
- storing chemicals in a secure lock-up each night to prevent badgers from exposure to poisons;
- covering up any digging excavations at night so badgers don't fall in and injure themselves;
- minimising the construction footprint so as not to encroach onto the woodland/grassland,

⁹Where features are situated outside of the Site boundary, the distance and direction is given at the closest point of the feature from the Site

¹⁰HMSO. (1992) Protection of Badgers Act.

¹¹<https://www.gov.uk/guidance/badgers-advice-for-making-planning-decisions> [Accessed: 10/01/2023]

- minimising lighting at night so low-level security lighting doesn't disturb badgers; and
- after development is complete, ensuring badgers are not cut off from the surrounding suitable habitat and landscaping contains wildlife friendly planting, providing shelter and berries.

If it is not possible to avoid impacts upon the setts, the works within 30m of the setts may require a Natural England mitigation licence.

3.4 Bats

3.4.1 Data Search

The desk study returned no records of bats from within a 1km radius of the Tilbury Site from over the last 10 years were returned by the records from the Essex Field Club.

The Kent Biological Records Centre returned records of nine bat species from a 1km radius of the Gravesend Site from over the last 10 years. These species and the number of records associated with them are listed below;

- Twenty-one records of common pipistrelle (*Pipistrellus pipistrellus*);
- Eleven records of soprano pipistrelle (*Pipistrellus pygmaeus*);
- Two records of Nathusius pipistrelle (*Pipistrellus nathusii*);
- Fourteen records of Daubenton's bat (*Myotis daubentonii*);
- Fifteen records of Natter's bat (*Myotis nattereri*);
- Eight records of whiskered bats (*Myotis mystacinus*);
- Eighteen records of brown long-eared bat (*Plecotus auritus*);
- Seven records of noctule bat (*Nyctalus noctula*); and
- One record of serotine bat (*Eptesicus serotinus*)

A licence for the destruction of a breeding site and resting place was granted in 2019 (licence reference: 2019-39320-EPS-AD2-1) approximately 200m west of the Tilbury Site.

3.4.2 Field Survey

The Tilbury Site has no trees with potential for supporting roosting bats. The only structure on Site is a small disused storage building (TN4, Photographs 4) The building is constructed of bricks and mortar with a bitumen felt flat roof. The door to the building is broken and open, leaving the inside quite exposed. The roof is in good condition with no lifts. The structure was deemed to have low potential for supporting roosting bats.

There are opportunities for foraging and commuting bats on the Tilbury Site with areas of scrub, grassland and ditches on the western section of the site that could act as both foraging habitat and provide commuting corridors. However, the area is very exposed with limited cover. Given the habitats on Site and the surrounding landscape, with large sections of coastal and floodplain grazing marsh, the Site is considered to have moderate suitability habitat for commuting and foraging bats.

The Gravesend Site has a single tree with high suitability for supporting roosting bats due to the multiple bark fissures, woodpecker holes and callous rolls in its trunk (TN14, Photograph 14). There is one structure within the Site (TN7, Photograph 11). This is a container made entirely of corrugated metal currently in use as a storage container. The container is in good condition with no gaps observed therefore, the structure was deemed to have negligible potential for supporting roosting bats.

The Gravesend Site contains opportunities for foraging and commuting bats within the scrub habitat and semi-improved grassland, as well as the ditch that runs along the southern edge of the Site. The Site is connected to a wider network of suitable habitat including ditches, the Thames and Medway Canal, and unmanaged grasslands. The Site has moderate suitability habitat for commuting and foraging bats.

3.4.3 Constraints and Recommendations

All native bats, and their roosting sites are protected from harm, killing and disturbance by Schedule 5 of the Wildlife and Countryside Act and the Conservation of Habitats and Species Regulations 2017 (as amended).

If works are proposed within a 20m radius of the high bat roosting suitability tree (see Figure 2 - TN14) at Gravesend, or the location is likely to be impacted by light spill from the Proposed Development then a series of emergence/re-entry surveys will need to be carried out to confirm presence/absence of bats. This tree will require three surveys between late April and late September, with at least one dawn survey carried out, preferably with one survey covering each of the three months when bats are active.

If works or light spill are expected within a 20m radius of the low suitability building at the Tilbury Site then a single emergence survey should be carried out. This survey should consist of either an dusk emergence or dawn re-entry survey on the building carried out between late April and late September.

Surveys will include a mixture of observation and audio recording to determine bat species, and any emerging/returning bats will be recorded. If bats are found to be using these features as a roost then a European Protected Species Licence will be required to remove or disturb the tree, before works can commence.

In line with the guidance for bat activity surveys set out within the Bat Conservation Trust (BCT) survey guidelines¹² a series of transect surveys are recommended to be carried out on both Sites between May and September, with one survey carried out per month. These surveys will feature a route around the Sites with numerous listening points, where three minute stops will be conducted to record bats within the area. Any bat calls and sightings on the transect route will also be recorded. These surveys will determine what features on Site are most attractive to bats, as well as determine the species currently using the Sites.

Given the desk study records of bats within 1km of the Sites and the moderate suitability of both Sites to support commuting and foraging bats, there is potential for commuting and foraging bats to pose a constraint to works. The noise and extra illumination on Site may impact which areas bats feed in and may alter the commuting works bats take across Site. Going forward the design of the proposals should take into account the likely presence of foraging/commuting bats and seek to minimise lighting and associated light spill.

3.5 Hazel Dormouse

3.5.1 Desk Study

There are no records of hazel dormouse (*Muscardinus avellana*) from within 1km over the last 19 years of either the data search from the Essex Field Club or the Kent Biological Records Centre desk studies.

3.5.2 Field Survey

While the scrub habitat on both Sites has some suitability for dormice, featuring food plants such as blackthorn and bramble, it is too isolated from other suitable habitats by both water courses, human development and open grassland to support dormice. In addition, neither of the Sites supported hazel (*Corylus avellana*) the primary food source of hazel dormice.

Due to the relative isolation of habitats on Site from other suitable areas for dormice, it is assumed dormouse is absent and that the species doesn't represent a constraint to development.

3.5.3 Constraints and Recommendations

Hazel dormice are a European Protected Species, protected under the Habitats Regulations (2017, as amended), and they and the habitat that they use for breeding and resting are fully protected by Schedule 5 of the Wildlife and Countryside Act.

Due to lack of suitable connected habitats on Site, hazel dormice can be scoped out, and do not need to be considered for further works at either Site.

3.6 Otter

3.6.1 Desk Study

There are no records of otter (*Lutra lutra*) from within 1km over the last 19 years within the data searches from the Essex Field Club and the Kent Biological Records Centre.

¹² Collins J (ed) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Edition). Bat Conservation Trust.

3.6.2 Field Survey

Both Sites have ditches that connect to the wider habitat and the River Thames however two of these, (TN12 & TN3) are quite narrow and would unlikely support otters. The Tilbury Site has two larger streams (TN9 & 10) with densely vegetated banks that are suitable for holt building. The presence of the large gravel pit lake (TN11) at Tilbury provides an additional habitat where otters may be present, as well as providing a source of water (other than the River Thames) that remains wet throughout the year.

Besides the two ditches present on the south and central section of the Site, there is no other suitable habitats on Site for otters.

3.6.3 Constraints and Recommendations

Otters are protected from deliberate or negligent killing or injury by Schedule 5 of the Wildlife and Countryside Act (1981) as amended, the Habitats Regulations (2017, as amended) and Section 41 of the Natural Environment and Rural Communities (2006) Act.

Despite the lack of desk study records from the Tilbury Site, there is some potential for otter to utilise the streams on Site. It is therefore recommended that otter surveys are undertaken to confirm presence or likely absence. One of the ditches, TN9 is located within 100m of the area where works are proposed to take place.

The survey will include a detailed search of the waterbodies and surrounding habitat for otter field signs and should include a search for evidence of otter presence at least 200-300m upstream and downstream of the Site. The optimal period for conducting this survey is the period of May to September. It is recommended that two survey visits are undertaken at least two months apart, ideally one at either end of the survey period. The survey may be undertaken in conjunction with a water vole survey.

Should otter presence be confirmed on Site a 30m buffer zone around otter habitat will be required. If otter presence is likely on Site then a precautionary working method should be implemented when working within 30m of otter habitat.

During construction impacts on waterbodies should, where possible avoid impacts on the ditches and gravel lake on the Sites. Where necessary solid and waterproof barriers should be erected between ditches and areas where construction is scheduled to take place.

3.7 Water Vole

3.7.1 Desk Study

There are no recent records of water vole (*Arvicola amphibius*) within 1km of the Tilbury Site however, there is a Water Vole mitigation site approximately 650m north of the Site. Water voles were translocated to this site in 2019 as mitigation for the Tilbury2 project¹³

There are 12 recent records of water vole within 1km of the Gravesend Site. The nearest record is directly adjacent to the Site to the south and was recorded in 2022.

3.7.2 Field Survey

All streams and ditches (TN9, 10 & 12) on both sites have potential to support water vole. Details of their locations can be seen in Figure 1 and Figure 2. All the ditches are vegetated with slow flowing water, some had more shallow banks than others, but all were wide enough and deep enough for water vole. These surveys should be undertaken between April and September.

3.7.3 Constraints and Recommendations

Water voles are protected from harm and killing by Schedule 5 of the Wildlife and Countryside Act (1981) as amended.

It is recommended that a baseline survey is carried out in water bodies on Site to determine the presence/likely absence of water voles. Water vole surveys involve a walkover of the edges of water courses; with field signs including latrines, feeding remains, burrows and runs, as well as sightings and soundings recorded. While water vole surveys are not constrained to certain times of year, it is recommended they are carried out between May and

¹³ <https://tilbury2.co.uk/wildlife-mitigation/> [accessed: 11/01/2023]

September in combination with survey for otter. The optimum timing is survey visits at the start and end of this survey period.

If water voles are found on Site, it is recommended that barriers to minimise disturbance of water courses are erected and that where possible routes of the proposed development should avoid crossing water bodies (with the exclusion of the River Thames), to reduce disturbance. Further protection of water bodies including protections for water voles should be covered in the CEMP produced for the Site.

During construction impacts on waterbodies should, where possible avoid impacts on the ditches and gravel lake on the Sites. Where necessary solid and waterproof barriers should be erected between ditches and areas where construction is scheduled to take place

3.8 Great Crested Newt

3.8.1 Desk Study

There are four waterbodies present within 500m of the Tilbury Site. Three of the waterbodies have been screened out for further assessment because they are flowing watercourses and likely brackish. As such they are considered unsuitable for great crested newt (*Triturus cristatus*).

No recent records of great crested newt were returned within 1km of the Tilbury Site. The most recent record was recorded 200m west of the site in 2007.

There are eight waterbodies present within 500m of the Gravesend Site. Two of the waterbodies have been screened out for further assessment because they are flowing watercourses that are likely brackish and unsuitable for great crested newts¹⁴.

No recent records of great crested newt were returned within 1km of the Gravesend Site. The nearest record was approximately 1.2km east of the Site in 2013.

3.8.2 Field Survey

The majority of waterbodies on Site were ditches (TN9 & 10) with slow flowing water and were deemed to be potentially suitable for breeding great crested newts. All three of these ditches were deemed to have 'good suitability' to support breeding great crested newts, with Habitat Suitability Index (HSI) assessment scores of 0.78, 0.74 and 0.75.

There was one gravel pit on Site that had standing water and was being used by a population of waterfowl. This gravel pit lake (TN11) is likely too large to support great crested newt due to impacts of wind driven wave action, and the presence of large amounts of waterfowl including diving ducks, making the waterbody less attractive to newts. An HSI assessment was carried out on the gravel lake, the water body was deemed to have 'poor suitability' to support breeding great crested newts with an HSI score of 0.46.

There is one ditch (TN12), running along the access road through the Tilbury Site, and one ditch that runs along the southern boundary of the Gravesend Site that are slow flowing, support marginal vegetation including southern reed and reed mace (*Typha angustifolium*) that are suitable to support breeding great crested newts. An HSI assessment of this water body was recorded as having 'good suitability' to support breeding great crested newts with an HSI score of 0.76.

The terrestrial habitat on both sites particularly the scrub and poor semi-improved grassland habitat has some suitability to support terrestrial great crested newts. There are limited above ground opportunities for great crested newt hibernation (e.g. wood or rubble piles). However, areas of existing scrub and margins of existing waterbodies provide habitat that could be utilised.

A full overview of the assessment of the HSI scores are recorded in Annex F.

¹⁴ Great crested newts do not generally like running water, though they will inhabit slow-flowing watercourses such as backwaters, ditches and canals.

3.8.3 Constraints and Recommendations

Great crested newts are a European Protected Species, protected under the Habitats Regulations (2017, as amended), and Schedule 5 of the Wildlife and Countryside Act. Under this legislation both individuals and the habitat that they use for breeding and resting are afforded full protection.

It is recommended that eDNA surveys are carried out on the suitable water bodies on Site, and those within a 250m radius deemed suitable for great crested newt to confirm presence/absence. eDNA surveys need to be carried out between mid-April and end of June.

Given that the waterbodies on site are ditches with potential for some elements of brackish water it is recommended that a single survey using traditional survey methods (night time torching and/or bottle trapping where appropriate) is conducted alongside the eDNA survey to provide a robust indication of presence/absence.

Where the presence of great crested newt is confirmed a series of six surveys carried out between March and early June should be undertaken to determine population and breeding status through a series of torching surveys, bottle trapping and egg searches. At least two of the surveys should be carried out between mid-April and mid-May when breeding is most likely to take place and all surveys should be carried out by an ecologist with a valid great crested newt survey licence.

3.9 Widespread Species of Reptile

Widespread species of reptile refers to common lizard (*Zootoca vivipara*), slow worm (*Anguis fragilis*), adder (*Viper berus*) and grass snake (*Natrix helvetica*).

3.9.1 Desk Study

The records from the Essex Field Club returned two records of slowworm, one record of grass snake, five records of adder and two records of common lizard from within 1km of the Tilbury Site from over the last 10 years. In addition Port of Tilbury have provided anecdotal records of established populations of adder, common lizard and slow worm within the Site.

The records from the Kent Biological Records Centre returned seven records of slowworm, one record of grass snake and two records of common lizard from within 1km of the Gravesend Site from over the last 10 years.

3.9.2 Field Survey

The tussocky grassland, scrub and tall ruderal habitats on both Sites provide suitable habitats for the widespread species of reptiles.

The presence of ditches on and in close proximity to both sections of Site offer suitable foraging and commuting habitat for grass snakes. While vegetated, the banks leading up to the 'plateau' area in the centre of the Tilbury Site, as well as the bunds that form the sea wall on both sites, feature banks with a south facing aspect that has potential to act as basking habitats, particularly for species more active in the earlier part of the year such as adders and common lizard. The plateau itself features a mosaic mix of grassland, ruderal and bare ground habitats that make this area highly suitable for reptiles, offering exposed ground for basking in close proximity to vegetative cover.

3.9.3 Constraints and Recommendations

All native UK reptile species; adder, common lizard, grass snake, sand lizard (*Lacerta agilis*), smooth snake (*Coronella austriaca*) and slow worm, are listed on Schedule 5 of the Wildlife and Countryside Act.

With the exception of the eastern bare ground sections of Tilbury (unsuitable for reptiles), a series of reptile surveys should be carried out on both parts of the Site between April and September when reptiles are most active. A series of artificial refugia (a combination of roofing felt and corrugated iron) should be placed on Site and be left to bed in for a period of at least one week before surveying commences on Site. Surveys consist of seven visits spread out through the active season and should ideally be carried out during conditions when reptiles are likely to be using the mats i.e. in temperatures below 18°C or after rainfall.

In the event that a reptile population is found, a population size class assessment may be required (up to a total of 20 visits), to confirm in greater detail the likely numbers of reptiles present and the form of mitigation works required. For impacts on smaller areas of habitat this may involve habitat manipulation to disperse reptiles into

adjoining areas of retained habitat, or for larger areas capturing and translocating reptiles to a suitable local receptor site.

The receptor site may require preparation through creation or management of a suitable grass/ scrub mosaic habitat and installation of features for reptile sheltering and hibernation (log piles and hibernacula). The details of any mitigation requirements would be set out in the reptile survey report following further surveys.

3.10 Birds

3.10.1 Desk Study

There are recent records for thirty one notable¹⁵ bird species within 1 km of both Sites. This includes fifteen species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), nine Species of Principal Importance (SPI), eleven species on the Birds of Conservation Concern 4 (BoCC4) Red list and six species on the BoCC4 Amber list.

Table 6. Bird Species Records

Common Name	Latin Name	Designation	Records Centre
Bar-tailed Godwit	<i>Limosa lapponica</i>	Birds of Conservation Concern – Red List	Essex Field Club, Kent Biological Records Centre
Barn Owl	<i>Tyto alba</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1	Essex Field Club
Black Redstart	<i>Phoenicurus ochrous</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1, Birds of Conservation Concern – Amber List	Essex Field Club
Black-tailed Godwit	<i>Limosa limosa</i>	Section 41 NERC Act, Birds of Conservation Concern – Amber List	Essex Field Club, Kent Biological Records Centre
Brambling	<i>Fringilla montifringilla</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1	Essex Field Club, Kent Biological Records Centre
Cetti's Warbler	<i>Cettia cettia</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1	Essex Field Club, Kent Biological Records Centre
Corn Bunting	<i>Emberiza calandra</i>	Section 41 NERC Act, Birds of Conservation Concern – Red List	Kent Biological Records Centre
Curlew	<i>Numenius arquata</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1, Birds of Conservation Concern – Red List	Essex Field Club, Kent Biological Records Centre
Fieldfare	<i>Turdus pilaris</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1, Birds of Conservation Concern – Red List	Essex Field Club, Kent Biological Records Centre
Firecrest	<i>Regulus ignicapilla</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1	Kent Biological Records Centre
Green Sandpiper	<i>Tringa ochropus</i>	Birds of Conservation Concern – Amber List	Essex Field Club
Herring Gull	<i>Larus argentatus</i>	Section 41 NERC Act, Birds of Conservation Concern – Red List	Essex Field Club, Kent Biological Records Centre
Hobby	<i>Falco subbuteo</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1	Kent Biological Records Centre

¹⁵ Notable bird species are taken as those listed: on Annex I of the EC Birds Directive (2009/147/EC); on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended); as Species of Principal Importance (SPI) for the Conservation of Biodiversity in England listed in Section 41 of the Natural Environment and Rural Communities Act 2006; as Red or Amber in the Birds of Conservation Concern (BoCC) 4 (Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015). Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds* 108, 708-746)

Common Name	Latin Name	Designation	Records Centre
House Sparrow	<i>Passer domesticus</i>	Section 41 NERC Act, Birds of Conservation Concern – Red List	Kent Biological Records Centre
House Martin	<i>Delichon urbica</i>	Birds of Conservation Concern – Red List	Essex Field Club
Kingfisher	<i>Alcedo atthis</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1	Essex Field Club, Kent Biological Records Centre
Merlin	<i>Falco columbarius</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1, Birds of Conservation Concern – Red List	Kent Biological Records Centre
Mistle Thrush	<i>Turdus viscivorus</i>	Birds of Conservation Concern – Red List	Kent Biological Records Centre
Nightingale	<i>Luscinia megarhynchos</i>	Birds of Conservation Concern – Red List	Kent Biological Records Centre
Peregrine Falcon	<i>Falco peregrinus</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1	Essex Field Club
Pied Avocet	<i>Recurvirostra avosetta</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1, Birds of Conservation Concern – Amber List	Essex Field Club, Kent Biological Records Centre
Red Kite	<i>Milvus milvus</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1	Essex Field Club, Kent Biological Records Centre
Short Eared Owl	<i>Asio flammeus</i>	Bird of Conservation Concern – Amber	Essex Field Club
Skylark	<i>Alauda arvensis</i>	Section 41 NERC Act, Birds of Conservation Concern – Red List	Essex Field Club
Song Thrush	<i>Turdus philomelos</i>	Section 41 NERC Act, Birds of Conservation Concern – Amber List	Essex Field Club, Kent Biological Records Centre
Spotted Flycatcher	<i>Muscicapa striata</i>	Section 41 NERC Act, Birds of Conservation Concern – Red List	Kent Biological Records Centre
Starling	<i>Sturnus vulgaris</i>	Section 41 NERC Act, Bird of Conservation Concern - Red	Essex Field Club, Kent Biological Records Centre
Turtle Dove	<i>Streptopelia turtur</i>	Section 41 NERC Act, Bird of Conservation Concern - Red	Essex Field Club
Western Marsh Harrier	<i>Circus aeruginosus</i>	Wildlife and Countryside Act 1981: Schedule 1 - Part 1, Birds of Conservation Concern – Amber List	Essex Field Club, Kent Biological Records Centre

The Thames Estuary and Marshes Ramsar and Special Protection Area (SPA) is located in close proximity to both the Gravesend and Tilbury Sites. The Ramsar is designated for supporting an internationally important populations of hen harrier (*Circus cyaneus*) and pied avocet (*Recurvirostra avosetta*), as well as important migratory populations of redshank (*Tringa totanus*), ringed plover (*Chadadirus hiaticula*), grey plover (*Pluvialis squatarola*), dunlin (*Calidris alpina*), knot (*Calidris canutus*) and black-tailed godwit (*Limosa limosa*). The SPA also support an international assemblage of gadwall (*Mareca strepera*), shoveler (*Anas clypeata*), pochard (*Aythya ferina*) and tufted duck (*Aythya fuligula*).

3.10.2 Field Survey

At low tide both Sites are adjoined by areas of foreshore habitat that provide habitat suitable to be utilised by the overwintering bird populations for which the SPA/Ramsar are designated. While none of the species for which the SPA/Ramsar is designated were seen to be utilising these areas during the extended Phase 1 habitat survey, their use and functional linkage to the SPA/Ramsar cannot at this stage be ruled out.

The scrub habitat on Site is suitable to support small nesting bird species that may be present on Site. Both areas contained swathes of grassland that were suitable for ground nesting species such as skylark (*Alauda arvensis*) and herring gull (*Larus argentatus*), particularly the Tilbury Site which has limited human intrusion. Areas of the Tilbury Site such as the grassland on the plateau feature areas of open ground that are suitable for ground foraging bird species such as black redstart (*Phoenicurus ochrous*), although there is no habitat suitable for the species to breed on Site.

A large gravel lake present within the Tilbury Site as well as the water bodies on both Sites are suitable for foraging waterfowl and possess marginal vegetation that is suitable as cover for nesting birds. Due to its close proximity to the Thames Estuary Ramsar, the gravel lake and to a lesser extent the ditches could be used for overwintering species that typically used shoreline habitats. The exposed mud along the banks of the gravel lake are suitable for wading species to forage in.

Sightings of western marsh harrier (*Circus aeruginosus*) and eider duck (*Somateria mollissima*) were recorded on the Tilbury Site. Sightings and soundings of kingfisher (*Alcedo atthis*), herring gull, song thrush (*Turdus philomelos*) and starling (*Sturnus vulgaris*) were recorded on the Gravesend Site.

3.10.3 Constraints and Recommendations

The Thames Estuary Ramsar is partially designated for the aggregation of waterfowl and waders that use the Site as overwintering habitat, as well as the populations of resident bird species it supports. The proposed works on Site have potential to cause for disturbance on Site, via increased levels of light, noise, air and water pollution as well as increased human presence during the construction phase. The presence of mudflat habitat at the foreshore adjacent to the north or south of the Site for the Gravesend and Tilbury sides of the site respectively makes the Site and immediate area attractive to overwintering birds, and increases the chances of disturbance.

A series of wintering bird surveys are already being carried out on Site to determine the assemblage of bird species on Site and with the immediate surrounding area. The results of these surveys will be coupled with noise modelling to determine the likely level of disturbance that the works will produce to the assemblage of the waterfowl and wading birds in the designated areas around Site. The results of these surveys will provide baseline information for a report to inform Habitat Regulations Assessment (HRA). This will include consideration of potential impacts of ground investigation works

Works involving excavation, or that produce high levels of noise are recommended to take place as far away from water sources used by birds as possible, and when required after clearance of vegetation suitable to support overwintering species, has been carried out by AECOM between November and March 2023 on both Site either side of the Thames.

Breeding birds and their nests are protected under the Wildlife and Countryside Act (1981, as amended). Schedule 1 species are afforded additional protection which makes it an offence to disturb individuals of these species when 'at or near' an active nest.

Breeding bird surveys are recommended to confirm the value of each site for breeding birds. A total of 5 monthly visits in the period March to July, inclusive should be undertaken. Experienced ornithologists would use bird sound and behaviour to classify the breeding status of birds present. The locations of all species of conservation importance that are breeding or likely to breed will be mapped and an estimate of their numbers (pairs/territories) derived.

During the implementation phase it is recommended that any trees or scrub vegetation is removed outside of the bird nesting season (i.e. during period September to February inclusive) to prevent breeding birds from being disturbed. It is also recommended that if any structures are scheduled to be demolished, they are searched prior to works commencing to determine if any birds are present within the structure.

If any site clearance of trees or scrub is due to take place between March and the beginning of September, an ecologist will be required to confirm the absence of active bird nests immediately prior to works commencing to avoid a breach of legislation.

If a nest is discovered, clearance or other construction works should be stopped immediately within an exclusion zone to be determined by an ecologist (generally 5m radius). The exclusion zone will be demarcated appropriately. The nest will subsequently be monitored, typically on a weekly basis, by a suitably qualified ecologist. Once it is confirmed that all fledglings have flown and ceased to return to the nest, and that no other nests are in use within the exclusion zone, the vegetation can be removed.

3.11 Terrestrial Invertebrates

3.11.1 Desk Study

The records supplied by the Essex Field Club returned three records of white letter hairstreak (*Satyrion y-album*) from within a 1km radius of the Tilbury Site from over the last 10 years.

Additional records of species listed on Section 41 of the NERC Act (2006) as amended and that are listed as red list species by the International Union for Conservation of Nature. These species included brown banded carder bee (*Bombus humilis*), shrill carder bee (*Bombus sylvarum*), five-banded digger wasp (*Cerceris quinquefasciata*), sea aster bee (*Colletes halophilus*) and the picture winged fly (*Dorycea graminum*).

The records supplied by Kent Biological Records Centre returned fifteen records of stag beetle (*Lucanus cervus*) from within a 1km radius of Gravesend Site from over the last 10 years.

3.11.2 Field Survey

The range of habitats present at the site (grassland, ephemerals/short-perennials, ditches, scrub, areas of bare ground) provide good structural diversity, and as a result the habitats are considered potentially suitable to support a diverse range of invertebrates.

The assemblage of bee and fly species recorded by the data search supplied by the Essex Field Club are associated with coastal grassland and sparsely vegetated land with areas of exposed bare ground. Suitable habitats suitable for these insect species is present within the plateau on the southern central area of the Tilbury Site. Notably the food plants for the two species of carder bee; red clover (*Trifolium pratense*) and tufted vetch (*Vicia caracca*) are present within the habitats on Site.

Stag beetles are typically associated with woodland, wood-pasture and parkland with significant quantities of fallen deadwood, preferably partially buried deadwood from English oak (*Quercus robur*) that acts as a breeding resource. This deadwood is then used by the larvae as a feeding resource for three to seven years. The lack of mature oak trees on either Site makes them less attractive to stag beetles. White letter hairstreak butterflies are associated with elms (*Ulmus* species) their larval food source and are often found in scrubland, hedges or woodland edge habitats. Adult white letter hairstreaks are pollinators of bramble and privet (*Ligustrum vulgare*) with the former present on both sites in large quantities. Despite the presence of adult food, the lack of elm trees makes inhabitation of the Site by white letter hairstreak unlikely on either of the two Sites.

Due to the lack of suitable larval food sources on either Site it is determined that neither stag beetles nor white letter hairstreaks represent a constraint to development. The short ephemeral vegetation and grassland habitats on the Tilbury Site are suitable to support the assemblage of bee and fly species.

3.11.3 Constraints and Recommendations

Further surveys for the general terrestrial invertebrate assemblage of both sites are recommended due to the designation of the current Tilbury Power Station LWS and future SSSI for invertebrates.

This survey should be carried out by an experienced entomologist with two or three survey visits undertaken between April and September to provide good coverage of different species groups. Each visit should involve use of a range of collection measures (e.g. direct observation, sweep netting, pooter) and collect specimens to allow identification to species level wherever possible.

3.12 Fish

3.12.1 Desk Study

There are two records of European eel (*Anguilla anguilla*) returned from within 1km of the Site within the last 10 years from the data provided by the Kent Biological Records Centre. Both these records come from the River Thames and were located 700m to the north west of the Site.

3.12.2 Field Survey

Table 7 summarises both the evidence of fish species being present within the Survey Area, and the potential for features and habitats within the Survey Area to support fish species.

Table 7. Summary of Fish presence/ potential presence within the Survey Area

Feature	Description	Location ¹⁶	Relevant Target Notes
Ditch (Gravesend Side)	Shallow ditch with steep banks and thick reed covered connected to the Thames and Medway Canal.	Makes up part of the southern boundary of the Gravesend Site	TN12
Ditch (Tilbury Side)	Wide, deep ditch with marginal vegetation and steep banks with aquatic connection to the River Thames.	Makes up the western boundary of the Tilbury Site	TN9
Ditch (Tilbury Side)	Shallow ditch with shallow banks with no aquatic connection to the River Thames.	Located within the Tilbury Site	TN10

3.12.3 Constraints and Recommendations

European eels are protected by 'The Eels' (England and Wales) Regulations (2009) that prohibits the obstruction of this species path to marine habitats, or to freshwater sources which eels use to mature in.

While no works within water courses are scheduled to be carried out it is recommended that any spoil removed during excavations are kept away from water course to prevent temporary blockages that prevent migration of eels to and from marine habitats. A CEMP that covers the impacts such as increased noise, vibration and pollution that may impact water courses on Site. This CEMP should also cover the management and mitigation to reduce the impact on the water course.

European eels are able to temporarily persist and move across terrestrial habitats, primarily at night or when water levels drop. If eels are found in terrestrial habitats works should cease and their progress should be monitored to ensure it reaches more suitable aquatic or marine habitats.

3.13 Marine Mammals

3.13.1 Desk Study

The records supplied by the Essex Field Club returned a single record of grey seal (*Halichoerus grypus*) and two records of beluga whale (*Delphinapterus leucas*) from within a 1km radius of the Tilbury Site from over the last 10 years.

The records supplied by Kent Biological Records Centre returned a single record of grey seal, harbour porpoise (*Phocoena phocoena*) and two records of beluga whale from within a 1km radius of Gravesend Site from over the last 10 years

3.13.2 Field Survey

Both harbour porpoise and grey seal are coastal species that are known to be present within the Thames estuary all year round. While there is no marine habitat suitable for harbour porpoise on either the Tilbury or Gravesend Site, the banks of the Thames have some suitability to support basking sites for both grey seal and harbour seal (*Phoca vitulina*), even though there are no records of this species in the data searches provided.

The two records of beluga from the data searches, are likely the same animal as the species is not a permanent resident or regular visitor to the UK. As such its presence is unlikely to be repeated during the lifespan of the construction works scheduled to take place, although there are other references of vagrant cetacean species such as northern bottlenose whale (*Hyperoodon ampullatus*) and humpback whale (*Megaptera novaeangliae*) within the Thames Estuary from outside the 10 year period, and as such the presence of larger cetacean species should be considered in relation to any works within the Thames that could result in potential disturbance to cetaceans/marine mammals (e.g. marine ground investigation works).

¹⁶Where features are situated outside of the Site boundary, the distance and direction is given at the closest point of the feature from the Site

3.13.3 Constraints and Recommendations

All cetacean species are protected under the Habitats Regulations (2017, as amended), and are fully protected by Schedule 5 of the Wildlife and Countryside Act. Common seals are protected by Section 41 of the Natural Environment and Rural Communities (2006) as amended.

It is understood ground investigation works are scheduled to take place in the River Thames between the two Sites and in the absence of mitigation there would be the potential for these works to have an impact upon seals and cetaceans within the watercourse. It is recommended that prior to marine ground investigation works commencing on Site an assessment of the potential on marine habitats is undertaken by a suitably qualified marine ecologist. A separate Precautionary Method of Working (PMoW) detailing the impacts, mitigation and enhancements in regard to marine mammals may be required.

3.14 Other Mammals

3.14.1 Desk Study

The records returned by the Essex Field Club listed no additional mammals species of note from within 1km of the Tilbury Site from over the last 10 years.

The records returned by the Kent Biological Records Centre returned a single record of water shrew and two records of hedgehog (*Erinaceus europaeus*) from within a 1km radius of the Gravesend Site from over the last 10 years.

3.14.2 Field Survey

The ditches on both Sites are suitable habitats for water shrews, due to the presence of reeds and emergent vegetation that can support prey species and allow shelter for hunting water shrews. The banks also provide habitat suitable for water shrews to build burrows in.

The scrub and ruderal habitat on both Sites is suitable foraging habitat for hedgehogs as well as providing shelter for the species during hibernation. Due to the connectivity to suitable adjacent habitat on the Gravesend Side there is potential for hedgehogs to commute on and off Site without coming into contact with roads or other barriers.

3.14.3 Constraints and Recommendations

Hedgehogs are listed on both Section 41 of the Natural Environment and Rural Communities Act (2004) as amended and Section 6 of the Wildlife and Countryside Act that protects them from killing and injury from certain methods. Both hedgehogs and water shrews as well as all other UK mammals are protected by the Wild Mammals (Protection) Act 1996.

It is recommended that works likely to impact the ditches on Site have a barrier placed between them and the work site to reduce or negate the impact on water shrews. Additionally the CEMP produced for the Site should elaborate on the protection and mitigation.

It is recommended that excavations are backfilled the same day where possible, and where this is not possible that a cover is placed over any excavations that are present. If this is not possible, one end of the excavation should be formed into a ramp to allow hedgehogs and other animals (including other mammals such as foxes) to escape the excavations under their own power.

3.15 Notable Plants

3.15.1 Desk Study

Six plant species, chicory (*Chicorium intybus*), common sea lavender (*Limonium vulgare*), common vetch (*Vicia sativa*), fern grass (*Catapodium rigidum*), horned pondweed (*Zannichelia palustris*) and hounds tongue (*Cynoglossum officinale*), listed on Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006) as amended were recorded within 1km of the Tilbury Site from over the last 10 years.

While no plants listed on either Schedule 8 of the Wildlife and Countryside Act (1981) as amended or on Section 41 of the Natural Environment and Rural Communities a species covered by the Convention on International

Trade in Endangered Species (CITES), the man orchid (*Orchis anthropophora*) was recorded within 1km of the Gravesend Site and from the last 10 years.

3.15.2 Field Survey

No notable species were noted during the Phase 1 survey. However, the survey was undertaken in November when some plant species would not be visible and therefore presence of protected/notable species cannot be ruled out.

Common vetch and chicory are two species that are found in grassland and short ephemeral vegetation. Suitable grassland and short ephemeral vegetation habitats are both present on the Tilbury Site. Horned pondweed is an aquatic plant that grows in slow moving waterbodies and in marshland, and as such the four ditches on Site are suitable to support this plant. Common sea lavender grows in salt marsh and coastal wetlands, and while there is no preferred habitat suitable on either Site, the species occasionally grows on the edges of brackish water bodies, and as such may establish itself along the ditches on Site.

Man orchid grows primarily on chalk soils which are not present within either the Tilbury or Gravesend Site while fern grass primarily grows on walls and as such both species are unlikely to be encountered on Site.

3.15.3 Constraints and Recommendations

A series of National Vegetation Classification surveys are recommended to be carried out on both the Gravesend and Tilbury Sites due to its partial designation for vegetation assemblages. These surveys should be carried out between May and September when plant species are most likely to be above ground on site, and the results will be used to inform the Habitat Regulations Assessment regarding the constraints and mitigation of designated sites on and in close proximity to the Site. The results of the NVC surveys will inform the design of the Site and promote areas to avoid when construction works are undertaken.

Should any of the species mentioned above, or additional species of note be found on Site, it is recommended that their proximity to the works are assessed and if needed, reports produced addressing the protection and mitigation in regard to these species. These reports may also result in changes to the work schedule and overall development and construction plans.

3.16 Invasive Non-Native Species

3.16.1 Desk Study

Four non-native invasive plant species; water fern (*Azolla filiculoides*), Nuttall's waterweed (*Elodea nuttallii*), Japanese knotweed (*Reynoutria japonica*), Virginia creeper (*Parthenocissus quinquefolia*), and one non-native invasive animal species; Chinese mitten crab (*Eriocheir sinensis*), listed on Schedule 9 of the Wildlife and Countryside Act (1981) as amended were recorded within 1km of the Gravesend Site from over the last 10 years in the records provided by Kent Biological Records Trust.

Two non-native invasive plant species; Japanese rose (*Rosa rugosa*) and perfoliate Alexanders (*Smyrnium perfoliatum*) listed on Schedule 9 of the Wildlife and Countryside Act (1981) as amended were recorded within 1km of the Tilbury Site from over the last 10 years in the records provided by the Essex Field Club.

The Essex Field Club also identified five other species; buddleia (*Buddleja davidii*), goat's rue (*Galega officinale*), false acacia (*Robinia pseudoacacia*), holm oak (*Quercus ilex*) and Russian vine (*Fallopia baldschuanica*) with potential to become invasive but not currently listed on any legislation.

3.16.2 Field Survey

No species listed on either Schedule 9 of the Wildlife and Countryside Act (1981) as amended or on the Invasive Alien (Enforcement and Permitting) Order (2019) were recorded on either of the Sites.

A single species; buddleia, with potential to become invasive was recorded on Site. Buddleia is very attractive to pollination insects, particularly butterflies, to the point where it can outcompete native plants. Buddleia is also able to grow on bare rock, and if allowed can grow and potentially damage any masonry or buildings it grows on.

While not listed on any legislation or mitigation, the presence of pampas grass (*Cortaderia selloana*) can quickly spread across existing grasslands via wind pollination, particularly from the elevated position on the plateau and outcompete native species.

3.16.3 Constraints and Recommendations

Buddleia can be cleared using typical mechanical and hand cutting means, with excavation of the root ball, or the application of contact herbicide to prevent regrowth. Buddleia does not represent a risk of regrowth from cut or fragmentary remains and can be disposed of alongside regular green waste. Pampas grass can regenerate from rhizomes and as such it is recommended that the root ball is excavated and disposed of as part of regular green waste.

A follow up walkover should be carried out, between April and September when plants are growing, in close proximity to where earthworks are being carried over to determine if invasive species are present. Should species found on either Schedule 9 of the Wildlife and Countryside Act and the Invasive Alien Species (Enforcement and Permitting) Order be found on Site, additional measures regarding mitigation and monitoring will be required for the works on Site.

4. Biodiversity Accounting

A habitat condition assessment of the habitats found on site was prepared based on the results of the site visit. This data can be used to inform the baseline of a separate Biodiversity Net Gain assessment (if required) once defined development proposals are available.

Table 8. Habitat Classification Conversion (Baseline) - Tilbury

Phase 1 Habitat Classification	UK Habitat Classification	Habitat Condition Assessment	Habitat Condition Assessment Sheet	Assessment	Assigned Condition
Semi Improved Grassland - West	Grassland – Modified Grassland	Grassland with scrub and areas of bare ground present.	5. Grassland	Biodiversity Metric 3.1 Technical Specification - Grassland	Moderate (2)
Semi Improved Grassland – South	Grassland – Modified Grassland	Grassland with areas of scrub present.	5. Grassland	Biodiversity Metric 3.1 Technical Specification - Grassland	Moderate (2)
Semi Improved Grassland – Plateau	Grassland – Modified Grassland	Grassland with low sward height and areas of bar ground present.	5. Grassland	Biodiversity Metric 3.1 Technical Specification - Grassland	Moderate (2)
Short Ephemeral Vegetation	Sparsely Vegetated Land – Ruderal/Ephemeral	Clear signs of succession on Site, with varied vegetation structure and invasive species below 5%.	21. Urban	Biodiversity Metric 3.1 Technical Specification - Urban	Good (3)
Scrub – Western Grassland	Scrub – Bramble Scrub	Scrub with grassland edge, with no invasives but dominated by bramble.	19. Scrub	Biodiversity Metric 3.1 Technical Specification - Scrub	Moderate (2)
Scrub – South West Corner	Scrub – Bramble Scrub	Scrub with grassland edge, with no invasives but dominated by bramble.	19. Scrub	Biodiversity Metric 3.1 Technical Specification - Scrub	Moderate (2)
Scrub – Plateau Perimeter	Scrub – Bramble Scrub	Scrub with grassland edge, with no invasives but dominated by bramble.	19. Scrub	Biodiversity Metric 3.1 Technical Specification - Scrub	Moderate (2)
Ditch I	Rivers and Streams - Ditches	Ditch with marginal vegetation cover but with one bank significantly shaded.	4. Ditches	Biodiversity Metric 3.1 Technical Specification - Ditches	Moderate (2)
Ditch II	Rivers and Streams - Ditches	Seasonal ditch with limited water plants present.	4. Ditches	Biodiversity Metric 3.1 Technical Specification - Ditches	Moderate (2)

Table 9. Habitat Classification Conversion (Baseline) - Gravesend

Phase 1 Habitat Classification	UK Habitat Classification	Habitat Condition Assessment	Habitat Condition Assessment Sheet	Assessment	Assigned Condition
Amenity Grassland	Grassland – Improved Grassland	Regularly managed grassland with limited biodiversity.	5. Grassland	Biodiversity Metric 3.1 Technical Specification - Grassland	Poor (1)
Line of Trees	Line of Trees (Associated with Bank or Ditch)	Native line of trees with no gaps or veteran trees present.	15. Line of Trees	Biodiversity Metric 3.1 Technical Specification – Line of Trees	Moderate (2)
Marshy Grassland	Grassland – Floodplain Wetland Mosaic	Wet all year round most years, with limited scrub and bare ground.	23. Wetland	Biodiversity Metric 3.1 Technical Specification - Wetland	Moderate (2)
Scrub	Scrub – Bramble Scrub	Scrub with grassland edge dominated by bramble.	19. Scrub	Biodiversity Metric 3.1 Technical Specification - Scrub	Moderate (2)
Semi Improved Grassland	Grassland – Improved Grassland	Grassland with limited sward height variation.	5. Grassland	Biodiversity Metric 3.1 Technical Specification - Grassland	Moderate (2)
Ditch I	Rivers and Streams - Ditch	Shaded ditch with good water quality and both marginal and water plants present.	4. Ditches	Biodiversity Metric 3.1 Technical Specification - Ditches	Moderate (2)

5. Opportunities for Enhancements

Opportunities for biodiversity enhancement will be explored further in liaison with Natural England and other relevant stakeholders once further baseline surveys have been undertaken. This may include natural revegetation, or seed harvesting from retained habitat to aid revegetation of impacted areas. In addition opportunities will be explored for enhancing retained habitats through sensitive ongoing management.

The proposed new cable tunnel is likely to generate a significant volume of arisings, and the potential for this material to be utilised for habitat creation in the wider local area should be explored.

6. Conclusion

This PEAR is based on a desk study and ecological surveys undertaken on the 17th and 25th of November to assess the ecological constraints to the Scheme and to provide advice in respect of Scheme design, site layout and / or site investigation.

The following further surveys summarised in Table 10 are likely to be required to support the proposed works. However, the full scope of surveys required should be finalised when the design of the scheme has been further developed, and there has been further consultation with Natural England.

Table 10. Summary of Recommendations

Feature	Recommendation	Timing
Thames Estuary & Marshes (Ramsar Site and Special Protection Area)	Habitat Regulations Assessment will be required to consider potential for effects on the nearby Thames Estuary and Marshes SPA and Ramsar. This should include consideration of ground investigation works. Wintering bird surveys are being undertaken to inform the assessment and it is possible noise modelling will also be required.	Initial HRA to be undertaken prior to commencement of ground investigation works.
Tilbury Power Station LWS (and proposed SSSI)	Further consultation is required with Natural England to determine the proposed boundary of the proposed SSSI, and potential impact on features for which this site is to be designated. The area to be covered by the SSSI designation should be avoided, or if not possible impacts minimised and appropriate reinstatement specified.	Undertake as soon as possible to inform design process.
Canal and Grazing Marsh, Higham LWS	Minimise extent and duration of works within the LWS.	Undertake as soon as possible to inform design process.
Habitats	National Vegetation Classification (NVC) survey of both sites is recommended to fully characterise the grassland communities on Site	Single visit between May and September
Badger	Undertake further badger survey at Tilbury to characterise the setts at Tilbury. Seek to avoid works within 30m of identified setts.	No seasonal constraint
Bats	Undertake bat activity transects across both Sites concentrating on the areas of grassland, scrubland and marginal vegetation should be carried out on both the Gravesend and Tilbury Sites. Emergence/re-entry surveys on the substation building (Tilbury) and the high potential bat roost tree (Gravesend).	One survey per month at each site between April and September Late April to September Three emergence/re-entry surveys on the bat roost tree. A single emergence/re-entry on the substation building.
Water Voles and Otters	Water vole and otter surveys on both Sites looking for field signs such as latrines, holts/burrows, feeding remains, footprints as well as sightings and soundings along the four ditches on Site (three on Tilbury and one in Gravesend).	Two visits between April and September
Wintering Birds	Surveys are already taking place to determine the use of habitats and surrounding habitats by overwinter species of bird.	November to March
Breeding Birds	A series of five visits should be undertaken at monthly intervals to allow the value of the site for breeding birds to be established and confirm requirements for mitigation/compensation	March to July
Great Crested Newt	An eDNA survey and single survey using traditional survey techniques (e.g. torch light survey) should be carried out on each of the suitable waterbodies within 250m of the Site. A series of six great crested newt surveys should be carried out if presence is confirmed within the waterbodies to determine the presence or absence of breeding great crested newts. These surveys should include a mixture of torch surveys, egg searches, bottle trapping and netting to help determine the presence of the species.	Late April to end June. Mid-March to mid-June.

Feature	Recommendation	Timing
Reptiles	A series of seven reptile surveys should be carried on both sites to determine the presence or absence of reptiles. Should reptiles be found on Site then further surveys (up to 20) may be required to determine population size.	April/May or September/October
Terrestrial Invertebrates	Two or three survey visits to be carried out by suitably qualified entomologists after liaison with Natural England to determine the make-up of the invertebrate assemblage, and identify any species that need additional protection during works.	April to September
Fish	No further surveys required assuming that no works within watercourses.	-
Marine Mammals	Marine ecologist to review proposals for any marine GI to identify any requirement for further survey, mitigation or monitoring	Prior to commencement of marine GI works.
Invasive non-native plant species	Walkover survey to check if any invasive non-native species are present.	April to September
Construction and Environment Management Plan (CEMP)	A CEMP informed by the surveys carried out as well as the Habitat Regulations Assessment will cover protection of ecological features and sensitive working methods.	Prior to construction
Biodiversity Net Gain Calculation	When an initial scheme design is available it is recommended that a biodiversity net gain calculation is undertaken to establish the likely change in biodiversity units and establish the requirements for compensation	Prior to planning/consenting

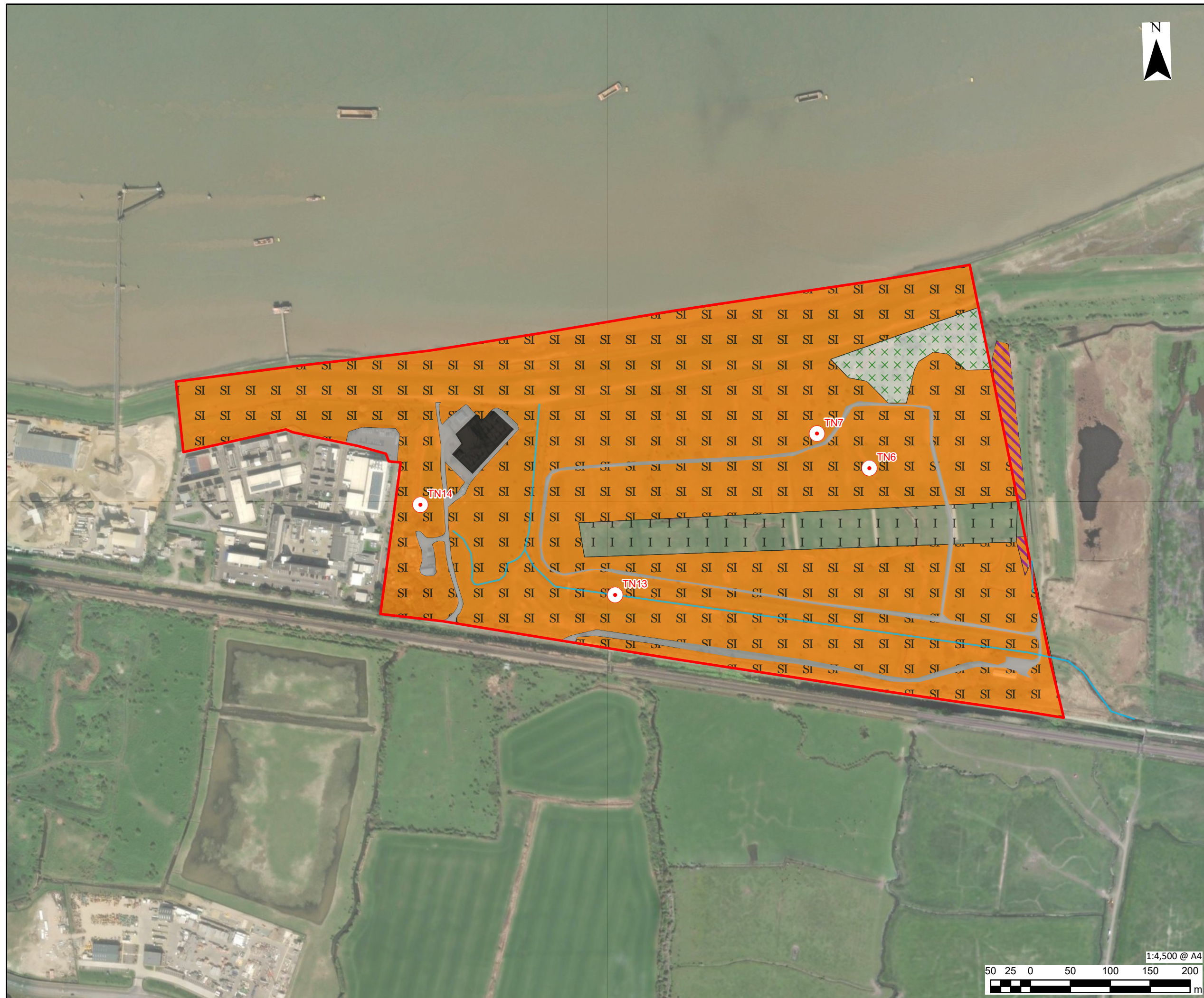
6.1 Survey Updates

Due to the mobility of animals and the potential for colonisation of the Site, the conclusions of this report are considered valid for a period of 12 months from writing. Beyond this date the ongoing validity of conclusions should be reviewed by appropriately qualified ecologist and the requirement for update surveys considered.

Annex A Figures



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Annex B Relevant Legislation and Planning Policy

B.1 Legislation

The UK is no longer a member of the European Union (EU). EU legislation as it applied to the UK on 31 December 2020 is now a part of UK domestic legislation. EU legislation which applied directly or indirectly to the UK before 11.00 p.m. on 31 December 2020 has been retained in UK law as a form of domestic legislation known as 'retained EU legislation'.

The Secretary of State for the Environment, Food and Rural Affairs and Welsh Ministers have made changes to parts of the *Conservation of Habitats and Species Regulations 2017* (referred to as the 2017 Regulations) so that they operate effectively. Most of these changes involve transferring functions from the European Commission to the appropriate authorities in England. All other processes or terms in the 2017 Regulations remain unchanged and existing guidance is still relevant.

B.2 Designated Sites

Special Protection Areas (SPA) / Special Areas of Conservation (SAC)

These sites in the UK no longer form part of the EU's Natura 2000 ecological network. The *Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019* (referred to as the 2019 Regulations) have created a national site network on land and at sea, including both the inshore and offshore marine areas in the UK. The national site network includes:

- existing SACs and SPAs
- new SACs and SPAs designated under these Regulations

Any references to Natura 2000 in the 2017 Regulations and in guidance now refers to the new national site network.

Formal Appropriate Assessment is required to be undertaken by the competent authority before undertaking, or giving consent, permission or other authorisation for any work which are likely to have a significant effect on such a site.

Wetland of International Importance (Ramsar site)

Designated under the *Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971* (the Ramsar Convention), in the UK, these sites are treated as having the same level of protection as SPA's and SAC's.

Sites of Special Scientific Interest

Under the *Wildlife and Countryside Act 1981* (as amended), it is an offence to carry out or permit to be carried out any operations likely to damage the Site of Special Scientific Interest (SSSI). These operations are listed in the SSSI notification.

Owners, occupiers, public bodies and statutory undertakers must give notice and obtain the appropriate consent under S.28 of the *Wildlife and Countryside Act 1981* (as amended), before undertaking operations likely to damage a SSSI.

National Nature Reserve

National Nature Reserves (NNR) are established under the National Parks and Access to the Countryside Act 1949. Most NNRs are also underpinned by SSSIs and are therefore protected by the measures detailed above. For NNRs not underpinned by SSSIs it is still an offence to carry out or permit to be carried out any potentially damaging operation.

NNRs are given protection through policies in a local development plan.

Local Nature Reserve

A Local Nature Reserve (LNR) is a statutory designation made under National Parks and Access to the Countryside Act 1949, by principal local authorities (district, borough or unitary councils).

The local authority must control the LNR land - either through ownership, a lease or an agreement with the owner.

LNRs are given protection through policies in a local development plan.

Locally Designated Sites

Local Wildlife Sites are sites with 'substantive nature conservation value'. They are defined areas, identified and selected for their nature conservation value, based on important, distinctive and threatened habitats and species within a region.

They are usually selected by the relevant Wildlife Trust, along with representatives of the local authority and other local wildlife conservation groups.

The LWS selection panel, select all sites that meet the assigned criteria, unlike SSSIs, which for some habitats are a representative sample of sites that meet the national standard. Consequently, many sites of SSSI quality are not designated and instead are selected as LWSs. Consequently, LWSs can be amongst the best sites for biodiversity.

B.3 Protected Species

Bats / Hazel Dormouse / Otter / Great Crested

These species, known as European Protected Species, are protected under Regulation 43 of the 2017 Regulations as amended by the 2019 Regulations. This makes it an offence to deliberately capture, injure or kill an animal; deliberately disturb an animal; or damage or destroy a breeding site or resting place used by an animal.

Deliberate capture or killing is taken to include "accepting the possibility" of such capture or killing. Deliberate disturbance of animals includes in particular any disturbance which is likely a) to impair their ability (i) to survive, to breed or reproduce, or to rear or nurture their young, or (ii) in the case of animals of hibernating or migratory species, to hibernate or migrate; or b) to affect significantly the local distribution or abundance of the species to which they belong.

Where development works are at risk of causing one or more of the offences listed above, a mitigation licence from Natural England can be obtained to facilitate the works that would otherwise be illegal.

These species are also protected under Schedule 5 of the *Wildlife and Countryside Act 1981* (as amended). This makes it an offence to intentionally or recklessly obstruct access to any structure or place used for shelter or protection or disturb an animal in such a place.

Lower levels of disturbance not covered by the *Conservation of Habitats and Species Regulations 2017* remain an offence under the *Wildlife and Countryside Act 1981* although a defence is available where such actions are the incidental result of a lawful activity that could not reasonably be avoided.

Water Vole

Water voles are protected under the *Wildlife and Countryside Act 1981* (as amended). There are no licensing purposes that explicitly cover development or other construction activities which could have an impact on water voles.

When development work is proposed in or near an area which is either known to or likely to contain water voles, then the developer will need to implement suitable mitigation to prevent impacts to water voles. The preferred mitigation option is to leave water voles *in situ*, with the development works adopting avoidance measures through redesign of the proposals.

Where impacts cannot be avoided, operations aimed at displacing water voles from a development site are now no longer covered by the "incidental result of an otherwise lawful action" defence in the *Wildlife and Countryside Act 1981* (as amended). Displacement of water voles now needs to be undertaken under a licence.

In England, small scale (limited to continuous lengths of bank not exceeding 50 m) displacement of water voles can be carried out at certain times of the year (February to April) for the purposes of conservation under a Class

Licence by a registered person. For larger scale displacements or displacements outside of this period, displacement can be undertaken under a site-specific conservation licence.

Where it is considered that the best outcome for water voles is capture and translocation to a different location then this action is considered by Natural England to be outside the scope of the defence as the intentional capture of water voles is unlikely to be considered 'incidental'. In these circumstances there may be genuine grounds for issuing a conservation licence for the purpose of translocating the water vole population to suitable alternative habitat.

Nesting Birds

All wild birds are protected under the *Wildlife and Countryside Act 1981* (as amended), with some species afforded greater protection under Schedule 1 of the *Wildlife and Countryside Act 1981* (as amended). In addition to the protection from killing or taking that all birds receive, Schedule 1 birds and their young must not be disturbed at the nest.

There are no licensing purposes that explicitly cover development activities affecting wild birds.

Widespread Species of Reptile (common lizard, slow worm, grass snake and adder)

Widespread species of reptile are protected against intentional killing and injury under Schedule 5 of the *Wildlife and Countryside Act 1981* (as amended). There is no requirement for a licence where development works affect common species of reptiles. Instead, Natural England advise¹⁷ that where reptiles are present, they should be protected from any harm that might arise during the development works through appropriate mitigation.

Badgers

Badgers and their setts are protected under the *Protection of Badgers Act 1992* (as amended). This makes it an offence to wilfully kill, injure or take a badger; or intentionally or recklessly damage, destroy or obstruct access to a badger sett or disturb a badger in its sett.

It is not illegal to carry out disturbance activities near setts that are not occupied, i.e. those that do not show signs of current use.

Where required, licences for development activities involving disturbance or sett interference or closure are issued by Natural England. Licences for activities involving watercourse maintenance, drainage works or flood defences are issued under a separate process.

When assessing the requirement for a licence in respect of development, Natural England¹⁸ state that badgers are relatively tolerant of moderate levels of noise and activity around their setts, and that a low or moderate level of apparent disturbing activity at or near to badger setts does not necessarily disturb the badgers occupying those setts.

Licences are normally not granted from December to June inclusive (the badger breeding season) because dependent cubs may be present within setts.

Species and Habitats of Principal Importance for the Conservation of Biodiversity

Section 40 of the Natural Environment & Rural Communities Act (NERC) 2006 sets out the duty for public authorities to conserve biodiversity in England.

Habitats and species of principal importance for the conservation of biodiversity are identified by the Secretary of State for England, in consultation with Natural England, are referred to in Section 41 of the NERC Act for England. The list, known as the 'England Biodiversity List', of habitats and species can be found on the Natural England web site.

The 'England Biodiversity List' is used as a guide for decision makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act 2006 to have regard to the conservation of biodiversity in England when carrying out their normal functions.

¹⁷Reptiles: guidelines for developers, English Nature 2004

¹⁸ Interpretation of 'Disturbance' in relation to badgers occupying a sett, Natural England (2009)

Non-native Invasive Plant Species

Under the Wildlife and Countryside Act 1981 (as amended), it is an offence to plant or otherwise cause these species to grow in the wild.

Any contaminated soil or plant material is classified as controlled waste and should be disposed of in a suitably licensed landfill site, accompanied by appropriate Waste Transfer documentation, and must comply with section 34 of the *Environmental Protection Act 1990*.

B.4 Planning Policy

National Planning Policy Framework, 2021

The NPPF was first published in March 2012 and has been updated in July 2018, February 2019 and most recently in July 2021.

The NPPF states the commitment of the UK Government to minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity. It specifies the obligations that the Local Authorities and the UK Government have regarding statutory designated sites and protected species under UK and international legislation and how this is to be delivered in the planning system. Protected or notable habitats and species can be a material consideration in planning decisions and may therefore make some sites unsuitable for particular types of development, or if development is permitted, mitigation measures may be required to avoid or minimise impacts on certain habitats and species, or where impact is unavoidable, compensation may be required.

Chapter 15 of the NPPF 'Conserving and enhancing the natural environment' sets out the requirements to consider biodiversity in planning decisions. A summary of the paragraphs of the NPPF relevant to terrestrial ecology and nature conservation, and to the IERRT project, is provided below.

Paragraph 174 states that "*Planning policies and decisions should contribute to and enhance the natural and local environment by:*

- a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);*
- b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;*
- c) maintaining the character of the undeveloped coast, while improving public access to it where appropriate;*
- d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;*
- e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and*
- f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate".*

Paragraph 175 states that "Plans should: distinguish between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value, where consistent with other policies in this Framework; take a strategic approach to maintaining and enhancing networks of habitats and green infrastructure; and plan for the enhancement of natural capital at a catchment or landscape scale across local authority boundaries."

Paragraph 179 states that "To protect and enhance biodiversity and geodiversity, plans should:

- a) Identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity; wildlife corridors and stepping stones that connect them; and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation; and*

b) promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity".

Paragraph 180 states that "When determining planning applications, local planning authorities should apply the following principles:

a) if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;

b) development on land within or outside a Site of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest;

c) development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists; and

d) development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to incorporate biodiversity improvements in and around developments should be encouraged, especially where this can secure measurable net gains for biodiversity."

Biodiversity Net Gain

Under the *Environment Act 2021*, Schedule 14, all planning permissions granted in England, unless exempt, will have to deliver at least 10% biodiversity net gain from an as yet unconfirmed date, expected to be in November 2021.

B.5 Regional Planning Policy

Relevant regional policies for the Gravesend side of the Site is detailed in the following documents;

- Kent Environment Strategy (2016)
- Kent's Plan Bee: Kent County Council's Pollinator Action Plan (2019)

Table 11 provides a summary of the relevant regional planning policies. For a precise wording of each specific policy, please refer back to the source document. The planning policy has been considered when assessing potential ecological constraints and opportunities identified by the desk study and field surveys; and when assessing requirements for further survey, design options and ecological mitigation as described in Annex C.

Essex County Council influences planning through the local borough councils it represents as such the relevant planning policies are covered in Section B.6.

Table 11. Summary of Regional Planning Policy

Document	Policy	Purpose
Kent Environment Strategy (2016)	4 - Monitoring and Evaluation	4.1 - Establish and monitor key performance indicators 4.2 - Evaluate progress and identify future risks, opportunities and actions aligned to Kent Environment Strategy priorities to inform current and future action
	5 - Conserve and enhance the quality and supply of the county of Kent's natural and historical resources and assets.	5 – Conserve and enhance the quality and supply of the county of Kent's natural and historical resources and assets. 5.1 - Establish a coherent, landscape-led approach to decision making through identification of the natural and historic features that underpin landscape character and a strategic approach to assessment of character and trends in landscape condition. 5.2 - Improve and increase functional habitat networks on land and in the sea, identifying opportunities and protecting and enhancing our natural and historic environment and landscape character through planning and decision making.

Document	Policy	Purpose
		5.3 - Identify and take forward opportunities for sustainable water management to improve quality and quantity of our water environment and resources
	8 - Influence future sustainable growth for the county of Kent	8.2 - Mitigate the impacts and address the ambitions identified through the Growth and Infrastructure Framework and local plans, such as sustainable and alternative transport options, green infrastructure, energy, water and flooding
	9 - Improve the county of Kent's environmental, social and economic resilience to environmental change.	9.3 - Improve water management and build flood resilience, maximising opportunities to deliver multiple benefits for our environment and residents into the future
Kent's Plan Bee: Kent County Council's Pollinator Action Plan (2019)	Objective 1 - For Kent County Council to manage the land it owns or controls or can influence in a way which can benefit pollinators' forage and habitat	The Council is: • putting in place, where it can, revised grass-cutting and pollinator-friendly planting regimes. It is reviewing how it reinstates land and manages it generally on road verges, in maintained schools and parks and all other parts of its estate. • reviewing the use of pesticides in its estate and seeking to end the use of the controversial neonicotinoid sprays. • finding ways to create corridors for wildlife throughout the landscape within and adjacent to its estate. • identifying, promoting and arranging where possible, appropriate training for staff involved in land management (including parks, highways, estate management and grounds maintenance) to better their understanding of the needs of pollinators and how they can help them in the course of their work (where they are not already doing that). • looking for opportunities to 'green' its buildings and assets with pollinator friendly planting and such things as bee hotels (space people can make for solitary bees to nest).
	Objective 2 - For Kent County Council to use the planning system to protect pollinators and improve the habitats on which they rely.	The council is: • looking to support the connection of landscapes to each other. • looking to develop approaches within KCC's planning services that will help to protect pollinator habitats. • using the Kent Design Guide, Kent Planning Officers Group and other appropriate • means to work with Kent's district planning authorities to encourage developments that improve pollinator habitats. • working with community groups, district and borough councils and through the Kent Association of Local Councils to map pollinator features at a community level in order to help people to take action. • looking to understand and better articulate the economic value of pollinators to Kent. • looking at how it might develop a pollinator impact assessment tool to inform planning decisions.

B.6 Local Planning Policy

Relevant local planning policies regarding the Tilbury Site are produced by Thurrock Borough Council are detailed in the following documents;

- Thurrock Borough Council Local Plan (2012)

Relevant local planning policies regarding the Gravesend Site are produced by Gravesham Borough Council are detailed in the following documents;

- Gravesham Local Plan Core Strategy (2014)

A summary of the relevant local planning policies is provided in the table below. For the precise wording of each specific policy please refer back to the source document. This planning policy has been considered when assessing potential ecological constraints and opportunities identified by the desk study and field surveys and when addressing requirements for further survey, design option and ecological mitigation.

The planning policies related to Gravesham Borough Council are listed in Table 12 and those listed in Thurrock Borough Council are listed in Table 13.

Table 12. Summary of Gravesham Local Planning Policy

Document	Policy	Purpose
Gravesham Borough Council Local Plan (2014)	Policy CS01: Sustainable Development	4.1.6 Planning applications that accord with the policies in the development plan for Gravesham will be approved without delay, unless material considerations indicate otherwise. 4.1.7 When considering development proposals the Council will take a positive approach that reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework and in this Core Strategy. It will work proactively with applicants jointly to find solutions which mean that proposals can be approved wherever possible, and to secure development that improves the economic, social and environmental conditions in the area. 4.1.8 Where there are no policies relevant to the application or relevant policies are out of date at the time of making the decision then the Council will grant permission unless material considerations indicate otherwise, taking into account whether: - Any adverse impacts of granting permission would significantly and demonstrably outweigh the benefits, when assessed against the policies in the National Planning Policy Framework taken as a whole; or - Specific policies in that Framework indicate that development should be restricted.
	Biodiversity	5.7.7 Gravesham Borough has a significant biodiversity resource. This includes: - Sites of international and national significance for wildlife, e.g. Thames Estuary and Marshes Special Protection Area (SPA) and Ramsar Site, North Downs Woodlands Special Area of Conservation (SAC), and Cobham Woods Site of Special Scientific Interest (SSSI). Internationally significant sites are all designated as Sites of Special Scientific Interest and so are protected by national legislation; - Species protected by European and/or national legislation, e.g. bats, great crested newts; - Local wildlife sites which are important for the conservation of wildlife at the county level, e.g. Ebbsfleet Marshes, Court Wood Shorne; - Roadside nature reserves, e.g. A226 Gravesend Road, Chalk; and - Priority habitats and species identified in the UK Biodiversity Action Plan, e.g. native woodland including ancient woodland, lowland calcareous (chalk) grassland. 5.7.8 Some previously developed sites in the urban area have high biodiversity value. The green space and green grid networks together with other areas such as school grounds and private gardens also have a role in providing and connecting habitats. 5.7.9 Recent evidence suggests that there has been a decline in bird populations in the internationally significant Special Protection Areas (SPA) and Ramsar sites that make up the North Kent marshes (Thames Estuary and Marshes SPA/Ramsar Site, Medway Estuary and Marshes SPA/Ramsar Site, and The Swale SPA/Ramsar Site). There is currently insufficient evidence to adequately assess the cause of this decline although interim findings indicate that recreational activity causes disturbance to birds and that more development will lead to an increase in disturbance. Further work is being carried out by the North Kent Environmental Planning Group (NKEPG) in relation to this matter. In the meantime, a precautionary approach to development will be applied. This means that developers may need to provide or contribute to mitigation measures for the recreation needs arising from their developments, which may include provision of alternative greenspace, contributions to visitor control mechanisms and/ or management of the SPAs, to ensure that detrimental impacts on the integrity of the SPAs/ Ramsar sites are avoided.

Document	Policy	Purpose
		5.7.10 As part of its commitment to ensuring the ongoing protection of SACs, SPAs and Ramsar sites, the Council will: implement the findings of the bird population and visitor studies commissioned by the NKEPG; ensure that any proposed strategic avoidance and/or mitigation measures are adopted as appropriate in all planning documents and in the assessment of planning applications; and adopt a flexible approach that enables development on a case by case basis, which also takes into consideration the potential for in-combination effects based on best available evidence until the full results of the NKEPG studies are available, using a precautionary approach to require Habitats Regulations Assessment (HRA) where effects are uncertain. The Council will consider the need for HRA to be undertaken for sites with outline planning permission at the reserved matters stage. 5.7.11 The Greater Thames Marshes has been declared a Nature Improvement Area (NIA). This recognises that it has a unique yet fractured landscape and significant biodiversity importance but that the biodiversity is in decline and struggling to compete with increasing pressures. The NIA seeks to protect and enhance this valuable habitat, increase numbers of endangered species and protect existing flora and fauna. In Gravesham, the NIA includes the River Thames and much of the marshland to the east of Gravesend. 5.7.12 Local Nature Partnerships have been set up to help local areas to manage the natural environment as a system and to embed its value in local decisions for the benefit of nature, people and the economy. Local Nature Partnerships have been approved for Kent and Thames Gateway. 5.7.13 The strategy is to ensure that there is no net loss of biodiversity in the Borough and to take every opportunity to improve biodiversity. Existing sites of biodiversity value will be protected according to their importance. Where development is proposed, ecological surveys must be conducted and mitigation strategies produced, where applicable, prior to seeking planning permission. Development will then be expected to be designed, laid out and constructed in a manner which protects habitats and important species and also includes features to enhance biodiversity. Biodiversity Opportunity Areas have been identified across Kent and the wider South East which incorporate areas of the greatest biodiversity value. In Gravesham, these comprise: North Kent Marshes; Thames-side Green Corridors; and Medway Gap and North Kent Downs. These areas give opportunities for the restoration or creation of new priority habitats and will be the focus for improvement where opportunities arise, for example through the Local Nature Partnerships and the Nature Improvement Area.
	Policy CS12: Green Infrastructure	5.7.22 A multifunctional linked network of green spaces, footpaths, cycle routes and wildlife stepping stones and corridors will be created, protected, enhanced and maintained. The network will improve access within the urban area, from the urban area to the rural area and along the River Thames. 5.7.23 Sites designated for their biodiversity value will be protected, with the highest level of protection given to internationally designated Special Protection Areas, Special Areas of Conservation and Ramsar sites, followed by nationally designated Sites of Special Scientific Interest, followed by Local Wildlife Sites and then by other areas of more local importance for biodiversity. 5.7.24 There will be no net loss of biodiversity in the Borough, and opportunities to enhance, restore, re-create and maintain habitats will be sought, in particular within the Biodiversity Opportunity Areas shown on the Strategic Green Infrastructure Network map and within new development. 5.7.25 Where a negative impact on protected or priority habitats/species cannot be avoided on development sites and where the importance of the development is considered to outweigh the biodiversity impact, compensatory provision will be required either elsewhere on the site or off-site, including measures for ongoing maintenance. 5.7.26 The overall landscape character and valued landscapes will be conserved, restored and enhanced. The greatest weight will be given to the conservation and enhancement of the landscape and natural beauty of the Kent Downs Area of Outstanding Natural Beauty and its setting. Proposals will take account of the Kent

Document	Policy	Purpose
		Downs Area of Outstanding Natural Beauty Management Plan, the Gravesham Landscape Character Assessment, and the Cluster Studies where relevant.

Table 13. Summary of Thurrock Local Planning Policy

Document	Policy	Purpose
Thurrock Borough Council Local Plan (2012)	Core Strategy Spatial Objectives	SSO11 - To sustain and enhance the open character of the Green Belt in Thurrock and only allow development in very special circumstances SSO12 - Protect and enhance the natural, historic and built environment including biodiversity, landscape character, Conservation Areas, Listed Buildings, Scheduled Monuments and other heritage assets and open space through positive improvement. SSO13 - Develop the Greengrid network of biodiversity sites, historic sites, green infrastructure and open spaces linking existing and new communities, the urban areas to countryside and access to the river. Provide new open spaces, improve the accessibility of existing open spaces and ensure safe connecting routes and corridors linking them. SSO19 - To safeguard and enhance the Thurrock riverside and coastal land for its various roles as a key asset of the Borough: as a haven for wildlife, a cultural and heritage environment, providing for leisure and recreation at Grays and East Tilbury and for port – related activity at Tilbury, London Gateway and other locations. To provide land for flood risk management including new/relocated habitats across the Borough.
	CSTP18 – Green Infrastructure	1. Green Infrastructure Network 1. The Council, with its partners, will restore, protect, enhance and where appropriate create its green assets. The Green Infrastructure seeks to address the connectivity between urban and rural areas in the Borough and ensure that such green assets are multi-functional in use. Green assets can be those in public or private ownership and can be legally protected or covered by non-statutory designations. 2. A net gain and New Development 1. The Council will require a net gain in Green Infrastructure. This will contribute to addressing the existing and developing deficiencies, ensuring connectivity and relieving pressure on designated biodiversity sites such as SSSI's. 2. Alongside the requirements for biodiversity set out in Policy CSTP19, development must contribute to the delivery of Green Infrastructure, including the acquisition, planning, design and ongoing management consistent with the emerging Greengrid SPD. A key element of this will be connectivity and the integrity of the network; sites should not be considered in isolation. 3. Opportunities to increase Green Infrastructure will be pursued in new developments through the incorporation of features such as green roofs, green walls and other habitat/wildlife creation and also innovative technology. 4. Green Infrastructure assets will be identified, enhanced and safeguarded through: - Not permitting development that compromises the integrity of green and historic assets and that of the overall Green Infrastructure network; - Using developer contributions to facilitate improvements to the quality, use and provision of multi-functional green assets and green linkages; and - Investment from external funding sources. 3. Deficits Where there is an identified deficit the Council will require the creation of green assets including parks and gardens; natural and semi-natural spaces; amenity greens; children's play space; and outdoor sports facilities. Developments in areas of deficiency should provide for the supply and ongoing management of new areas of high quality natural and semi-natural space to address the new demand for green infrastructure. The guidance for provision of Green Infrastructure will be identified in the Greengrid SPD.

Document	Policy	Purpose
		4. Programmes i. The Council will work with partners to develop and implement Green Infrastructure through an area-based Greengrid Improvement Zones at a local level as necessary in order to deliver the green infrastructure in accordance with the overarching objectives of the Greengrid Strategy. ii. The Council will lead in Green Infrastructure management through developing best practice biodiversity enhancement throughout both urban-amenity and infrastructure land. This will be coordinated by programmes of education and community engagement and will support the development of environmental skills training in the region. iii. Allocations for new Green Infrastructure for Lakeside will be identified in other relevant Development Plan Documents. iv. The Council will identify projects to enhance the network further by improving the quality of existing provision and create new facilities to address existing deficiencies and serve the increasing population and to improve links between sites.
CSTP19 - Biodiversity		Development will be encouraged to include measures to contribute positively to the overall biodiversity in the Borough. 1. The Biodiversity Network The Council will create a robust network of ecological sites centring on the Core Strategy and Policies for Management of Development (as amended) Chapter 5 – Thematic Policies Adopted January 2015 128 designated sites, i.e. SSSIs, SPAs, Ramsar, Local Nature Reserves and Local Wildlife Sites. These sites will be safeguarded and enhanced to mitigate the effects of past habitat loss and fragmentation, development and climate change. 2. Positive Biodiversity Management i. The Council will ensure that all designated sites are managed appropriately and will prepare suitable Biodiversity Management Plans, with partners, to demonstrate how positive management will be achieved. ii. Buffering and extensions to existing sites and additional habitat will be sought through the adoption of appropriate Biodiversity Site Management Plans. iii. Access will be balanced against biodiversity interest. 3. Key Sites The Council has identified the following key sites that it will work with partners to enhance and will pursue appropriate opportunities to increase the biodiversity network in the Borough. i. East Thurrock Marshes; ii. Mardyke Valley Project; iii. Local Wildlife Sites; and iv. Living Landscapes Sites. 4. Climate Change and Habitat Loss The Council recognises the need for mitigation for habitat loss due to climate change. It supports the identification, through the Thames Estuary 2100 project, of potential inter-tidal habitat creation sites at Fobbing Marshes and East Tilbury, and fresh water habitat creation sites at North Fobbing Marshes, South Fobbing Marshes, Tilbury and West Tilbury Marshes and the Mardyke. 5. Biodiversity and Geodiversity Action Plans i. The Council is committed to delivering the actions set out within the Thurrock, Essex and UK Biodiversity Action Plans. ii. The Council will promote small-scale biodiversity interventions such as green roofs. iii. The Council supports the production and implementation of the Geodiversity Action Plans being

Document	Policy	Purpose
		developed by local 'geo' groups in Eastern England as part of the East of England Geodiversity Partnership.
PMD7 – Biodiversity, Geological Conservation and Development.		1. Development proposals will be required to demonstrate that any significant biodiversity habitat or geological interest of recognised local value is retained and enhanced on-site. Where it can be demonstrated that this is not possible, and there is no suitable alternative site available for the development, developers will be required to show that their proposals would mitigate any loss of biodiversity or geological interest. In circumstances where it can be demonstrated that neither retention on site nor mitigation is possible, developers will be required to provide appropriate compensation for any significant loss of biodiversity or geological interest, such that there is no overall net loss of biodiversity habitat or features of geological conservation interest in Thurrock. The Council will seek to achieve net gains in biodiversity where such gains would be possible, with particular reference to the desirability of re-creating priority habitats and the recovery of priority species. 2. The Council will not permit development that would result in the loss, or partial loss, of a locally designated biodiversity or geological site, except in exceptional circumstances where it can be demonstrated that there is no alternative, subject to the sequential approach outlined in (1) above. 3. To enable the Council to determine an application which would result in a loss of biodiversity or geological value, the developer will be required to submit a detailed justification setting out: i. why the loss is considered to be unavoidable ii. an assessment of what species and habitat would be lost or adversely affected as a result of development (including an ecological survey where appropriate) iii. how the loss or adverse effect is proposed to be mitigated on-site through habitat restoration or creation; and/or compensated for through the acquisition and management of a suitable site within the area, or a financial contribution towards the purchase and management of such a site or management of an existing site to bring it up to a necessary standard. 4. Thurrock Council will require development proposals to incorporate biodiversity or geological features into the design as far as possible. These may include green roofs, brown roofs and the creation of green corridors for wildlife. 5. Where it is necessary to secure the biodiversity or geological interest of a development site, the Council will seek the provision and implementation of a Biodiversity or Geological Management through planning obligations. The Council will evaluate development proposals and biodiversity management plans or geological management plans against recognised best practice.

Annex C Methodology

C.1 Desk Study

A desk study was carried out to identify nature conservation designations and protected and notable habitats and species potentially relevant to the Proposed Development including scheduled invasive non-native species.

A stratified approach was taken when defining the desk study area, based on the likely zone of influence of the Proposed Development on different ecological receptors and an understanding of the maximum distances typically considered by statutory consultees. Accordingly, the desk study identified any international nature conservation designations within 10 km of the Site boundary, other statutory nature conservation designations within 2 km of the Site boundary and local non-statutory nature conservation designations and protected and notable habitats and species within 2 km of the Site boundary.

The desk study was carried out in November 2022 using the data sources detailed in Table 14. Protected and notable habitats and species include those listed under Schedules 1, 5 and 8 of the Wildlife and Countryside Act 1981 (as amended); Schedules 2 and 4 of the Conservation of Habitat & Species Regulations 2010 (as amended); and species and habitats of principal importance for nature conservation in England listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. Records of invasive non-native scheduled species were also collated. Such species are listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and the Invasive Alien species (Permitting and Enforcement) Order 2019.

A request was made for local biological records from both the Essex Field Club and the Kent Biological Records Centre.

Table 14. Summary of desk study sources

Document	Date	Purpose
Multi-Agency Geographic Information for the Countryside (MAGIC) website	December 2022	International statutory designations within 10 km of the Site. Other statutory designations within 2 km. Ancient woodlands and notable habitats within 500m of the Site. Higher Level Environmental Stewardship agreements applied to the Site. Information on habitats and habitat connections (based on aerial photography) relevant to interpretation of planning policy and assessment of potential protected and notable species constraints.
Essex Field Club	December 2022	Statutory and Non-statutory designations within 1 km of the Site Protected and notable species records within 1 km of the Site (records for the last 10 years only).
Kent Biological Records Centre	December 2022	Statutory and Non-statutory designations within 2 km of the Site Protected and notable species records within 1 km of the Site (records for the last 10 years only).
Ordnance Survey 1:2500 Pathfinder maps and aerial photography	December 2022	Information on habitats and habitat connections (based on aerial photography) relevant to interpretation of planning policy and assessment of potential protected and notable species constraints.

C.2 Field Survey

The field survey comprised an extended Phase 1 Habitat Survey and an appraisal of the potential suitability of the habitats present to support protected and notable species and invasive species.

Two AECOM ecologists visited the Site on 17th and 25th November 2022 and carried out an extended Phase 1 Habitat Survey, including the classification of all habitats on-site and adjacent to the Site, and an assessment of the potential of the Site to support nesting birds and roosting bats as well as a check for invasive species. A further walkover of the Gravesend site on 23rd January 2023 extended the survey to cover areas that were not accessible during the November 2022 visits.

Phase 1 Habitat Survey

A Phase 1 Habitat Survey, a standard method of environmental audit, was undertaken in November 2022 in accordance with the standard survey methods (Joint Nature Conservation Committee, 2016)¹⁹. It involved categorising the different habitat types and habitat features within the survey area. The information gained from the survey was used to determine the likely ecological value of the Site, and to direct any more specific survey work, which may need to be carried out prior to the submission of a planning application. The standard Phase 1 Habitat Survey method was extended to record target notes on protected, notable and invasive species.

Where relevant ecological receptors were present, target notes were recorded and the positions of these are shown on the Phase 1 Habitat map (Figure 1 and 2 in Annex A). Typical and notable plant species were recorded, where present, for different habitat types and reflect the conditions at the time of survey. This was not intended to be a detailed inventory of the plant species present in the survey area, as this is not required for the purposes of a Phase 1 Habitat Survey.

Appraisal of Potential Suitability of Habitats to Support Protected and Notable Species

An appraisal was made of the potential suitability of the habitats present to support protected and notable species of plants or animals. Field signs, habitat features with potential suitability to support protected species and any sightings or auditory evidence were recorded when encountered, but no detailed surveys were carried out for any particular species.

A note was made of visible instances of any invasive non-native plant species listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) and the Invasive Alien Species (Enforcement and Permitting) Order (2019, as amended).

Plant Abundance (DAFOR) Results

Plant species were recorded for different habitat types and reflect the conditions at the time of the survey. Phase 1 Habitat surveys are not intended to be a detailed inventory of the plant species present on the survey area, nor is it required to possess a full list of plant species found within the red-line boundary. DAFOR stands for Dominant, Abundant, Frequent, Occasional and Rare, and is a way of measuring species abundance. The frequency of plant species present was recorded using the DAFOR Scale, and the overall values of species within habitat blocks are recorded in Annex E.

Table 15. Plant Abundance (DAFOR) Scale Designations

Abundance		Relative Cover (percentage)
D	Dominant	50-100
A	Abundant	30-50
F	Frequent	15-30
O	Occasional	5-15
R	Rare	<5

Source: *Guidance Notes for Recording DAFOR, Norfolk Wildlife Trust*

¹⁹ Joint Nature Conservation Committee (JNCC) (2016) Handbook for Phase 1 Habitat Survey – a technique for environmental audit. JNCC

Great Crested Newt Habitat Suitability Index (HSI) Assessment

Prior to undertaking the Phase 1 Habitat survey, aerial photography and 1:2500 Ordnance Survey mapping were examined to attempt to identify all ponds and other freshwater waterbodies within 250m of the Site's red line boundary. The process could not guarantee to definitively identify all ponds present but is reasonable within the limits (i.e. access to ponds and resolution of aerial photography) of available data.

Access allowing, all ponds identified by the desk study and field survey were inspected and appraised for their suitability to support great crested newts (*Triturus cristatus*). This entailed deriving a Habitat Suitability Index (HSI) for all the waterbodies based on the standard method (Oldham *et al.*, 2000)²⁰. The HSI uses ten suitability indices thought to affect great crested newt. Water bodies were scored between 0 and 1, according to the published scoring system, with zero indicating the poorest habitat and one indicating excellent great crested newt habitat as shown in Table 16. Water bodies that are brackish, or have high quantities of salt water are considered unsuitable for great crested newts due to the toxic nature of high salinity levels to amphibians. The suitability indices are listed in Annex F.

Table 16. Categories of HSI Scores

HSI Score	Water Body Suitability for GCN
<0.5	Poor
0.5-0.59	Below Average
0.6-0.69	Average
0.7-0.79	Good
>0.8	Excellent

Initial Bat Roosting Assessment

On the basis of the external assessment, the overall suitability of these trees and structures to support roosting bats was classified according to the scale outlined in the table below with the follow up survey effort requirement outlined in the following table.

Table 17. Criteria used to describe Bat Roost Suitability

Suitability Level	Type of Roost		
Habitat Suitability/Level of Risk	Summer/Transitional Roost used by non-breeding birds	Habitat Suitability/Level of Risk	Summer/Transitional Roost used by non-breeding birds
Confirmed	Presence of bats or evidence of bats. Confirmation of roost status may require further survey.		
High	Feature with multiple roosting opportunities for one or more species of bats with good connectivity to high quality foraging habitat.	Feature with multiple roosting opportunities for breeding bats (size, temperature), with close proximity and connectivity to high quality foraging habitat.	Large site that offers cool stable conditions with multiple roosting opportunities in close proximity to high quality foraging habitat.
Medium	Feature with some roosting opportunities and connectivity to moderate or high-quality foraging habitat	Feature providing some roosting opportunities with some connectivity to moderate or high-quality foraging habitat.	Medium sized feature with some roosting opportunities and some connectivity to moderate or high-quality foraging habitat.
Low	Feature with a limited number of roosting opportunities with poor connectivity to foraging habitat.	Feature with a limited number of roosting opportunities for breeding bats with low proximity and connectivity to low or moderate quality foraging habitat	Small sized feature which may be subject to disturbance or environmental variations, with a limited number of roosting opportunities and poor connectivity to foraging habitat.

²⁰ Oldham R.S., Keeble K., Sean M.J.S. & Jeffcote M. (2000). Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*). Herpetological Journal, 10(4), 143-155.

Suitability Level		Type of Roost	
Habitat Suitability/Level of Risk	Summer/Transitional Roost used by non-breeding birds	Habitat Suitability/Level of Risk	Summer/Transitional Roost used by non-breeding birds

Table 18. Survey Effort for Bat Roosts

Roost Location	Low Suitability	Moderate Suitability	High Suitability
Building	One survey visit; either a dusk emergence or dawn re-entry survey.	Two separate survey visits. One dusk emergence and a separate dawn re-entry survey.	Three separate survey visits consisting of at least one dusk emergence and a separate dawn re-entry survey, with the third visit either a dusk or dawn survey
Tree	No Survey Effort Required	Two separate survey visits. One dusk emergence and a separate dawn re-entry survey.	Three separate survey visits consisting of at least one dusk emergence and a separate dawn re-entry survey, with the third visit either a dusk or dawn survey.

Source: Adapted for Table 4.1 within the Bat Surveys for Professional Ecologists: Good Practice Guidelines (Collins, 2016)

C.3 Limitations and Assumptions

The south eastern section to the Tilbury Site was inaccessible due to the proximity of unconsolidated sands/muds within this section. The majority of this area is bare ground, and the recent disturbance and prevalence of bare ground makes it unsuitable for most species. This is not considered a constraint to the conclusions of the PEA.

Existing sub-stations at both sites were not accessible. However, these areas consist of hardstanding areas and this is not considered a constraint.

An ecological survey represents a 'snapshot' in time of the ecological condition of a site. The ecological character of a site can change substantially throughout both the course of a year, and from year to year impacting on the extent and quality of habitats potential to support protected species. As the survey was carried outside the main plant growing season for both native and invasive non-native species it is probable that some species weren't present during the time of survey. This technical note is however not a detailed inventory of plant species present and the potential oversight of some species is not a constraint for this level of survey.

None of these limitations either singly or in combination is significant enough to affect the baseline, impact assessment and resulting mitigation or enhancement referenced in this report.

Annex D Target Notes and Photographs

TN Number	Target Note
TN1	Badger Setts with camera traps mounted outside (Tilbury)
TN2	Location of Mammal Burrow (Tilbury)
TN3	Plateau with grassland and ephemeral vegetation (Tilbury)
TN4	Shed with negligible bat potential (Tilbury)
TN5	Reptile Refugia on Site (Tilbury)
TN6	Location of the strip of Marshy Grassland (Gravesend)
TN7	Location of the Shooting Range Green (Gravesend)
TN8	Line of Trees along Ditch (Gravesend)
TN9	Ditch on Tilbury Site
TN10	Ditch on Tilbury Site
TN11	Ditch on Tilbury Site
TN12	Gravel Pit on Tilbury Site
TN13	Ditch on Gravesend Site
TN14	High Potential Bat Roost Tree



Photograph 1 – Western Block of Grassland and Scrub at Tilbury Site



Photograph 2 – Grassland and Scrub on the Southern Edge of the Tilbury Site



Photograph 3 – Hardstanding at Tilbury Site



Photograph 4 – Building with low bat suitability at Tilbury



Photograph 5 – Grassland and Short Ephemeral habitat on Tilbury Plateau



Photograph 6 – Scrub and grassland habitat on the banks of the Tilbury Plateau



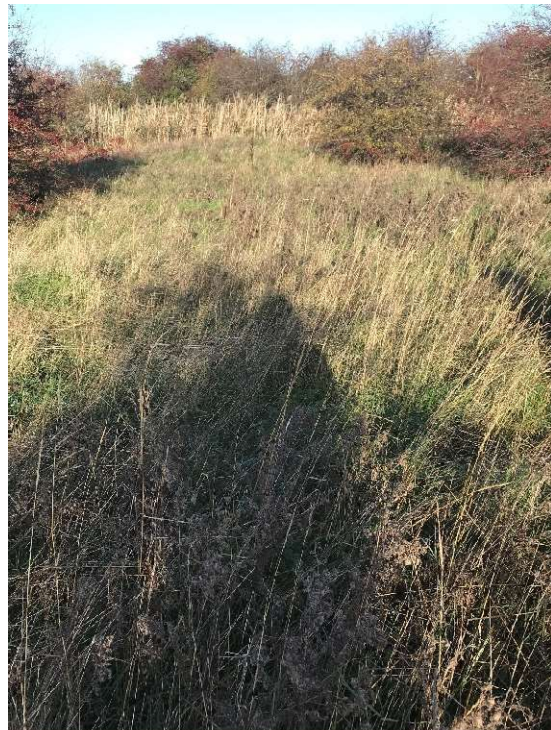
Photograph 7 – Shooting Range Amenity Grassland at Gravesend Site



Photograph 8 – Semi Improved Grassland Bare Ground at the Gravesend Site



Photograph 9 – Strip of Marshy Grassland at Gravesend Site



Photograph 10 - Scrub at Gravesend Site



Photograph 11 – Large Ditch at the western edge of the Tilbury Site



Photograph 12 – Gravel Pit Lake at Tilbury Site



Photograph 13 – Grassland and shipping container on Site



Photograph 14 – High Potential Bat Roost Tree

Annex E DAFOR Results

E.1 Tilbury Site

Bare Ground

Common Name	Latin Name	Frequency
Broad Leaved Dock	<i>Rumex obtusifolius</i>	Rare
Hawkbit	<i>Leontodon</i> species	Rare
Mugwort	<i>Artemisia vulgaris</i>	Occasional
Scentless Mayweed	<i>Tripleurospermum inodorum</i>	Rare
Sea Beet	<i>Beta vulgaris</i>	Rare

Introduced Shrub

Common Name	Latin Name	Frequency
Bramble	<i>Rubus fruticosus</i> aggregate	Occasional
Buddleia	<i>Buddleja davidii</i>	Abundant
Prickly Lettuce	<i>Lactuca serriola</i>	Rare
Ragwort	<i>Jacobaea vulgaris</i>	Rare
Red Fescue	<i>Festuca rubra</i>	Rare
Southern Reed	<i>Phragmites australis</i>	Occasional
Willow	<i>Salix</i> species	Frequent

Scrub

Common Name	Species		Location		
	Latin Name	Scrub I	Scrub II	Scrub III	
Blackthorn	<i>Prunus spinosa</i>	Occasional	Frequent	-	
Bramble	<i>Rubus fruticosus</i> aggregate	Dominant	Dominant	Dominant	
Broad Leaved Dock	<i>Rumex obtusifolius</i>	-	-	Rare	
Buddleia	<i>Buddleja davidii</i>	-	-	Rare	
Burnet Rose	<i>Rosa pimpinellifolia</i>	-	Rare	-	
Cleavers	<i>Galium aparine</i>	Occasional	-	-	
Dogwood	<i>Coronus sanguinea</i>	-	-	Occasional	
Dog Rose	<i>Rosa canina</i>	-	-	Occasional	
Elder	<i>Sambucus nigra</i>	-	-	Rare	
Fennel	<i>Foeniculum vulgare</i>	Occasional	-	Occasional	
Hawkbit	<i>Leontodon</i> species	-	-	Rare	
Hawthorn	<i>Crataegus monogyna</i>	-	Occasional	Occasional	
Hogweed	<i>Heracleum spondylium</i>	Occasional	-	-	
Mugwort	<i>Artemisia vulgaris</i>	Frequent	-	Occasional	
Scotch Broom	<i>Cytisus scoparius</i>	-	-	Rare	
Teasel	<i>Dipsacus fullonum</i>	-	Rare	-	
Traveller's Joy	<i>Clematis vitalba</i>	Occasional	-	-	
Willow	<i>Salix</i> species	-	Occasional	Rare	

Short Ephemeral

Common Name	Latin Name	Frequency
Annual Mercury	<i>Mercurialis annua</i>	Rare
Bramble	<i>Rubus fruticosus</i> aggregate	Rare
Broad Leaved Dock	<i>Rumex obtusifolius</i>	Occasional
Dandelion	<i>Taraxacum officinale</i>	Occasional
Dog Rose	<i>Rosa canina</i>	Rare
Dwarf Mallow	<i>Malva neglecta</i>	Rare
Mullein	<i>Verbascum thapsus</i>	Rare
Narrow Leaved Ragwort	<i>Senecio inaequidens</i>	Occasional
Pampas Grass	<i>Cortaderia selloana</i>	Rare
Scentless Mayweed	<i>Tripleurospermum inodorum</i>	Frequent
Teasel	<i>Dipsacus fullonum</i>	Rare

Semi Improved Grassland

Species		Location		
Common Name	Latin Name	Grassland I	Grassland II	Grassland – Plateau
Apple	<i>Malus domestica</i>	Rare	-	-
Bramble	<i>Rubus fruticosus</i> aggregate	-	-	Rare
Beech	<i>Fagus sylvatica</i>	-	Rare	-
Bristly Oxtongue	<i>Helminthotheca echioides</i>	Occasional	-	-
Broad Leaved Dock	<i>Rumex obtusifolius</i>	-	Occasional	-
Cherry	<i>Prunus avium</i>	Rare	-	-
Chicory	<i>Cichorium intybus</i>	Rare	Rare	-
Cleavers	<i>Galium aparine</i>	-	-	Occasional
Cocks Foot	<i>Dactylis glomerata</i>	Abundant	Frequent	Dominant
Common Nettle	<i>Urtica dioica</i>	Occasional	Occasional	
Cow Parsley	<i>Anthriscus sylvestris</i>	Frequent	-	-
Creeping Thistle	<i>Cirsium arvense</i>	Occasional	-	-
Dandelion	<i>Taraxacum officinale</i>	-	-	-
English Ivy	<i>Hedera helix</i>	-	Rare	-
Everlasting Pea	<i>Lathyrus latifolius</i>	Rare	-	-
False Oat Grass	<i>Arrhenatherum elatius</i>	Abundant	-	Abundant
Fennel	<i>Foeniculum vulgare</i>	Occasional	-	Occasional
Garlic Mustard	<i>Alliaria petiolate</i>	Rare	-	-
Hawkbait	<i>Leontodon</i> species	Occasional	Occasional	Frequent
Hawthorn	<i>Crataegus monogyna</i>	Rare	-	-
Hogweed	<i>Heracleum spondylium</i>	Occasional	-	-
Horse Radish	<i>Armoracia rusticana</i>	Rare	-	-
Narrow Leaved Ragwort	<i>Senecio inaequidens</i>	Rare	-	Occasional
Red Clover	<i>Trifolium pratense</i>	-	Frequent	Occasional

Species		Location		
Common Name	Latin Name	Grassland I	Grassland II	Grassland – Plateau
Red Fescue	<i>Festuca rubra</i>	Frequent	Abundant	Abundant
Ribwort Plantain	<i>Plantago lanceolata</i>	Occasional	-	-
Scentless Mayweed	<i>Tripleurospermum inodorum</i>	Frequent	-	-
Scotch Broom	<i>Cytisus scoparius</i>	-	-	Rare
Shining Cranesbill	<i>Geranium lucidum</i>	-	-	Occasional
Teasel	<i>Dipsacus fullonum</i>	-	Rare	-
Tufted Vetch	<i>Vicia caracca</i>	-	Occasional	Occasional
White Dead Nettle	<i>Lamium alba</i>	-	Rare	-
Willow	<i>Salix</i> species	Rare	Rare	Rare
Yarrow	<i>Achillea millefolium</i>	Occasional	Rare	-

E.2 Gravesend Site

Amenity Grassland

Common Name	Latin Name	Frequency
Creeping Cinquefoil	<i>Potentilla reptans</i>	Occasional
Dandelion	<i>Taraxacum officinale</i>	Rare
Perennial Rye Grass	<i>Lolium perenne</i>	Dominant
Red Fescue	<i>Festuca rubra</i>	Rare
Yarrow	<i>Achillea millefolium</i>	Rare

Bare Ground

Common Name	Latin Name	Frequency
Bristly Oxtongue	<i>Helminthotheca echioides</i>	Occasional
Canadian Fleabane	<i>Conzys canadensis</i>	Rare
Creeping Cinquefoil	<i>Potentilla reptans</i>	Occasional
Dandelion	<i>Taraxacum officinale</i>	Occasional
Hawkbit	<i>Leontodon</i> species	Rare
Perennial Rye Grass	<i>Lolium perenne</i>	Occasional
Red Fescue	<i>Festuca rubra</i>	Rare
Ribwort Plantain	<i>Plantago lanceolata</i>	Rare

Line of Trees

Common Name	Latin Name	Frequency
Apple	<i>Malus domestica</i>	Rare
Blackthorn	<i>Prunus spinosa</i>	Frequent
Broad Leaved Dock	<i>Rumex obtusifolius</i>	Rare
Dog Rose	<i>Rosa canina</i>	Occasional
Hawkbit	<i>Leontodon</i> species	Occasional

Common Name	Latin Name	Frequency
Hawthorn	<i>Crataegus monogyna</i>	Abundant
Mugwort	<i>Artemisia vulgaris</i>	Rare
Reed Mace	<i>Typha angustifolium</i>	Rare
Red Fescue	<i>Festuca rubra</i>	Rare
Southern Reed	<i>Phragmites australis</i>	Occasional
Willow	<i>Salix</i> species	Frequent

Marshy Grassland

Common Name	Latin Name	Frequency
Bramble	<i>Rubus fruticosus</i> aggregate	Rare
Dog Rose	<i>Rosa canina</i>	Rare
Hawthorn	<i>Crataegus monogyna</i>	Rare
Southern Reed	<i>Phragmites australis</i>	Dominant
Willow	<i>Salix</i> species	Occasional

Scattered Scrub

Common Name	Latin Name	Frequency
Bramble	<i>Rubus fruticosus</i> aggregate	Dominant
Colts Foot	<i>Tussilago farfara</i>	Rare
Dog Rose	<i>Rosa canina</i>	Occasional
Elder	<i>Sambucus nigra</i>	Rare
Hawthorn	<i>Crataegus monogyna</i>	Occasional
Red Fescue	<i>Festuca rubra</i>	Occasional
Southern Reed	<i>Phragmites australis</i>	Rare
Yarrow	<i>Achillea millefolium</i>	Rare

Semi Improved Grassland

Common Name	Latin Name	Frequency
Alexanders	<i>Smyrnium olusatrum</i>	Occasional
Bristly Oxtongue	<i>Helminthotheca echioides</i>	Occasional
Broad Leaved Dock	<i>Rumex obtusifolius</i>	Occasional
Canadian Fleabane	<i>Conyza canadensis</i>	Rare
Cleavers	<i>Galium aparine</i>	Rare
Cocks Foot	<i>Dactylis glomerata</i>	Frequent
Cherry	<i>Prunus avium</i>	Rare
Common Nettle	<i>Urtica dioica</i>	Occasional
Cow Parsley	<i>Anthriscus sylvestris</i>	Occasional
Creeping Cinquefoil	<i>Potentilla reptans</i>	Occasional
Dog Rose	<i>Rosa canina</i>	Occasional
False Oat Grass	<i>Arrhenatherum elatius</i>	Frequent
Elder	<i>Sambucus nigra</i>	Rare

Common Name	Latin Name	Frequency
Hawkbitt	<i>Leontodon species</i>	Occasional
Hawthorn	<i>Crataegus monogyna</i>	Occasional
Herb Robert	<i>Geranium robertianum</i>	Rare
Hogweed	<i>Heracleum spondylium</i>	Rare
Marsh Thistle	<i>Cirsium pratense</i>	Occasional
Mugwort	<i>Artemisia vulgaris</i>	Frequent
Ragwort	<i>Jacobaea vulgaris</i>	Rare
Red Fescue	<i>Festuca rubra</i>	Dominant
Southern Reed	<i>Phragmites australis</i>	Rare
Yarrow	<i>Achillea millefolium</i>	Occasional

Annex F Habitat Suitability Index Assessment Results

Table 19. Great Crested Newt Habitat Suitability Indices and Description

Suitability Indices	Suitability Index Title	Suitability Index Description
1	Geographic Location	Different areas of the UK represent different indices scores
2	Water Body Area	The optimum water body size is between 500 and 750m ² .
3	Water Permeance	The optimal frequency of drying is one year a decade
4	Water Quality	The presence of indicator organisms (that same that are used to assess running water) is the water quality indicator.
5	Water Body Shading	Great crested newt occurrence is significantly reduced above a threshold of 75% shade.
6	Impact of Waterfowl	Waterfowl impact on water body vegetation, water turbidity and are predators of newts.
7	Occurrence of Fish	The effect if fish presence is related to the species, Some species can have negative impacts and newts hardly ever coexist with larger predatory fish species. Other species (depending on conditions) are not detrimental.
8	Waterbody Density	In general; scrub, unimproved grassland, woodland and gardens are regarded as being suitable terrestrial habitat, unlike arable fields, improved pasture and hard standing. The SI9 is the combination between positive factors (suitable habitat) and negative factors (e.g. inherent barriers to movement such as roads). The surrounding habitat is scored according to the extent of high-quality terrestrial newt habitat.
9	Terrestrial Habitat	The highest occurrence of great crested newt is found in water bodies with emergent vegetation cover between 25% and 50% and submerged vegetation between 50% and 75%
10	Macrophytes	

The resulting HSI for the water bodies were calculated using the geometric mean of the ten suitability indices;

$$HSI = SI_1 \times SI_2 \times SI_3 \times SI_4 \times SI_5 \times SI_6 \times SI_7 \times SI_8 \times SI_9 \times SI_{10})^{1/10}$$

Water bodies were scored between 0 and 1, according to the published scoring system, with zero indicating the poorest habitat and one indicating excellent great crested newt habitat.

Table 20. GCN HSI Assessment Results

HSI Assessment Category	Ditch I		Ditch II	
	Description	Value	Description	Value
S1 – Geographic Location	Geographic Location A (South and South East)	1	Geographic Location A (South and South East)	1
S2 – Pond Area	622m ²	1	1563m ²	0.87
S3 – Pond Permanence	Never Dries	0.9	Rarely Dries	1
S4 – Water Quality	Moderate	0.67	Moderate	0.6
S5 – Shade	60% Shade from Trees	1	0% Shade on Waterbody	1
S6 – Waterfowl	Minor waterfowl presence on the ditch surface	0.67	Minor waterfowl presence on the ditch surface	0.67
S7 – Fish	Fish likely to be present within the ditch on Site	0.67	Fish likely to be present within the ditch on Site	0.67
S8 – Number of Ponds within 1km	Over 10 water bodies in close proximity	1	Over 10 water bodies in close proximity	1

HSI Assessment Category	Ditch I		Ditch II	
	Description	Value	Description	Value
S9 – Terrestrial Habitat	Good surrounding terrestrial habitat	1	Moderate surrounding terrestrial habitat	0.67
S10 – Macrophyte Cover	0-5% Cover	0.3	0-5% Cover	0.3
Overall HSI Score		0.78		0.74
Pond Habitat Suitability Category		Good		Good

HSI Assessment Category	Ditch III		Ditch IV	
	Description	Value	Description	Value
S1 – Geographic Location	Geographic Location A (South and South East)	1	Geographic Location A (South and South East)	1
S2 – Pond Area	1084m ²	0.95	711m ²	1
S3 – Pond Permanence	Rarely Dries	1	Rarely Dries	1
S4 – Water Quality	Moderate	0.67	Moderate	0.67
S5 – Shade	0% Shade on waterbodies	1	60% Shade from Trees	1
S6 – Waterfowl	Minor waterfowl presence on the ditch surface	0.67	Minor waterfowl presence on the lake surface	0.67
S7 – Fish	Fish likely to be present within the ditch on Site	0.67	Fish likely to be present within the lake on Site	0.67
S8 – Number of Ponds within 1km	Over 10 water bodies in close proximity	1	Over 10 water bodies in close proximity	1
S9 – Terrestrial Habitat	Moderate surrounding terrestrial habitat	0.67	Moderate surrounding terrestrial habitat	0.67
S10 – Macrophyte Cover	0-5% Cover	0.3	0-5% Cover	0.3
Overall HSI Score		0.75		0.76
Pond Habitat Suitability Category		Good		Good

HSI Assessment Category	Gravel Lake	
	Description	Value
S1 – Geographic Location	Geographic Location A (South and South East)	1
S2 – Pond Area	6610m ²	Over 2000 ² m in area, so omitted from calculation
S3 – Pond Permanence	Never Dries	0.9
S4 – Water Quality	Moderate	0.67
S5 – Shade	10-20% Shade from Trees	1
S6 – Waterfowl	Major waterfowl presence on the ditch surface	0.01
S7 – Fish	Fish likely to be present within the lake on Site	0.67

HSI Assessment Category		Gravel Lake	
	Description	Value	
S8 – Number of Ponds within 1km	Over 10 water bodies in close proximity	1	
S9 – Terrestrial Habitat	Poor surrounding terrestrial habitat	0.33	
S10 – Macrophyte Cover	0-5% Cover	0.3	
Overall HSI Score		0.46	
Pond Habitat Suitability Category		Poor	

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Appendix D – Historic Environment Desk Based Assessment

TKRE Cable Tunnel Replacement Project

Appendix D - Historic Environment Desk Based Assessment

nationalgrid

National Grid Electricity Transmission

June 2023

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National Grid

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1 Introduction

1.1 Background

- 1.1.1 AECOM Ltd (hereafter referred to as AECOM) was commissioned by National Grid to produce a Historic Environment Desk-based Assessment (DBA), to support the Environmental Screening Report for the TKRE Cable Tunnel Replacement Project (hereafter referred to as 'the Proposed Development'). The Proposed Development relates to the replacement of the below ground cabled section of the TKRE 400 kV circuits with the construction of new bored tunnel under the River Thames to carry new XLPE cables, together with new associated infrastructure either side of the Thames comprising:
- Two tunnel shafts one each side of the Thames measuring approximately 15m in diameter and 50m deep;
 - Two new tunnel headhouses to cover the tunnel shaft and house monitoring and ventilation equipment;
 - Two new Sealing End Compounds (SECs) which will house the connection between the overhead lines and underground cable; and
 - Overhead line re-stringing to connect the overhead lines to the new SECs.
- 1.1.2 Each required headhouse and SEC would fall within the jurisdiction of Thurrock Council (north of the River Thames) and Gravesham Borough Council (south of the River Thames).
- 1.1.3 This Historic Environment DBA has been prepared to determine the heritage baseline (archaeology, historic buildings and historic landscapes) placing each of the two sites within their wider historic environment context to inform the assessment of significance of the heritage resource and the impact of the Proposed Development on identified heritage assets and their settings.

1.2 Scope and Structure

- 1.2.1 This Historic Environment DBA has been prepared to support the Environmental Screening Report for the Proposed Development by establishing the heritage baseline and archaeological and historical background of the two new headhouse and SEC compound sites and surrounding study areas. It assesses the potential for previously unrecorded buried archaeological remains to exist within the Site and provides an assessment of the significance of the designated and non-designated historic environment resource with the potential to be affected by development. It concludes with an assessment of potential impacts of the Proposed Development on the historic environment resource and any anticipated constraints.
- 1.2.2 The Site is defined as the extent of the EIA screening boundary. To the north at Tilbury this is comprised of the location of the proposed headhouse, tunnel shaft, Sealing End Compound (SEC), laydown areas, as well as access road and parking area to the north of the existing headhouse. To the south at Gravesend this is comprised of the location of the proposed headhouse, tunnel shaft, Sealing End Compound (SEC), laydown areas and access road to the south of the existing Eastcourt Marshes Electricity Substation. Between the Tilbury and Gravesend, a connecting tunnel is proposed to be bored under the River Thames to connect the two proposed headhouse with 400kV circuits.

- 1.2.3 The desk-based assessment is structured in seven sections, with illustrations and appendices at the end:
- Section 2 provides a summary of relevant national legislation and local planning guidance. This section also includes an overview of Historic England policy and guidance;
 - Sections 3 sets out the methodology for the determination of the study area, the baseline and the assessment of the heritage potential and significance (Assessment Methodology);
 - Section 4 provides a description of the historical and archaeological background of the Site and study area and the designated and non-designated assets identified (Heritage Baseline);
 - Section 5 presents the assessment of the known and potential archaeological assets within the Site which have the potential to be impacted by the Proposed Development;
 - Section 6 presents the results of a preliminary assessment of the potential impacts of the Proposed Development on the known and unknown heritage resources; and
 - Section 7 summarises the conclusions and recommendations of the assessment.

1.3 Proposed Development Location

- 1.3.1 The Proposed Development is located to the east of Tilbury and Gravesend which occupy both the north and south banks of the River Thames (Figure 1). On the north side, the Proposed Development is located to the northeast of the now demolished Tilbury Power Station with the construction of the northern headhouse and SEC compound east of Tilbury, Essex (centred NGR 566295 175834).
- 1.3.2 The proposed cable tunnel alignment proceeds on a northwest southeast orientation south to the Eastcourt Marshes Electricity Substation where the southern headhouse and SEC compound will be constructed, which lies at the eastern extent of Gravesend, Kent (centred NGR 567429 174097).
- 1.3.3 The cable tunnel beneath the River Thames is 2.14km long (headhouse to headhouse) and 5m in diameter and will surface at the two proposed headhouses.
- 1.3.4 The Proposed Development, north of River Thames, is 1km southeast of Tilbury, and is set within an industrial landscape to the north (Plate 7), west and south boundaries, and tidal marsh to the east that has seen intermittent mineral extraction and waste material depositing. The site lies approximately 170m north of the Thames' northern bank.
- 1.3.5 The Proposed Development, south of the River Thames, is 800m east of Gravesend and is set within coastal marshland to the east that has been developed into the Milton Rifle Range (Plates 9 and 10), industrial buildings and Metropolitan Police Specialist Training Facility to the west and enclosed agricultural fields to the south, with the site bounded by the Thames and Medway Canal on its southern extent. The site lies approximately 30m south of the Thames' southern bank.

2 Planning Framework

2.1 National Legislation

Ancient Monuments and Archaeological Areas Act 1979

- 2.1.1 The Ancient Monuments and Archaeological Areas Act (1979) ('the Act') is the central piece of legislation for the protection of the archaeological resource. The first section of the Act requires the Secretary of State for National Heritage to maintain a schedule of nationally important sites. For the purpose of the Act, a monument is defined as:

"a) any building, structure or work, whether above or below the surface of the land, and any cave or excavation;

b) any site comprising the remains of any such building, structure or work or of any cave or excavation; and

c) any site comprising, or comprising the remains of, any vehicle, vessel, aircraft or other moveable structure or part thereof which neither constitutes nor forms part of any work which is a monument as defined within paragraph a) above; d) and any machinery attached to a monument shall be regarded as part of the monument if it could not be detached without being dismantled' (Section 61 (7))."

- 2.1.2 The Act further defines an ancient monument as: *"any Scheduled Monument; and any other monument which in the opinion of the Secretary of State is of public interest by reason of the historic, architectural, traditional, artistic or archaeological interest attaching to it" (Section 61 (12))."*

- 2.1.3 A set of criteria, defined as survival/condition, period, rarity, fragility/vulnerability, diversity, documentation, group value and potential, assist in the decision-making process as to whether an asset is deemed of national importance and best managed by scheduling.

The Planning (Listed Buildings and Conservations Areas Act) 1990

- 2.1.4 The Act sets out the principal statutory provisions which must be considered in the determination of any application affecting either listed buildings or conservation areas.
- 2.1.5 Section 66 of the Act states that in considering whether to grant planning permission for development which affects a listed building or its setting, the local planning authority or, as the case may be, the Secretary of State shall have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses.
- 2.1.6 Section 72 of the Act establishes that special attention be paid to the desirability of preserving or enhancing the character or appearance of a Conservation Area.

2.2 National Planning Policy

National Planning Policy Framework 2021

- 2.2.1 The National Planning Policy Framework (NPPF; Ministry of Housing, Communities and Local Government. 2021) sets out the Government's planning policies for England and how these should be applied to contribute to the achievement of sustainable development.
- 2.2.2 Section 16 of the NPPF deals specifically with the historic environment. Where changes are proposed, the NPPF sets out a clear framework to ensure that heritage assets are conserved, and where appropriate enhanced, in a manner that is consistent with their significance.

- 2.2.3 The NPPF sets out the importance of being able to assess the significance of heritage assets that may be affected by a development. Significance is defined in Annex 2 of the NPPF as being the “value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic”. Significance is not only derived from an asset's physical presence, but also from its setting. The setting of a heritage asset is defined in Annex 2 as “the surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve”.
- 2.2.4 Paragraph 194 of the NPPF states that in determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the asset's importance and no more than is sufficient to understand the potential impact of the proposal on their significance. Similarly, paragraph 195 includes a requirement on local planning authorities, having assessed the particular significance of any heritage asset that may be affected by a proposal, to take this into account when considering the impact of a proposal on a heritage asset.
- 2.2.5 In determining planning applications, local planning authorities should take account of the following points:
- The desirability of sustaining and enhancing the significance of heritage assets and putting them to viable uses consistent with their conservation;
 - The positive contribution that conservation of heritage assets can make to sustainable communities including their economic vitality; and
 - The desirability of new development making a positive contribution to local character and distinctiveness.
- 2.2.6 Paragraphs 199 to 203 of the NPPF introduce the concept that heritage assets can be harmed or lost through alteration, destruction or development within their setting. This harm ranges from less than substantial through to substantial. With regard to designated assets, paragraph 199 states that great weight should be placed on its conservation, irrespective of whether any potential harm is considered to be substantial or less than substantial. The paragraph goes further to say that the more important the asset, the greater the weight should be on its conservation. In paragraph 200, a distinction is made in respect of those assets of the highest significance (e.g., scheduled monuments, Grade I and Grade II* listed buildings) where substantial harm to or loss should be wholly exceptional.
- 2.2.7 Paragraph 201 states that in instances where development would cause substantial harm to or total loss of significance of a designated asset, consent should be refused unless it can be demonstrated that it is necessary to achieve substantial public benefits that outweigh that harm or loss. Paragraph 202 says in instances where development would cause less than substantial harm to the significance of a designated asset, the harm should be weighed against the public benefits of the proposal to provide a balanced judgement.
- 2.2.8 With regard to non-designated assets, paragraph 203 states that the effect of the application on the significance of the asset should be considered in determining the application. A balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset.

National Planning Policy Framework 2021

- 2.2.9 The Planning Practice Guidance (PPG) (Ministry of Housing, Communities and Local Government, 2019) provides further advice and guidance that expands the policy outlined in the NPPF. It expands on terms such as ‘significance’ and its importance in decision making. The PPG clarifies that being able to properly assess the nature, extent and the importance of the significance of the heritage asset and the contribution of its setting, is very important to understanding the potential impact and acceptability of development proposals (paragraph 008 Reference ID: 18a-008-20190723).

- 2.2.10 The PPG states that in relation to setting, a thorough assessment of the impact on setting needs to take in to account, and be proportionate to, the significance of the heritage asset under consideration and the degree to which proposed changes enhance or detract from that significance and the ability to appreciate it (paragraph 009 Reference ID: 18a-009-20190723). The setting of the heritage asset is also of importance and a thorough assessment of the impact on setting needs to take into account, and be proportionate to, the significance of the heritage asset under consideration and the degree to which the proposed changes enhance or detract from that significance and the ability to appreciate it. The extent and importance of setting is often expressed by reference to visual considerations. Although views of or from an asset will play an important part, the way in which an asset is experienced in its setting is also influenced by other environmental factors such as noise, dust and vibration from other land uses in the vicinity, and by our understanding of the historic relationship between places.
- 2.2.11 Paragraph 013 of the PPG recognises that the contribution that setting makes to the significance of the heritage asset does not depend on there being public right or the ability to experience that setting. When assessing any application for development which may affect the setting of a heritage asset, local planning authorities may need to consider the implications of cumulative change (Paragraph: 013 Reference ID: 18a-013-20190723 Revision date: 23 07 2019).
- 2.2.12 The PPG discusses how to assess if there is substantial harm. It states that what matters in assessing if a proposal causes substantial harm is the impact on the significance of the asset. It is the degree of harm to the asset's significance rather than the scale of the development that is to be assessed (paragraph 017). Generally, harm to heritage assets can be avoided or minimised if proposals are based on a clear understanding of the heritage asset and its setting (paragraph 008 Reference ID: 18a-008-20190723). The NPPF indicates that the degree of harm should be considered alongside any public benefits that can be delivered by development. The PPG states that these benefits should flow from the Proposed Scheme and should be of a nature and scale to be of benefit to the public and not just a private benefit and would include securing the optimum viable use of an asset in support of its long-term conservation (paragraph 020 Reference ID: 18a-020-20190723).

Overarching National Policy Statement for Energy (EN-1)

- 2.2.13 The EN-1 policy statement sets out the national policy for energy infrastructure. It details the need for new significantly electricity and gas infrastructure projects, details assessment principles and also the impacts forthcoming proposals will have on the environment. The Historic Environment is detailed within Section 5.8, detailing the description of both designated and non-designated heritage assets (sections 5.8.2-4); describing the need for appropriate Desk Based Assessments in the event of potential heritage asset impact (sections 5.8.9-10); a consideration of impacts of proposed developments on heritage assets (section 5.8.12) with the presumption in favour of conservation (section 5.8.14) of assets as well as their setting (sections 5.8.18-19). Preservation of heritage assets through excavation and written record when impact/change is unavoidable is detailed in sections 5.8.19-22.
- 2.2.14 The EN-5 policy statement taken together with the Overarching National Policy National Policy Statement for Energy (EN-1) sets out the national policy for decisions taken by the Infrastructure Planning Commission (IPC) on applications for electricity networks infrastructure (section 1.8). The policy refers to Section 9 of the Electricity Act 1989, where it states that applicants have a duty in formulating proposals for new electricity networks infrastructure. These proposals must take into consideration the historic environment when creating proposals, and to reasonably preserve or mitigate any effect on sites, buildings and objects of architectural, historic or archaeological interest (section 2.2.6).

2.3 Local Planning Policy

- 2.3.1 The Proposed Development lies within the administrative areas of Thurrock Council and Gravesham Borough Council.

The Thurrock Local Plan

- 2.3.2 The Thurrock Local Development Framework (Thurrock Council 2015) was adopted in January 2015 to replace the Thurrock Local Plan 1997. It recognises the significant role the historic environment plays in creating a sense of place and allows links to the historic development of Thurrock, as well as the important cultural and economic roles heritage can provide for the borough. It seeks to prevent loss of the historic environment, protect and achieve broader benefits of the historic environment in the borough (Thurrock Council 2015).

- 2.3.3 Core Strategic Spatial Policies (CSSP) provide a framework to facilitate the spatial distribution, locations, allocations and key strategic schemes through Thurrock and form the overarching framework for policies within them. Core Thematic Policies (CSTP) provide a framework for important themes or topics, and seek to set out how the Council intends to provide protection and advice.

- 2.3.4 CSTP24 outlines the historic environment of Thurrock and the importance of preserving and/or enhancing assets within Thurrock for the benefit of the community and other stakeholders. The key aspects of CSTP24 are as follows:

- Part 1 - Protecting and Enhancing Heritage Assets I: The Council will preserve or enhance the historic environment by:
 - Promoting the importance of the heritage assets, including their fabric and their settings;
 - Encouraging the appropriate use of heritage assets and their settings;
 - Supporting increased public access to historic assets, including military and industrial heritage;
 - Reviewing the designation of local heritage assets, including considering the designation of new Conservation Areas;
 - Retaining non-designated heritage assets which are considered locally important as well as those with statutory protection; and
 - Encouraging proposals that include enhancement of surrounding landscapes and integration between priority heritage assets and the Greengrid.
- Part 2 - Proposed Development: All development proposals will be required to consider and appraise development options and demonstrate that the final proposal is the most appropriate for the heritage asset and its setting, in accordance with:
 - The objectives in part 1 above;
 - The requirements of PMD 4 Historic Environment;
 - Conservation Area Character Appraisals and Management Proposals as appropriate; and
 - Relevant national and regional guidance.
- Part 3 - Priorities for Heritage Regeneration and Enhancement: The Council will work collaboratively with owners and partners to encourage the appropriate regeneration and use of priority heritage assets to secure their long-term future. The Council will identify priority heritage assets from:
 - English Heritage's national Heritage at Risk Register;
 - The Thurrock Heritage at Risk Register, which will be reviewed annually;

- The Conservation Area Management Proposals, which will be reviewed at least every five years;
- A local list of heritage assets once produced; and
- The Historic Environment Record.
- Part 4 - Of priority heritage assets already identified, the Council will:
 - Ensure that the setting of Tilbury Fort, including views of it from the river, are appropriately protected and enhanced, and that encroachment on the open land around it is not permitted;
 - Ensure that the setting of Coalhouse Fort is appropriately protected from development and that its fabric is conserved;
 - Resist development that undermines an understanding of the role the river Thames has played in the historic development of Thurrock;
 - Promote public access between Tilbury Fort and Coalhouse Fort through riverside links;
 - Ensure that any new development close to, or within, Bata Village or the Bata Factory complex is well designed and contributes positively to their settings; and
 - Ensure that Thurrock's historic landscapes, and the contribution made to them by ancient woodland, hedgerows and trees, are appropriately considered in all development.

The Gravesham Local Plan

- 2.3.5 The Gravesham Local Plan 2011 to 2028 (Gravesham Borough Council 2014) was adopted in 2014 to replace the Gravesham Local Plan First Review 1994. It recognises the significant role the historic environment plays in providing a sense of community identity and local distinctiveness, and seeks to employ a positive approach to historic environment to ensure the historic character and distinctiveness of the Borough is conserved and enhances (Gravesham Borough Council 2014).
- 2.3.6 Core Strategy (CS) provide a framework for Spatial and Thematic policies to facilitate the form and pattern of development necessary to ensure the vision is fully realised by 2028. Policy CS20 refers to Heritage and the Historic Environment: *Ensure that the Borough's current needs and aspirations are met whilst enabling future generations to benefit from, interpret and enjoy this irreplaceable legacy. Furthermore, it outlines the heritage assets cultural, architectural and historic importance, these assets have the potential to act as a significant draw for inward investment and heritage led regeneration. This is both through the enhancement of their settings and the creation of a more interesting and attractive place to live, work and visit.*
- 2.3.7 CS20 states the following for any development within the borough that has the potential to impact on Heritage and the Historic Environment: *"The Council will expect any proposals for development to demonstrate a thorough understanding of the heritage significance of any affected assets, their context and setting. Proposals should have regard to any relevant conservation area appraisals and associated management plans, lists of buildings of national and local architectural or heritage interest and guidance relating to areas of archaeological interest adopted by the Council".*
- 2.3.8 CS20 also seeks to support proposals and initiatives that seek to preserve and where applicable enhance the significance of heritage assets within the Borough, their setting and significance.

2.4 Other Policy Guidance

Historic England Guidance

- 2.4.1 Historic England has published a series of Good Practice Advice (GPA) notes of which those of most relevance to this appraisal are:
- GPA2 - Managing Significance in Decision-taking (March 2015);

- GPA3 - The Setting of Heritage Assets (2nd Edition) (December 2017); and
- Advice Note 12, Statements of Heritage Significance (October 2019).

- 2.4.2 GPA2 (Historic England 2015a) emphasises the importance of having a knowledge and understanding of the significance of heritage assets likely to be affected by the development and that the “first step for all applicants is to understand the significance of any affected heritage asset and, if relevant the contribution of its setting to its significance” (paragraph 4). Early knowledge of this information is also useful to a local planning authority in pre-application engagement with an applicant and ultimately in decision making (paragraph 7).
- 2.4.3 GPA3 (Historic England 2017) provides advice on the setting of heritage assets. Setting is as defined in the NPPF and comprises the surroundings in which a heritage asset is experienced. Elements of a setting can make positive or negative contributions to the significance of an asset and affect the ways in which it is experienced. Historic England state that setting does not have a boundary and what comprises an asset’s setting may change as the asset and its surrounding evolve. Setting can be extensive and particularly in urban areas or extensive landscapes can overlap with other assets. The contribution of setting to the significance of an asset is often expressed by reference to views and the GPA in paragraph 11 identifies those views such as those that were designed or those that were intended, that contribute to understanding the significance of assets.
- 2.4.4 Advice Note 12 (Historic England 2019a) outlines a recommended approach to assessing the significance of heritage assets in line with the requirements of NPPF. It includes a suggested reporting structure for a ‘Statement of Heritage Significance’, as well as guidance on creating a statement that is proportionate to the asset’s significance and the potential degree of impact of a proposed development. The Advice Note also offers an interpretation of the various forms of heritage interest that an asset can possess, based on the terms provided in the NPPF Glossary (Annex 2: Glossary); namely archaeological, architectural, artistic, and historic.

HEMA Principles of Cultural Heritage Impact Assessment in the UK

- 2.4.5 *Principles of Cultural Heritage Impact Assessment* (ClfA, IHBC & IEMA 2021) provides guidance on understanding cultural heritage assets and evaluating the consequences of change.
- 2.4.6 Understanding cultural heritage assets is split into three stages: Description, Significance and Importance. The description arrives at a factual statement that establishes the nature of the asset. The heritage values of the asset are then analysed (the guidance stresses that these include but are not limited to aesthetic, historic, scientific, social or spiritual values) and a statement of cultural significance given. Finally, the importance of the asset is assessed, and a conclusion drawn as to the level of protection that the asset merits in planning policy and cultural heritage legislation. The guidance notes that unlike cultural significance importance is scaled and can be described as high, medium or low.
- 2.4.7 The process of evaluating the consequences of change is split into three stages: Understanding change, assessing impact and weighting the effect. All aspects of a proposal that could change a cultural heritage asset or its setting are first explained. If these changes affect the cultural significance of the asset the resulting impact, which could be positive or negative, and its magnitude is then assessed. The effect is a combination of the magnitude of the impact and the cultural heritage asset’s importance, and the scale of the effect will determine by how much the issue should influence the design of the proposal and whether the proposal is acceptable and will be permitted.

Chartered Institute for Archaeologists

- 2.4.8 This baseline assessment has been carried out in accordance with guidance set out by the Chartered Institute for Archaeologists (ClfA) and Historic England, in particular the Standard and Guidance for Historic Environment Desk-Based Assessment (ClfA 2020) and the Code of Conduct (ClfA 2022).

3 Assessment Methodology

3.1 Study Area

- 3.1.1 The study area for the assessment was defined as 1km for designated and non-designated heritage assets from the Proposed Development's EIA Screening Boundary. The study area has been chosen to place the Proposed Development within its wider heritage context and inform the assessment of the significance of the heritage resource.
- 3.1.2 The study area has been defined to identify all potentially affected designated and non-designated assets, their setting and geographical extent, and to inform the context and potential survival of archaeological remains within each of the headhouse and SEC compound sites and their immediate surrounding areas. These assets will be assessed to determine the archaeological potential of the Site and identify any key constraints.

3.2 Data Sources

- 3.2.1 The following sources of information have been used to inform the baseline conditions and assessment of likely significant effects on the heritage resource:
- Historic England's National Heritage List for England (NHLE) (<http://historicengland.org.uk>);
 - Historic Environment Record data for Essex maintained by Place Services (<http://placeservices.co.uk>);
 - Historic Environment Record data for Kent maintained by Kent County Council (<https://webapps.kent.gov.uk>);
 - Archaeological Data Service (<http://archaeologydataservice.ac.uk>);
 - National Library of Scotland maps (<http://maps.nls.uk>) ;
 - British Geological Survey geology viewer (<http://geologyviewer.bgs.ac.uk>);
 - Cranfield Soil and Agrifood Institute Soilscales (<https://landis.org.uk/soilscales>);
 - Essex and Kent Archives (visited 16/03/2023 and 17/03/2023 respectively);
 - Defence of Britain Archive (Council for British Archaeology, Archaeology Data Service (<https://archaeologydataservice.ac.uk/archives/view/dob>);
 - Various documentary and internet sources, including Victoria County History, British History Online; and
 - Kent County Council and Thurrock Council's online land, planning and development websites and the planning and advice documents contained within.

3.3 Site Visit

- 3.3.1 A Site Visit was carried out on 24 March 2023 in order to:
- Assess the general historic character of the area incorporating the proposed development, the surrounding study area and the topographic setting;
 - assess the condition of known archaeological and historic building assets and their setting;
 - identify areas of potential within the proposed development that may contain previously unidentified archaeological remains; and
 - identify the location, extent and severity of modern ground disturbance and previous construction impacts within the proposed development.

3.3.2 Photographs taken during the Site Visit are located in Appendix E of this report.

3.4 Significance of Assets and Setting

- 3.4.1 Assessment of the significance of heritage assets and their setting has been undertaken in consideration of guidance and good practice issued by Historic England. A methodology for the assessment of significance of heritage assets is outlined in Advice Note 12 (Historic England, 2019) whilst Historic England GPA3 (Historic England 2017) provides the basis of a methodology for the assessment of setting.
- 3.4.2 Significance is often established by statutory designations such as listed buildings, scheduled monuments and conservation areas. More particular advice as to what makes up significance is set out in Advice Note 12, which establishes a method for thinking consistently about the heritage values that can be ascribed to a place. When making an assessment of significance numerous aspects are considered including architectural interest, historic interest, group value, social value, former uses and local distinctiveness. These aspects are grouped into four values: evidential, historic, aesthetic and communal.
- 3.4.3 The terminology used in this assessment relates to the terminology used in the NPPF, referring to significance in terms of heritage interest and not heritage values. Whilst heritage interest and heritage values are not completely interchangeable, they are broadly similar.

3.5 Archaeological Potential

- 3.5.1 Assessment of the archaeological resources draws on three factors:
- An assessment of the potential for the survival of archaeological deposits within the site based on an evaluation of previous ground disturbance;
 - An assessment for the potential for archaeological deposits to exist within the site based on the results of the baseline study; and
 - An assessment of the significance of known and potential archaeological assets within the site, as well as within the defined study area.
- 3.5.2 The level of disturbance to buried archaeological remains caused by previous development has been assessed based on available data listed above, with particular attention paid to previous archaeological evaluations and excavations in the study area.
- 3.5.3 The potential for an area to contain archaeological remains is rated 'high', 'medium', 'low', 'negligible', or 'unknown'. This rating is based on an understanding of the archaeological resource as a whole and its national, regional and local context. This includes the number, proximity and significance of known and predicted archaeological/historical sites or find spots within the Site and its surrounding study area.

3.6 Consultation

- 3.6.1 National Grid have approached Historic England in consultation during the Strategic Options Appraisal phase of the Proposed Development. As part of the non-statutory appraisal, Essex County Council and Kent County council will be consulted on the Proposed Development, this will allow each council to confirm the requirements and scope of any archaeological work required within the Site, should this be necessary following this desk-based assessment.

3.7 Limitations and Assumptions

- 3.7.1 The assessment has relied upon data and records provided by third parties, and therefore it has been assumed that this information is accurate and up to date at the time of reporting.
- 3.7.2 The assessment has been undertaken using the available design for the Proposed Development and the maximum likely extents of land required for its construction, operation and maintenance.
- 3.7.3 The site walkover survey on 24 March 2023 was undertaken in good conditions with clear visibility. Access was limited to public areas and rights of way, which afforded views of the land parcels within the Proposed Development boundary (so far as was possible) and the surrounding area.

4 Heritage Baseline

4.1 Topography and Geology

- 4.1.1 The Proposed Development is located to the east of Tilbury and east of Gravesend on north and southern sides of the River Thames respectively. The underlying bedrock geology of both sites is Lewes Nodular Chalk Formation, comprising of Seaford Chalk and Newhaven Chalk, formed approximately 72.1 to 93.9 million years ago during the Cretaceous Period. Both sites are located on the Thames floodplain with superficial geology recorded as Alluvium, comprising clay, silt, sand and peat, formed between 11.8 thousand years ago and present during the Quaternary Period. Soils within the Proposed Development area are recorded as being loamy and clayey soils of coastal flats with naturally high groundwater (Soilscapes 2023).
- 4.1.2 The local environment is dominated by the River Thames which bisects the centre of the Proposed Development, with the River Thames Banks to the north and south respectively. The proposed northern tunnel shaft and SEC compound location at Tilbury comprises a level area of hardstanding formerly used for parking, storage and as a compound for the demolition of the Tilbury Power Station. The associated laydown area to the northeast of the tunnel shaft is also a flat area of hardstanding with the access track and hardstanding parking area to the south of the shaft are essentially flat with a gentle slope southwards towards the River Thames. The proposed southern tunnel shaft site and SEC site east of Gravesend is located within an area of relatively flat grassland, former marshland immediately south of the existing tunnel headhouse with a drainage ditch enclosing its southern extent.

4.2 Heritage Assets Tilbury

- 4.2.1 Designated heritage assets are pre-fixed with **(NHLE)** for National Heritage List for England, each asset has been cross-referenced to the gazetteer in Appendix A, and their location is shown on Figure 2. Non-designated assets are referenced using the Essex HER unique identifier number. These are pre-fixed with **(MEX)**. Each non-designated asset has been cross-referenced to the gazetteer in Appendix A, the locations of non-designated assets in relation to the Tilbury site are shown on Figure 2, with events shown on Figure 3.

Designated Heritage Assets

- 4.2.2 There are no World Heritage Sites, Listed buildings, Conservation Areas, Registered Battlefields or Registered parks and Gardens within the 1km study area.

Scheduled Monuments

- 4.2.3 The eastern extent of the scheduled area of Tilbury Fort **(NHLE 1021092)** lies approximately 500m to the west of the proposed Tilbury headhouse and SEC compound, with the star fort itself located 820m west of the EIA Screening Boundary. The fort includes buried remains of an Henrician blockhouse, with the larger fort and battery constructed in the 17th century, which saw alterations in the 19th and 20th centuries. The blockhouse was a two storey D-shaped fortified barracks, with curved elevation and gun ports which would have provided a wide field of fire across the river. In the late 16th century an encircling ditch and counterscarp bank with drawbridge and palisade were constructed.
- 4.2.4 Following the Restoration of Charles II in 1660 and a highly successful Dutch raid up the Thames and Medway in 1667 a complete reorganisation of the national defences was commissioned. This included Tilbury where the construction of a new star fort and battery began in 1670. The design, by Charles II's chief engineer Sir Bernard de Gomme, was based on defensive principles pioneered in the Low Countries and included the optimum siting of cannon at the forward batteries. The defence of the batteries by complicated outerworks and bastions to the rear was principally a Dutch design

and extremely rare in England (Plate 1). The fort is pentagonal in plan, with bastions projecting from four of the five angles which allowed gun pieces to be positioned behind the parapets. Surrounding the fort is a brick-built curtain wall which encloses the fort and links the bastions, with parallel earthen banks around the perimeter designed to absorb impact from bombardments (Plate 4). Other earthworks consists of a berm which flanks the curtain wall and bastions which is surrounded by a 50m wide moat which follows the outline of the fort, which is crossed by a causeway and redan to the north of the fort.

- 4.2.5 Three further scheduled monuments are located beyond the study area approximately 1.15km to the north east. While not within the study area, they contribute to the understanding of military and coastal defence of the River Thames, the approach to the Port of London and Royal Dockyards at Woolwich, and Deptford. East Tilbury Battery (**NHLE 101388**) and Coalhouse Fort Battery (**NHLE 1013943**) were both constructed towards the late 19th century as part of the Twydall Profile form of defensive installation and demonstrate the continued defence of the River Thames through the post-medieval period. Bowaters Farm Anti-aircraft Battery (**NHLE 1012185**) was constructed in 1940 and was in use until 1944. These assets combined show an interrelated military landscape from the 16th century through to the mid-20th century, which would have been important for the defence of London, the Port of London, and settlements adjacent to the River Thames leading up to London. Improvements and alterations to Tilbury Fort demonstrate its strategic importance on the Thames and have demonstrated the development in both military engineering and artillery.

Listed Buildings

- 4.2.6 Tilbury Fort Officers Barracks (**NHLE 1375568**) is a grade II* listed building located within Tilbury Fort 890m to the west of the EIA Screening Boundary. The asset comprised a terrace of 22 two-storey officers' houses within Tilbury Fort; today, the asset comprises seven houses and a museum. The Board of Ordnance commissioned the construction of the houses in 1772 and is believed to have been constructed on land originally used as the officers' range.

Non-designated Heritage Assets

- 4.2.7 There are 25 non-designated heritage assets located within 1km of the Site, of which two are recorded within the Site itself.
- 4.2.8 A full list of non-designated assets is provided in the gazetteer at Appendix A with an accompanying figure marking the location of the described assets in relation to the Site (see Appendix E Figure 3).

Previous Archaeological Investigations

- 4.2.9 There have been 14 previous archaeological and geo-archaeological investigations undertaken within 1km of the northern extent of Site. These have been summarised below.
- 4.2.10 A borehole survey was conducted by Cambridge Archaeological Unit in 2004 (**EEX54327**) at the Tilbury Wastewater Treatment works, 520m west of the EIA Screening Boundary. No records of this work have been published.
- 4.2.11 A number of archaeological investigations have been undertaken at Tilbury Fort including archaeological salvage excavations conducted in 1973 (**EEX41441**) and in 1980 (**EEX41142**) and (**EEX6048**). The results of these investigations do not appear to have been published and are not included in the EHER report.
- 4.2.12 An archaeological watching brief was conducted by Field Archaeology Group – ECC in 1994 (**EEX52855**) at the Stanford Le Hope STW Water Pipeline, 650m north west of the EIA Screening Boundary. The results of the watching brief on the 7km pipeline were limited only revealing charcoal flecks and smears of degraded pottery/daub.
- 4.2.13 Archaeological recording was conducted by Field Archaeology Group – ECC in 2002 (**EEX53549**) at Tilbury Fort, 930m west of the EIA Screening Boundary. The works consisted of plan recording of

the West Powder Magazine Roof showing the buildings features and photography of the roof to the same effect.

- 4.2.14 An archaeological watching brief was conducted by Oxford Archaeology between 2005-2006 (**EEX55618**), 450m west of the EIA Screening Boundary. The works were conducted ahead of the Biosolids Dyer project and revealed made ground overlying peat and alluvial layers. Archaeological features were also found, likely associated with a post-medieval farm that occupied the works area prior to the construction of the water treatment works.
- 4.2.15 An archaeological evaluation was conducted by Essex County Council in 2008 (**EEX55585**) at Tilbury Power Station, 640m north west of the EIA Screening Boundary. The works were carried out as part of a planning condition for the construction of a 400KV Gas Insulated Switchgear substation. The evaluation recorded no archaeological features or finds, it did reveal the location of waterlogged marsh deposits.
- 4.2.16 A geoarchaeological watching brief, historic borehole review and walkover survey were conducted by Wessex Archaeology in 2008 (**EEX56725**) at the Tilbury Coal Power Station, 150m west of the EIA Screening Boundary. No archaeological finds or features were revealed during the fieldwork portion of these works.
- 4.2.17 An archaeological watching brief was conducted by Field Archaeology Group – ECC in 2010 (**EEX55947**) and (**EEX55950**), 570m north of the Site boundary. The works involved the monitoring of trial pits and groundworks for a pond and bund associated with Tilbury Wildlife, no archaeological finds or features were found.
- 4.2.18 A series of site surveys were conducted by Essex County Council in 2012 (**EEX56482**), 910m north west of the EIA Screening Boundary. The surveys recorded new sites and updating existing site details of a variety of World War II features within the study area.
- 4.2.19 A geotechnical survey and report were conducted by Museum of London Archaeology between 2018-2019 (**EEX59528**), 680m west of the EIA Screening Boundary along the northern bank of The Thames.
- 4.2.20 An archaeological evaluation was conducted by Wessex Archaeology in 2019 (**EEX59539**), immediately west of the EIA Screening Boundary. The works formed part of the evaluation stage for the Tilbury II Power Station. A second archaeological evaluation was conducted by Wessex Archaeology in 2019 (**EEX59539**) at the former Tilbury Power Station, 330m north west of the EIA Screening Boundary.

Archaeological and Historic Background

- 4.2.21 Evidence of *in situ* Palaeolithic remains are nationally rare, with findspots of isolated findspots of flint artefacts providing most of the limited evidence for an early human activity. The Anglian glaciation icesheet would have covered Essex and up to the outskirts of present-day London, changing the landscape and contributing to the lack of Lower Palaeolithic remains within the study area. The Anglian glaciation was responsible for the shifting course of the Thames southwards resulting in its present day location (Natural England 2013).
- 4.2.22 The Site is situated within the Tilbury Marshes close to the riverbank indicating that much of the land is a result of river deposits of alluvium, comprising clay, silt, sand and peat deposits over the past 12000 years. During the early Mesolithic, Britain would have been connected to Europe via the now drowned land bridge known as 'Doggerland', enabling transient and mobile groups of hunter gatherers to exploit a wider landscape. Evidence of Mesolithic settlement is, like the preceding Palaeolithic, largely limited to isolated findspots or scatters of flint artefacts, although none are recorded within the study area.
- 4.2.23 It is likely that this area saw use by Mesolithic and early Neolithic hunter gatherer groups further north from the Site as sea levels were at present day levels, findspots recorded within the study area

contribute towards this assumption (Medlycott, M, 2011). Settlement activity from the Neolithic period survive in part due to the waterlogged nature of the intertidal zone, with the Blackwater Estuary preserving extensive evidence of settlement activity in the north east of the county (Natural England 2013).

- 4.2.24 With the end of the Anglian glaciation at the start of the Holocene the surrounding landscape saw rising sea and river levels. The marshes which the Site boundary occupies were created and sustained by material carried by the Thames which carried through to the Anglo-Saxon period. Sea levels did decrease towards the end of the Iron Age period, combined with wetland drainage in the Roman period leading to expansion of salt-making industry along the marshes. Evidence of this industry was found within the study area with a potential Saltern or 'Red Hill' (**MEX6632**) found 850m north of the Site boundary, highlighting the changing sea level throughout the periods with the current Thames bank situated 130m south of the Site boundary.
- 4.2.25 Chance finds of possibly Palaeolithic worked flint (**MEX6469**) found within the Tilbury Fort and a Neolithic flint axe (**MEX6567**) found 400m to the north of Tilbury Fort have occurred on the northern bank of the Thames, approximately 800m west of the Site. The artefacts do indicate land usage during the Palaeolithic and into the Neolithic.
- 4.2.26 No Iron Age non-designated heritage assets have been recorded within the study area.
- 4.2.27 Roman activity within the region is well represented, with a variety of sites and chance finds found within the study area and beyond. Following the annexation of Britain by the Rome following the invasion of AD 43, the landscape saw changes. To the north of the Site, Colchester was captured and developed into a veteran colony, as well as the founding of Londinium which is now present day City of London. These towns formed administrative centres for the Roman Empire, with new architectural and social structures created, as well as roads that interconnected between the towns. These roads attracted the local population and roadside settlements were constructed along them, for example Old Ford which was built on the road from London to Colchester. The countryside outside of these administrative centres saw relatively little change, as new farmsteads and agricultural practises developed in the Late Iron Age, with a continuity through into the early Roman period. In the latter Roman period there was a shift to arable farming with the number of rural settlements declining but the overall amount of farmland remaining the same (Museum of London 2006). Stane Street was a Roman road located to the north of site which ran from Ermine Street to Colchester with associated Mansio which acted as a stopping point along the road.
- 4.2.28 The closest activity outside of the study area is the Grays industrial site, 3.63km to the north west. The site comprises a pottery production area with kilns dating from the 2nd and 3rd centuries, with associated ditches and two cremations. Chance finds of Roman tiles, flint blocks, potsherds, bones and oyster shells were found at Tilbury Central dock 2.5km west of the Site, indicating the potential for settlement activity around that area. A Roman settlement has also been revealed to the north of the Site at Gun Hill, which comprised of enclosure, field systems, structures and kilns. Numerous salterns have been recorded along the northern bank of the Thames Estuary, such as Corringham and a further four at East Tilbury (Biddulph et al 2012).
- 4.2.29 Evidence for Roman activity within the study area includes four records of Roman material, burials and one settlement recorded in the Essex Historic Environment Record. Roman pottery was found at three locations within the study area, a Romano British pottery rim sherd (**MEX6254**) was found towards the south eastern extent of the Site. Roman Samian ware was found in 1912 (**MEX6255**) 80m east of the Site and is believed to be contemporary with pottery found at a site in East Tilbury and dates to the late 1st century. A collection of Roman pottery (**MEX6630**) was found 30m south of the EIA Screening Boundary along the Thames foreshore. Evidence of a Roman settlement (**MEX6102**) was found 350m east of the Site, now under the present high tide level. Archaeological features found consisted of four curvilinear ditches through to be hut circles with two containing 3 rings of stake marks each showing evidence of wattlework framing, a trackway east of the huts, another hut contained evidence of an oven and floor-planking. Pottery was found across the site interpreted as native type with marked late Iron Age elements, as well as 1st and 2nd century Samian

ware. Roman burials (**MEX6025**) and fragments of a Roman lamp with lion relief (**MEX132122**) are recorded 960m north of the Site boundary. The burials were found in 1910 with iron and bronze bracelets, however the record states they were found at West Tilbury and the location of them is an approximation within the HER. This approximation of location can be extended to the Roman lamp as well, with its exact location unknown. These two assets, while their locations are approximate do show a greater Roman presence within the area surrounding the Site.

- 4.2.30 After the withdrawal of the Roman Empire from Britain in the early 5th century, the Roman influence on the region regressed, leading to influences from other parts of Europe. The town of Tilbury can find its origin in the 19th century, however there is evidence from these periods within the study area and within the vicinity.
- 4.2.31 There are no non-designated heritage assets dating from the early medieval period within the study area, but the local region does show activity during this period. Excavations at Gun Hill, approximately 1.7km north of the Site revealed Saxon occupation in the form of a single sunken floor building with contemporary pottery and salt making tools (Drury P J and Rodwell W, 1973). This excavation shows early medieval presence following the Roman withdrawal and the establishment of domestic dwelling within the area. Saint Cedd is noted as founding a Christian minster at Tilbury in the 7th century, as well as minsters around the surrounding area.
- 4.2.32 The Domesday Survey of AD 1086 records Tilbury as 'Tilberia/Tilibiam', with mention of a Ranulf from William de Warenne, Osbern and Ralph from Swein of Essex, Hunwald from Theodoric Pointel, with 12 foals, 31 cattle, 260 sheep and a fishery. This survey would have been of East Tilbury and West Tilbury, which are located 2.3km north east and 1.7km north of the Site respectively. To the north of Site, open field systems were commonplace and formed the majority of land use within the study area (Thurrock Council 2007). East and West Tilbury both contain a listed church respectively. The Church of Saint Katherine (NHLE1337129) is located 2.55km north east of the EIA Screening Boundary in East Tilbury and was constructed in the 12th century. The Church of Saint James (NHLE1111541) is located 1.7km north of the EIA Screening Boundary in West Tilbury and was constructed in the late 11th century. Both churches post-date the entries in the Domesday Survey of AD 1086, but show the development of both villages within the medieval period. A medieval sea wall (**MEX6629**) is located towards the eastern extent of the Site and 300m north of the Thames' foreshore. The sea wall does not appear at present ground level but does appear on the 1777 Andre and Chapman map of Essex. A road and causeway (**MEX60477**) was located on the redan outwork 950m west of the EIA Screening Boundary on land which the Tilbury Fort now occupies. The road is believed to have been the route from West Tilbury to the north down to the original ferry crossing at the Thames, which was later removed in the 16th century. The West Tilbury marshes (**MEX1042105**) saw improvement in the medieval period for animal grazing, and was the area in which the Tilbury Fort was constructed in the 16th century.
- 4.2.33 Following the Reformation in the 16th century, the surrounding landscape saw extensive development. Drainage of the areas marshes and embankments saw land along the Thames reclaimed (Essex County Council, 2011). This period saw the most substantial development of the area in the form of fortifications along the coastline, specifically the construction of Tilbury Fort (**NHLE 1021092**) in the 16th century, which lies approximately 9875m west of the site boundary. Built in 1540 during the latter part of King Henry VIII's reign due to tensions with France. The original phase of the fort was a two storey D-shaped blockhouse fort, one of a series that Henry VIII constructed to defend the Thames approach to London. It was one of a pair, with the other constructed on the opposite side of the Thames in Gravesend, with Coalhouse constructed to the east in blockhouse similar to Tilbury. The fort was later rebuilt in 1672 in its current pentagonal form with improvements to the rampart walls and a double moat, only the southern gatehouse and chapel survive from the original construction. The armaments within the fort were steadily reduced into the mid-19th century, but then a process of rearmament with more modern armaments began in 1867, with new earthworks constructed at the same time (Essex County Council 2011). A second -grade II* designated heritage asset lies within the boundaries of Tilbury Fort, a row of 22 terrace houses (**NHLE 1375568**) approximately 900m west of the Site boundary. The houses were constructed in the 18th century and were used to house officers stationed at Tilbury Fort.

- 4.2.34 While the area encompassing the study area was used for military defence during this period, study of the landscape and historic mapping shows the reclaimed marshes and agricultural land were the predominant uses for the area at the time of Tilbury Forts construction and redevelopment (Essex County Council 2011).
- 4.2.35 Towards the end of the 19th century shows a rapid development of what is now the town of Tilbury. The construction of the Tilbury Riverside station which formed part of the London, Tilbury & Southend Railway line, and allowed for passengers to travel directly to the ferry crossing located on the Thames foreshore (Thurrock.gov.uk, Accessed 29/03/2023). Although the railway improved travel link along the Thames foreshore and crossing the Thames to places like Gravesend, the construction of Tilbury docks which are located 2.3km to the west of Site facilitated rapid growth of the town.
- 4.2.36 Following the expansion of Tilbury in the later 19th century with the construction of the Tilbury Riverside station and Tilbury docks, the modern period saw developments to the defence and industrial aspects of the area. Tilbury Fort saw further redevelopments of its armaments (**MEX6052**), with the addition of two 6 inch breach loading guns converted from naval use as well as four 12-pounder quick firing guns, these new guns required emplacements to be built over existing emplacements along the forts defensive wall.
- 4.2.37 A landing stage (**MEX1036402**) was constructed in 1928 and opened in 1930 by the then Prime Minister J. Ramsey MacDonald, located 220m east of the EIA Screening Boundary. The landing stage was used to embark/disembark ferry passengers (Thurrock.gov.uk, Accessed 29/03/2023).
- 4.2.38 Several Second World War non-designated heritage assets have been identified within the study area. Two spigot mortar emplacements were built within Tilbury fort approximately 880m west of the Site boundary, one was constructed at the north west bastion (**MEX31803**) and the other at the south east bastion (**MEX31804**).
- 4.2.39 At the now removed Fort Road railway level crossing, 890m north west of the EIA Screening Boundary two World War Two defences were recorded. A road barrier (**MEX31805**) consisting of five anti-tank cubes with surrounding ditches excavated to form anti-tank and anti-glider defence, this non-designated asset was recorded in aerial photography in 1944. Immediately north east of the Fort Road level railway crossing was a turret (**MEX31806**), situated on allotments approximately 870m north east of the Site boundary. The turret type is unknown and no records of it remain.
- 4.2.40 A pillbox (**MEX31812**) is located 100m south of the Site. Its design is characteristic of the 'Essex Lozenge', a design unique to Essex (Osborne 2008). It was constructed to provide for its occupants shelter while being able to form a wide field of fire across the Thames foreshore and onto the Thames itself (Plate 5).
- 4.2.41 A series of anti-glider ditches (**MEX39674**) were recorded 790m north of the Site boundary. These were constructed to disrupt potential enemy gliders from landing safely in the drained marshes and farmland that is within and surrounding the study area.
- 4.2.42 A D-Day assembly area (**MEX1041248**) was located 920m north west of the Site boundary. This was formed to allow for the marshalling of troops and equipment prior to embarkation at Tilbury docks in advance of the Normandy landings of June 6th 1944.
- 4.2.43 Following the end of the Second World War the industrial landscape of the area changed in the mid-20th century with the construction of Tilbury A coal-fired power station, built in 1958, and Tilbury B oil-fired power station, built in 1969 (**MEX1032967**). Tilbury A power station was mothballed in 1981 and largely demolished in 1999, including the turbine hall. Remaining listed elements were cleared in 2019. The conversion of Tilbury B to burn biomass began in 2011, but this was halted in 2013 and the power station was decommissioned and demolished in 2016-2019.

- 4.2.44 Two non-designated heritage assets are recorded within the study area as 'Undated'. A potential Saltern or 'Red Hill' (**MEX6632**) is located 830m north east of the Site boundary, and contained briquetage and pottery sherds. Red hill sites are well represented within the county, with over 300 sites recorded that date from the Late Iron Age Through to the Roman period. No dating was provided in the HER but the location is approximately 880m north of the already discussed Roman settlement (**MEX6102**) and may have been contemporary. A series of linear oyster beds (**MNL39665**) was found during aerial photography in the 1950s 980m east of the Site boundary. The date and full extent of these oyster beds is unknown and no other information regarding them is available.

Historic Cartography

- 4.2.45 Earliest available cartographic evidence of the Site is present within the 1777 André and Chapman map of Essex (see Figure 6). This map illustrates the area of East Tilbury Marsh, and the Site appears to be situated west of the marshes' south-western extent. This western area lies adjacent east to the water outlet east of Tilbury Fort and is an area of two enclosed fields which is separated from the main open marshland area. An embankment feature, likely part of a sea wall, is present on the eastern edge of the Site, and this appears to follow the alignment of the waterway located to the east of the southern leg of the Site. The south-eastern section of the Site is located to the east of the possible sea wall, and is located within the 18th century saltmarshes which bordered the Gravesend Reach. The northern area of the Site crosses over an old field boundary separating the fields adjacent to Tilbury Fort from the wider East Tilbury Marshland.
- 4.2.46 These borders are reflected within the 1778 plan drawing of Tilbury Fort. This plan goes into greater detail of the field boundaries within the areas adjacent west of the Site. The fields appear to be divided by water filled ditches likely used to graze livestock and extend further into the Thames than the present day riverbanks. The Site would likely be contained within the north-eastern and south-eastern fields, with the northern areas of the Site again crossing the probable sea wall.
- 4.2.47 The field boundaries are altered within East Tilbury 1st edition Ordnance Survey (OS) Drawing 1805. The probable sea wall is still within the same alignment, however, the this only appears on the eastern boundary only, with the northern branches of this feature not presented within the map, however, it does appear again on later cartographic examples. Indeed, this is true within the West Tilbury tithe map 1838 (see Figure 7). However, it appears that the field boundaries connect to each other either side of this feature possibly indicating that this northern wall was no longer in use but still visible within the landscape. The tithe apportionments of fields which are likely to be within the footprint of the Site detail the fields to be Six Acre Marsh and Three Acre Field. These names give indication of the size of the fields as well as the environment and land type, which appears to consist of marshland. The apportionment details note that these fields were tenanted out and farmed, with their use being largely cattle grazing.
- 4.2.48 The next available cartographic example is the 1st edition OS map of 1863 and depicts the field systems to be similar to the tithe map layout of 1838. The boundary feature, which has been depicted within the Site since the Andre and Chapman map of 1777, is labelled as the Sea Wall in the south and the Old Counter Wall in the north. This is later reflected within the 2nd edition OS map of 1897; however, the field boundaries have been altered within the Site to create a more open field system (see Figure 8). There is very little change to the Site or surrounding areas within the 1907 revised OS map of Kent, or the revised 1915 OS map of Essex and the revised 1938 edition OS map.

Historic Landscape Character

4.2.49 Several sources were consulted to inform the assessment, including the following:

- National Character Area Profile: 81. Greater Thames Estuary;
- ECC Historic Landscape Characterisation Report;
- Historic Ordnance Survey maps, and;
- Information from the heritage walkover to identify elements that contribute to an understanding of the historic landscape.

4.2.50 In general, the local area is relatively flat and low-lying, and is characterised by industrial development to the west and post-medieval residential to the north west, open managed coastal wetland to the east which has seen some areas used for quarrying and material storage, with the site itself forming part of the wider industrial landscape.

4.2.51 The proposed development lies within the Greater Thames Estuary Character Area of the National Character Area Project 'coastal managed wetland' (Natural England 2013). The key characteristics and features of the character area are:

- Predominantly flat, low-lying coastal landscape where extensive open spaces are dominated by the sky, and the pervasive presence of water and numerous coastal estuaries extend the maritime influence far inland.
- Eastern edge of the London Basin with its underlying geology of the extensive London Clay, containing important sites for geodiversity including fossiliferous deposits, and overlain by productive loamy soils derived from intertidal alluvial muds.
- Geological contrast and variety along the coastline provided by Sheppey, a long, low island rising from a stretch of very flat marsh along the Swale Estuary in Kent with low, steep clay cliffs facing towards Essex, and Mersea Island in the Blackwater Estuary in Essex.
- Coastline of major geomorphological interest for its coastal processes. Accretion of material carried by the sea from the north recharges intertidal coastal habitats, which are subject to coastal squeeze from rising sea levels.
- Open grazing pastures patterned by a network of ancient and modern reed-fringed drainage ditches and dykes, numerous creeks and few hedges or fences, with tree cover a rarity.
- Traditional unimproved wet pasture grazed with sheep and cattle combined with extensive drained and ploughed arable land protected from floods by sea walls, with some areas of more mixed agriculture on higher ground.
- Strong feelings of remoteness and wilderness persist on extensive salt marshes, mudflats and reclaimed farmed marshland, which support internationally important plants, invertebrates and populations of breeding and overwintering birds, notably overwintering Brent geese.
- Open mosaic habitats on brownfield sites support nationally important invertebrate assemblages and key populations of rare invertebrate species.
- Distinctive landmarks of coastal military heritage including Napoleonic military defences, forts and 20th-century pillboxes.
- Some of the least settled parts of the English coast with numerous small villages and hamlets on higher ground and marsh edges reflecting medieval patterns and the coastal economy.
- Highly urbanised areas within London and on marsh edges subject to chaotic activity of various major developments including ports, waste disposal, marine dredging, housing regeneration, mineral extraction and prominent power stations plus numerous other industry-related activities.

- Increasing development pressures around major settlements and especially towards London, with urban, industrial and recreational sites often highly visible within the low-lying marshes.
- Major historical and current transport link to Inner London provided by the River Thames, with an extensive network of road and rail bridges spanning its reaches within the city.

- 4.2.52 The Historic Landscape Characterisation (HLC) of Thurrock is identified along the northern Thames Estuary, the landscape is described as: *A largely urban or urban-edge landscape, bordered by former marshes along the Thames. There are extensive areas of mineral extraction, both on the river terraces formed by earlier routes of the River Thames, and on the chalk outcrops. The modern urban areas include South Ockendon, Grays, Tilbury and Corringham.*
- 4.2.53 Historic elements of the landscape can still be seen within the study area. The scheduled monument of Tilbury Fort (**NHLE1021092**) which was built in the 16th century during the latter stages of Henry VIII's reign as a response to fears of French naval attacks. Having been a constant element of defence of the Thames and London for four centuries the area surrounding the Site and study area remained mostly managed coastal wetland and enclosures until the construction of Tilbury Power Station (**MEX1032967**).
- 4.2.54 The HLC for Thurrock identifies two historic landscape character types for the Site. The first is an area of coastal managed wetland that forms the majority of the Site, and the second a small portion of the land to the west designated as industry (Essex County Council 2011). To the west of the Site, there are existing buildings that fit the industry designation, with part forming aspects National Grids presence that form part of the proposed development. While the Site has remained as mostly 'coastal managed wetland', the industrial landscape to the west has seen growth and redevelopment through the 20th century, with the inclusion and subsequent demolition of Tilbury power station along the western extent of the Site.

4.3 Heritage Assets Gravesend

- 4.3.1 Designated heritage assets are pre-fixed with (NHLE) for National Heritage List for England, and also have corresponding unique ID numbers as non-designated assets, these assets will only be included in the designated assets section of the gazetteer. Each asset has been cross-referenced to the gazetteer in Appendix B, and their location is shown on Figure 2. Non-designated assets have been given unique reference numbers. These are pre-fixed with (TQ). Each non-designated asset has been cross-referenced to the gazetteer in Appendix B, the location of non-designated assets is shown on Figure 2, with events shown on Figure 3.

Designated Heritage Assets

- 4.3.2 There are no World Heritage Sites, Scheduled Monuments, Conservation Areas, Registered Battlefields or Registered parks and Gardens within the 1km study area surrounding the southern tunnel headhouse and SEC compound. There are however four listed buildings within the study area.

Listed Buildings

- 4.3.3 Four listed buildings are located within the 1km study area.
- 4.3.4 The Readers (**NHLE 1089019**) (**TQ 67 SE 1114**) is a grade II listed building located on the corner of Orlick Road and Lower Higham Road approximately 750m south of the Site boundary. The asset comprises of a T-shaped timber-framed house with roughcast brick infilling and curved braces on the first floor. The house was likely built in the 15th or 16th century and still retains a casement window and Tudor arched stone doorcase, with a modern extension on the right side of the house.
- 4.3.5 54-58 Vicarage Lane (**NHLE 1089005**) located at the corner of Vicarage Lane and Lower Higham Road approximately 950m to the south of the Site boundary. The grade II listed building consists of

three cottages. The buildings date to the 18th century, the two cottages to the south are located where the original farmhouse stood, with the northernmost cottage a later addition. The building comprises two storeys of brown and red brick with a tiled, hipped roof with three 3 hipped dormers. Modern brick extensions are found to the rear of No 56 Vicarage lane.

- 4.3.6 44 Chalk Road (**NHLE 1341493**) is a grade II listed building located approximately 1km to the south of the Site boundary. The asset comprises an 18th century farmhouse two storeys in height with red brick stringcourse which was once painted, hipped tiled roof and moulded wooden eaves cornice. This asset claims to be the Charles Dickens' honeymoon cottage.
- 4.3.7 1 Chalk Road (**NHLE 1089043**) is grade II listed and located approximately 1km to the south of the Site boundary. The asset comprises a two storey cottage faced with weatherboarding and a tiled roof, two 2 sash windows with glazing bars intact, and a doorcase with small flat hood over supported on brackets. Above the door a small engraved tablet states that this was where Charles Dickens and Kate Hogarth spent their honeymoon in 1836. Some early chapters of "Pickwick" may also have been written here. No. 44 Chalk Road also makes a claim to being the honeymoon house.

Non-designated Heritage Assets

- 4.3.8 There is one non-designated heritage asset located within the Site. There are 48 non-designated heritage assets located within 1km of the Site.
- 4.3.9 A full list of non-designated assets is produced in the gazetteer at Appendix B with accompanying figure marking the location of the described assets (see Appendix E Figure 2 with non-designated asset locations marked).

Previous Archaeological Investigations

- 4.3.10 There have been 42 previous archaeological and geo-archaeological investigations undertaken within 1km of the southern extent of Site. These have been summarised below:
- 4.3.11 There have been four separate excavations at Chalk Roman Villa, 1.1km south of the Site boundary. Three were excavated by the Ministry of Works in 1959-1961 (**EKE3947**), 1961 (**EKE3948**) and 1974-1975 (**EKE3949**). The fourth excavation was conducted in 1978-1979 by Springhead Excavation Group. No site reports are associated with the four HER entries.
- 4.3.12 A geotechnical evaluation and report were conducted by Geotechnics-Materials Limited in 1994 (**EKE9779**) at Westcourt Marshes, 570m south west of the study area. Eleven trial pits were excavated down to an organic peat layer, with no archaeological finds were recovered.
- 4.3.13 An archaeological desk-based assessment was conducted by Wessex Archaeology in 1996 (**EKE21323**), 600m south west of site. The assessment focused on the Gravesend Waste Water Treatment Works, and subsequent development at the site and found a high potential for Roman and prehistoric remains.
- 4.3.14 A geotechnical ground investigation was conducted by Babtie in 1997 (**EKE7181**) for the Denton Relief Road, 870m south west of the Site boundary. The works consisted of six boreholes and six trial pits excavated to an organic peat layer, no archaeological finds were recovered. An archaeological evaluation was conducted by the Institute of Archaeology, University of London in 1999 (**EWX6628**) at the Denton Relief Road, Gravesend, 880m south west of the Site boundary. The evaluation revealed worked flint from the Mesolithic/Neolithic period, as well as prehistoric and Roman archaeological features. An archaeological watching brief and borehole survey were conducted by Oxford Archaeology between 2002-2003 (**EKE8724**), 750m west of the Site boundary. The works were located at the Denton Relief Road project and found no archaeological remains in either the watching brief or borehole survey.
- 4.3.15 An archaeological excavation was conducted by Pre-Construct Archaeology in 1997 (**EKE8797**) at Damigos Road, Gravesend, 900m south west of the Site boundary. The excavation was conducted

prior to housing development works and found archaeological evidence from the medieval period and the post-medieval West Court Manor.

- 4.3.16 An archaeological evaluation was conducted by Wessex Archaeology in 1997 (**EWX6586**), 680m south west of the Site boundary. The evaluation was located at the Gravesend Wastewater Treatment Works where Romano-British pottery and other finds from the period were recovered. An archaeological watching brief (**EWX6597**) was conducted during the construction phase at the Gravesend Wastewater treatment Works in 1999. No further Roman deposits were observed but artefacts and known about deposits were located.
- 4.3.17 A geotechnical ground investigation was conducted by Soils Ltd in 1998 (**EKE9780**) at Lower Higham Road, Gravesend, 840m south west of the Site boundary. The works involved soil samples taken at subsequent levels of the ground investigation, no archaeological finds were recovered.
- 4.3.18 An archaeological watching brief was conducted in 1998 (**EKE8432**), 1.1km south of the Site boundary. The watching brief was on works being conducted at 7 Manor Close, Chalk and found no archaeological remains.
- 4.3.19 Two archaeological desk-based assessments were carried out under the same HER event number (**EWX9136**). The first was in 2000 focusing on the Eastcourt Marshes, and the second by Museum of London Archaeology in 2001 and focuses on the Westcourt Marshes, but this may be an input error as Museum of London Archaeology had conducted an assessment on this area in a separate HER listing (**EWX9176**). Both were conducted to assess the archaeological impact from the redevelopment of the Metropolitan Police Firearms and Public Order Training Centre. No archaeological features were identified within that site boundary apart from the post-medieval Milton Range. Museum of London Archaeology found archaeological potential in the area and four putative crop marks of potentially Bronze Age date.
- 4.3.20 An archaeological evaluation was conducted by Essex County Council Field Archaeology Unit in 2001 (**EKE8607**), 890m south west of the Site boundary. The evaluation was conducted in advance of redevelopment of playing fields and revealed evidence of Late Iron Age, Roman and post-medieval land use.
- 4.3.21 An archaeological trial trench evaluation was conducted by Museum of London Archaeology in 2001 (**EKE10622**), located 730m south of the Site. The evaluation excavated 22 evaluation trenches and found no archaeological remains.
- 4.3.22 An archaeological desk-based assessment was conducted by Museum of London of Archaeology in 2001, focusing on the Westcourt Marshes, Gravesend (**EWX9176**) 600m south east of the Site boundary. The assessment identified the potential for the study area to contain archaeological features and four putative crop marks of potential Bronze Age date. An archaeological evaluation was conducted by Museum of London Archaeology in 2001 (**EKE8749**), 600m south east of the Site boundary. The works were located within the Westcourt Marshes, Gravesend in advance of redevelopment and found no archaeological remains.
- 4.3.23 An archaeological survey was conducted by Kent County Council in 2004 (**EKE14761**), the survey covered the entirety of the Site and beyond. The survey focused on mineral extraction sites around the Thames Estuary. The survey produced information on the historic environment found within mineral extraction sites, focusing particularly on Pleistocene geology, palaeolithic archaeology and industrial archaeology.
- 4.3.24 An archaeological evaluation was conducted by Oxford archaeology in 2006 (**EKE9270**) at Lion Business Park, Gravesend, 800m south west of the Site boundary. The evaluation was conducted in advance of development of the business park and found Late Neolithic/Early Bronze Age activity associated with flint knapping as well as beaker pottery which was recovered.

- 4.3.25 A borehole survey was conducted by Oxford Archaeology in 2006 (**EKE9782**) at Denton Marshes, Gravesend, 760m south west of the Site boundary. The works comprised of five boreholes which revealed alluvial and peat deposits possibly dating from the Roman period.
- 4.3.26 An archaeological desk-based assessment was conducted by National Grid between 2006-2007 (**EKE17269**), 900m south east of the Site boundary. The works focused on the Grain to Shorne Gas Pipeline, and reviewed existing archaeological and cultural information. A fieldwalking programme (**EKE17316**) was also conducted for the Grain to Shorne Gas Pipeline, and was conducted by Canterbury Archaeological Trust in 2006, 900m south east of the Site boundary. A magnetometry survey was conducted along the route of the Grain to Shorne Gas Pipeline by Stratascan in 2006 (**EKE17318**), 900m south east of the Site boundary. The results survey found scattered readings interpreted as geological or pedological anomalies, overall, the results of the survey produced little evidence for archaeological activity.
- 4.3.27 A series of test pits were excavated by Archaeology South-East in 2008 (**EKE13337**), 850m east of the Site. The test pits were located on the Isle of Grain, and sought to confirm geophysical and geotechnical information as part of a Paleoenvironmental Evaluation. The evaluation found extensive spreads of fluvial sediments originating from river terraces across the study area.
- 4.3.28 The Hoo Peninsula Historic Landscape Project was conducted by English Heritage between 2009-2012 (**EKE15020**) and (**EKE15021**), the project covered the entirety of the Site and beyond. The project consisted of aerial photographic and Lidar mapping and analysis. The survey revealed a wide date range of archaeological features, including buried remains visible as cropmarks, and surface remains seen as earthworks and structures. The survey also revealed previously unknown archaeological sites and provided views of the landscape, villages, architectural and inter-tidal remains.
- 4.3.29 A review was conducted by English Heritage between 2010-2011 (**EKE15400**), which covered the southern extent of the Site and beyond the Site boundary. The review described the Quaternary paleoenvironmental development and deposits of the Hoo peninsula region. The results of the review aided in the creation of GIS datasets on geological and archaeological sites within the Peninsula.
- 4.3.30 A historic landscape characterisation and historic seascape characterisation was conducted in 2011-2012 (**EKE13239**), the characterisations covered the entirety of the Site and beyond. They were carried out as part of the Hoo Peninsula Historic Landscape Project, which identified the changes in the Hoo Peninsula landscape and seascape, through factors such as historic and archaeology of its constituent buildings, fields, rivers and routeways.
- 4.3.31 An archaeological monitoring and survey was conducted by Archaeology South-East at Shorne Marshes in 2013 (**EKE16356**), 750m east of the Site boundary. The works comprised monitoring of a 950m long security ditch, excavated to a depth of 2m from the surface level. The excavation revealed geological material consistent with the Thameside marshes, as well as organic peat deposits. Archaeological remains of a post-medieval shooting butt were revealed to the west of the security ditch, with field ditches were found across the excavation.
- 4.3.32 An archaeological evaluation was conducted by CgMs Consulting in 2016 (**EKE15826**), 700m south west of the Site boundary. The evaluation comprised forty-four trial trenches to ascertain the presence, extent, date and nature of buried archaeological remains. Five trenches were not excavated due the presence of deep made ground and modern surfaces. A single trench revealed Romano-British archaeological features with residual Late Bronze Age, Iron Age, medieval and modern residual finds.
- 4.3.33 An archaeological evaluation was conducted by Thames Valley Archaeological Services in 2016 (**EKE15872**), 580m south west of the Site boundary. The evaluation consisted of 39 trial trenches excavated in advance of construction of industrial units and associated parking, access and landscaping. No archaeological remains were identified during the evaluation.

Archaeological and Historic Background

- 4.3.34 Evidence of *in situ* Palaeolithic remains are nationally rare, with findspots of isolated findspots of flint artefacts providing most of the limited evidence for an early human activity. Previous surveys of the area of white the study area forms part of highlight the poor provenance of most finds and uncertainties over the extent of earlier derived material in assemblages (Essex County Council and Kent County Council 2011).
- 4.3.35 The Site is situated within the North Kent Marshes which is located within the Dartford and Gravesham Conurbation. Kent has a reasonably populated prehistoric background, with several flint tool deposits found across the north of the county. There is also settlement evidence from the Neolithic, such as megalithic structures found on the North Downs and three earthen long barrows at the Wye valley (Kent County Council 2001). Two non-designated heritage assets were found within the study area from this period. Excavations at the Lion Business Park (**TQ 67 SE 286**) 740m south west of the EIA Screening Boundary found examples of work flint and fragments of bunt unworked flint, as well as pottery sherds from the Neolithic/Bronze Age. Works at the Denton Relief Road (**TQ 67 SE 41**) 850m west of the EIA Screening Boundary found three pieces of worked flint, which included a Tranchet axe.
- 4.3.36 Bronze Age and Iron Age activity has been discovered within the county, with the North Downs and Greensand areas showing a concentration of activity, however settlement evidence has been found across the county showing that during these periods the county was well populated (Kent County Council 2001). One non-designated heritage asset is located within the study area from the Bronze Age, and two non-designated heritage assets are located within the study area from the Iron Age. Four circular cropmarks (**TQ 67 SE 277**) 670m south west of the EIA Screening Boundary have been recorded within the Westcourt Marshes and interpreted as Bronze Age in date and have been interpreted as enclosures. A Late Iron Age pit (**TQ 67 SE 238**) and Late Iron Age ditches (**TQ 67 SE 239**) were found 880m south west of the Site boundary. The large pit contained late Iron Age pottery, daub and animal bones which showed signs of butchery, the ditches were believed to be part of a field system which continued onto into the Roman period with a later ditch found in the vicinity indicting agriculture use across both periods.
- 4.3.37 There was interaction between the peoples of the south-east and the Romans as early as the 1st century BC, documentary sources note the existence of the island, its inhabitants and products during this time (Allen, Bird & Croxford, 2019). Given the counties location within the country and vicinity to mainland Europe, the county would have seen occupation from the earliest to latest stages of the Roman occupation (Kent County Council 2001). The county is home to major Roman sites such as Canterbury, Rochester and Dover, as well as the roadside settlement of Springhead and the religious centre of Horton Kirby to the south of the Site. Well established farmsteads were also created to the south west of the study area namely Darenth, Keston and Lullingstone (Allen, Bird & Croxford, 2019). Study of The Rural Settlement of Roman Britain Resource shows the extent of the Roman interaction with the landscape. The landscape outside of the study area contains numerous settlements lining each side of Watling Street down towards Strood. (ADS 2018).
- 4.3.38 Seven non-designated heritage assets are located within the study area. Excavations at Chalk 1.02km south of the EIA Screening Boundary account for two of the non-designated heritage assets. A Roman building 'Chalk Villa' (**TQ 67 SE 15**) was excavated 940m south of the Site boundary, the villa is believed to have burnt down during the late 3rd century. The excavations also revealed several pits, three graves contain infant burials and mid-1st century pottery. Subsequent excavations within the vicinity revealed hypocaust, tiles and a complex Roman bath house. A human skull and sherds of 2nd century Roman pottery (**TQ 67 SE 18**) were found during construction work in 1959. 30m to the west a Roman poppy-head beaker and sherds of a second vessel were also discovered.
- 4.3.39 Second century pottery including Samian ware (**TQ 67 SE 36**) was found 570m west of the Site boundary. A Roman ditch (**TQ 67 SE 382**) was found 800m south of the EIA Screening Boundary at Dalefield Way, pottery, fired clay, slag and struck flint were recovered from the ditch indicating that it may have been used between the Iron Age and Roman periods. A dump of Roman material and

Roman ditch were found 790m west of the Site boundary, the dump **(TQ 67 SE 1001)** comprised of Samian ware pottery, terra nigra, other early Roman pottery, animal bones, shell and building material, the ditch **(TQ 67 SE 1003)** contained Roman remains.

- 4.3.40 After the withdrawal of the Roman Empire from Britain in the early 5th century, the Roman influence on the region regressed, leading to influences from other parts of Europe. Anglo-Saxon influence on the region is represented mostly by funerary sites such as Darenth Park (NHLE 1003126), but very few settlement sites. There is evidence for the continuing use of both Roman roads and towns within the region, with the county being divided into 'lathes'. As the Saxon period progressed, parishes were formed and some settlements nucleated, however open field systems that were common at the time in other parts of the country were not utilised within the county (Kent County Council 2001). There are non-designated heritage assets from the early-medieval period within the study area.
- 4.3.41 Gravesend is recorded in the Domesday survey of 1086AD as being within the hundred of Tollingtrough and owned by Bishop Odo of Bayeux. There was an expansion of settlement within the county, facilitated by the opening of Wealden pastures which Gravesend saw some of this expansion (Kent County Council 2001). Two non-designated heritage assets are found within the study area. A section of medieval ridge and furrow **(TQ 67 SE 1019)** was located 200m west of the EIA Screening Boundary at is now the Metropolitan police training centre, this farming practise shows the extent of the organisation of settlements and surrounding farmland towards the end of the medieval period.
- 4.3.42 Evidence of a medieval manor house **(TQ 67 SE 242)** were revealed 940m south west of the study area, comprising of a double cellared structure of chalk walls against an exposed natural chalk face with flint wall along the western and northern sides.
- 4.3.43 The parish of Gravesend was confirmed by Queen Elizabeth I in 1568, as well as the antient privileges granted to Gravesend during the reign of King Henry IV. It is this period where a large expansion of industrial and agricultural practises can be seen within the study area and the surrounding landscape. This development was visible across the county following the Dissolution of the Monasteries, with the redistribution of church land which resulted in the networks of village, towns and cities which were seen through into the post-medieval period (Kent County Council 2001).
- 4.3.44 The industrial landscape of Gravesend developed during this period, which can be seen in industrial buildings, bridges, canals and the expansion of Gravesend docks. Denton Smock Mill **(TQ 67 SE 1251)** was constructed before 1840 940m west of the Site boundary, it was used to grind corn and was demolished prior to 1897 on land that is now part of Gravesend docks. Mapping from 1852 shows a windmill **(TQ 67 SE 1004)** 840m west of the Site boundary, the windmill is no longer extant with modern industrial buildings built over it.
- 4.3.45 The Thames and Medway Canal **(TQ 67 SE 20)** was established in 1778 to allow military craft to move between Deptford and Woolwich Dockyards to Chatham Dockyard allowing the traffic to not use the Thames estuary (Warren and Thomas, 2006) (Plate 8). Three bridges were constructed across the Thames and Medway Canal within the study area. Bridge No. 3 **(TQ 67 SE 343)** was a swing bridge 870m west of the Site boundary which originally carried Mark Lane over the canal, the bridge is no longer extant. Bridge No. 5 **(TQ 67 SE 345)** was a swing bridge 760m east of the Site boundary, the bridge had a footpath over the Thames Medway Canal to Lower Higham Road, the bridge is no longer extant with a modern wooden bridge now in its place. A third swing bridge **(TQ 67 SE 49)** is located 90m south east of the EIA Screening Boundary and was believed to have been a hand operated bridge which has subsequently been restored.
- 4.3.46 Three non-designated heritage assets are associated with Gravesend docks which saw expansion during this period. Denton Wharf **(TQ 67 SE 1005)** is visible on mapping from 1852 660m west of the Site boundary, and would have acted as a loading and unloading point within Gravesend docks. A quay **(TQ 67 SE 1018)** was visible on the 1st edition Ordnance Survey map of 1869 and is still in use today, likely having been rebuilt. A jetty **(TQ 67 SE 1040)** was also identified on the 1st edition Ordnance Survey map of 1869, constructed of parallel rows of timber posts running into the Thames,

a new jetty has been constructed to the right of this jetty and a rubble slipway is visible between the two.

- 4.3.47 As the industrial landscape of Gravesend changed, the agricultural landscape also changed during this time. Three non-designated heritage assets pertaining to agricultural farmsteads are recorded within the study area. West Court Farmstead (**MKE84361**), Great Clane Lane Farmstead (**MKE84362**) and Farmstead north of Readers (**MKE84363**) were farmsteads which contained agricultural buildings and courtyards which are no longer extant, all between 740 and 800m south west of the EIA Screening Boundary.
- 4.3.48 Ship breaking activities (**TQ 67 SE 1024**) were recorded 1.03km west of the EIA Screening Boundary, likely a historical record as the derelict boats that showed signs of ship breaking are no longer extant on the Thames foreshore.
- 4.3.49 Milton Rifle Range (**TQ 67 SE 1185**) was located across the Site extending 900m east from the Site boundary. Constructed in 1862 the range was located on the Eastcourt Marshes and comprised of low earthen mound firing points, target mounds and markers gallery with weather shelter. The range was used until around 1980. It is now used as a firing range for the Metropolitan Police Training Facility. A shooting stand (**TQ 67 SE 1252**) was located 890m east of the EIA Screening Boundary and would have been incorporated into Milton Rifle Range. Excavations around the shooting stand found bullets which were of calibres used by the British Army, highlighting its use as a military training facility at the start of the 20th century.
- 4.3.50 The modern landscape of the Site saw little change until the construction of the Eastcourt Marshes Electricity Substation. The Study area shows development in this period attributing to urban housing, industry and transport infrastructure such as roads and railway. Second World War defences are well represented within the study area with numerous records within the Kent Historic Environment Record.
- 4.3.51 There was development to the dock and coastal area of Gravesend, with a causeway (**TQ 67 SE 1032**) is visible on the 3rd edition Ordnance Survey map of 1908 580m west of the Site boundary, comprising of wood and steel and is extant. A mooring post (**TQ 67 SE 1033**) is located 160m north west of the Site boundary, comprising of three piles with posts in a triangular shape with cross timbers situated on the Thames foreshore. A hard (**TQ 67 SE 1048**) was located on the Thames foreshore 970m east of the Site boundary, comprising of irregular small boulders and retained by angled posts which would have been used to beach vessels on.
- 4.3.52 Two Halts are within the study area and would have served as stopping points along the Gravesend West Railway Line. Denton Halt railway station (**TQ 67 SE 217**) was located 900m west of the EIA Screening Boundary and is no longer extant. Milton Range halt (**TQ 67 SE 342**) was located 700m east of the Site boundary, and is no longer extant.
- 4.3.53 Eight non-designated heritage assets are located within the study area that pertain to World War Two defence, similar to that of Tilbury the landscape held strategic importance for defending the local area and London from both aerial and naval attacks. An air raid warden post (**TQ 67 SE 346**) is located 470m south of the EIA Screening Boundary comprising a concrete structure with fittings, the building would have been used to provide early warning of air raids to Gravesend. A searchlight battery (**TQ 67 SE 89**), originally interpreted as a Bronze Age settlement was located 610m south of the Site boundary. The battery comprised of two curvilinear embanked enclosures with embanked entrances and offset banks that were likely to have supported sandbags, with searchlights at the centre of one enclosure and a light anti-aircraft machine gun within the other enclosure. A second searchlight position (**TQ 67 SE 1156**) was located 420m south west of searchlight battery (**TQ 67 SE 89**), it is assumed this searchlight battery would have been similar in composition to that of the northern battery and is no longer extant. Denton Heavy Anti-aircraft Battery (**TQ 67 SE 1209**) was located at Mark Lane 770m west of the Site boundary, comprising of four 4.5' guns south of North Kent railway. The battery formed part of a network of anti-aircraft defences and was decommissioned in 1945 and later removed in 1985. A road block (**TQ 67 SE 1161**) was located on Lower Higham

Road 1km south east of the Site boundary, and would have formed part of the anti-invasion defences. Two concrete platforms (**TQ 67 SE 1045**) are located on the Thames foreshore 150m north west of the Site boundary, they are believed to be bases for navigational beacons used during the Second World War to aid ships sailing up and down the Thames. A barrage balloon location (**TQ 67 SE 1021**) was located 550m north east of the Site boundary, the balloon was located over the Thames and would have provided a defence against dive-bombing aircraft. Denton Sewage Works Battle Headquarters (**TQ 67 SE 1196**) was located 510m south west of the Site Boundary, the headquarters was part of the overall defence network of the local area and would have been manned by the local Home Guard regiment, the building was decommissioned around the end of the war and the sewage works occupies its location.

- 4.3.54 Two salt working sites (**TQ 67SE 1013**) and (**TQ 67 SE 1014**) were recorded 110m west and 350m south east of the EIA Screening Boundary respectively. These are likely attributed to the Late Iron Age/Roman period as these were common along the Thames and utilised the Thames to produce salt as a domestic and trade resource.
- 4.3.55 An undated hoard (**MKE113306**) chance find was located 950m south of the Site boundary, supplementary information for this non-designated asset shows that it was found during the 1961 excavations around Chalk Roman Villa. It is likely that the hoard is associated with the Roman period due to its proximity to Chalk Roman Villa.
- 4.3.56 Evidence of a shipwreck (**TQ 67 SE 1044**) was located 70m north west of the Site boundary. While designated as a wreck, supplementary evidence attributes the oval stone bank found running at an angle from the foreshore to be associated with cargo or ballast from a vessel. It is unknown as to when this non-designated heritage asset is from but it is like post-medieval or later with the intense use of the Thames for shipping in these periods.
- 4.3.57 A post-built structure (**TQ 67 SE 1047**) was located 770m north east of the Site boundary. Consisting of a row of 12 abraded small wooden posts running from the foreshore into the water, no date has been ascribed to this structure, but it is likely post-medieval or later in date and was used by ships mooring along the Thames.
- 4.3.58 A brick tank (**TQ 67 SE 278**) was located 800m south of the Site boundary. This comprises a brick-built structure, possibly used as a water tank. It was noted during a walkover survey in 2003 and visible on the 1932 Ordnance Survey map. Modern urban development is now located at the point where the brick tank was recorded and it appears to no longer be extant.

Historic Cartography

- 4.3.59 The earliest available cartographic data for this Site is within a 1694 levels survey of the area conducted by George Russell of Rochester. The levels survey shows that the Site is situated within areas of enclosed marshland fields, with the field boundaries marked at ditches and sewer drains, all of which link and lead to the estuary to the north. There is no indication as to how these fields were utilised, although it is suspected they would have been either arable or livestock farmland. Within the 1840 Tithe Map of Chalk, the field boundaries appear to be largely the same as the 17th century, with the largest changes being with construction of the canal to the south of the Site.
- 4.3.60 The tithe apportionments do not provide names of the different fields; however, it is possible to have an indication of land use through the occupier of the fields. It appears that throughout the 19th century the majority of the marshland was under agriculture and tenanted out to farmers. This is true until the 1860s, when areas of this marshland were taken on by the War Department, leading to the establishment of Milton Firing Range in 1862. The first butts were built in 1870, and the military were present here until the 1980s. The western area of the firing range would originally lain within the Site, however, the original extent of the range is no longer extant.
- 4.3.61 There are no plans available of the firing range, however, the site is visible within all OS maps from the 1897 2nd edition OS map, the 1908 3rd edition OS map, and the revised edition OS map of 1932.

The earlier 1863 Essex Sheet OS map shows no evidence of the range, and instead depicts a sheepfold within one of the fields, indicating they were used for sheep grazing. Within these maps, minimal changes are occurring within the Site or within the surrounding areas.

Historic Landscape Character

4.3.62 Several sources were consulted to inform the assessment, including the following:

- National Character Area Profile: 81. Greater Thames Estuary;
- KCC Historic Landscape Characterisation;
- Historic Ordnance Survey maps; and
- Information from the heritage walkover to identify elements that contribute to an understanding of the historic landscape.

4.3.63 In general, the local area is relatively flat and low-lying, and is characterised by industrial development to the west and post-medieval residential to the south and south west, with the site itself being a pocket of open, managed coastal wetland.

4.3.64 The proposed development lies within the Greater Thames Estuary Character Area of the National Character Area Project 'coastal managed wetland' (Natural England 2013). The key characteristics and features of the character area are:

- Predominantly flat, low-lying coastal landscape where extensive open spaces are dominated by the sky, and the pervasive presence of water and numerous coastal estuaries extend the maritime influence far inland;
- Eastern edge of the London Basin with its underlying geology of the extensive London Clay, containing important sites for geodiversity including fossiliferous deposits, and overlain by productive loamy soils derived from intertidal alluvial muds;
- Geological contrast and variety along the coastline provided by Sheppey, a long, low island rising from a stretch of very flat marsh along the Swale Estuary in Kent with low, steep clay cliffs facing towards Essex, and Mersea Island in the Blackwater Estuary in Essex;
- Coastline of major geomorphological interest for its coastal processes. Accretion of material carried by the sea from the north recharges intertidal coastal habitats, which are subject to coastal squeeze from rising sea levels;
- Open grazing pastures patterned by a network of ancient and modern reed-fringed drainage ditches and dykes, numerous creeks and few hedges or fences, with tree cover a rarity;
- Traditional unimproved wet pasture grazed with sheep and cattle combined with extensive drained and ploughed arable land protected from floods by sea walls, with some areas of more mixed agriculture on higher ground;
- Strong feelings of remoteness and wilderness persist on extensive salt marshes, mudflats and reclaimed farmed marshland, which support internationally important plants, invertebrates and populations of breeding and overwintering birds, notably overwintering Brent geese;
- Open mosaic habitats on brownfield sites support nationally important invertebrate assemblages and key populations of rare invertebrate species;
- Distinctive landmarks of coastal military heritage including Napoleonic military defences, forts and 20th-century pillboxes;
- Some of the least settled parts of the English coast with numerous small villages and hamlets on higher ground and marsh edges reflecting medieval patterns and the coastal economy;
- Highly urbanised areas within London and on marsh edges subject to chaotic activity of various major developments including ports, waste disposal, marine dredging, housing

regeneration, mineral extraction and prominent power stations plus numerous other industry-related activities;

- Increasing development pressures around major settlements and especially towards London, with urban, industrial and recreational sites often highly visible within the low-lying marshes; and
- Major historical and current transport link to Inner London provided by the River Thames, with an extensive network of road and rail bridges spanning its reaches within the city.

4.3.65 The historic landscape character types identified within the study area are noted within The Kent Historic Landscape Characterisation (Kent County Council 2001).

4.3.66 The proposed development lies within the Greater Thames Estuary Character Area of the National Character Area Project 'coastal managed wetland' (Natural England 2013). It also lies within Historic Landscape Character Area 28 (HLCA 28) of the Kent Historic Landscape Character (Kent County Council 2001).

4.3.67 The Historic Landscape Character Area 6 (HLCA 6) is identified along the northern coast and marshland, the landscape is described as: *Relatively balanced mix of reclaimed marsh and coastal landscape types typifying the relationship between humans and the marine environment. Areas situated closer to the mouth of the Thames, i.e. the area around the Hoo peninsula, contain a greater degree of industrial activity. It is likely that this belt continued further east towards HLCA 19 (Wantsum Channel) but the expansion of Whitstable and Herne Bay town (part of HLCA 22, Former Blean Forest) has overlain any evidence of this.*

4.3.68 Historic elements of the landscape can still be seen within the study area. Buildings such as The Readers (**NHLE 1089019**), 1 Chalk Road (**NHLE1089043**), 44 Chalk Road (**NHLE1341493**) and 54-58 Vicarage Lane (**NHLE1-89005**) demonstrating the urban development of Gravesend in the post-medieval period. The Site has not been a vital aspect of the historical landscape of Gravesend, with only the development of Milton Rifle Range and the Eastcourt Marshes Electricity Substation developed within its boundaries.

4.3.69 The Site comprises a single historic landscape characterisation type 5.3 Reclaimed Marsh - Small Regular Enclosures. This HLC type is defined by its small land parcels of marshland and low lying grassland which are bounded by drainage ditches and the Thames. Despite being altered by the construction of the Milton Rifle Range and existing Eastcourt Marshes Electricity Substation the Site largely retains its rectangular shape bounded to the east and south by drainage ditches, and is still legible as part of a wider pattern of small rectilinear enclosed fields extending along the southern bank of the River Thames.

4.3.70 To the west of the Site, there are existing buildings that fit an industrial designation, with several industrial buildings along the Thames foreshore associated with Gravesend Docks. The Site has remained as 'small regular enclosure' the industrial landscape to the west has seen growth and redevelopment through the post-medieval and modern periods, that have expanded on Gravesend Docks and its associated industries.

5 Assessment of the Baseline

5.1 Tilbury

- 5.1.1 The desk-based assessment has identified a single designated heritage asset, the Tilbury Fort Scheduled Monument on the western edge of the study area. A second designated asset, the grade II* listed Officers' Barracks is located within the fort just beyond the study area. Twenty-one non-designated heritage assets, dating from the Palaeolithic to modern periods are located within the 1km Study Area. None of these assets are recorded within the Site itself, however historic mapping suggests that the ormer medieval seawall (**MEX6629**) may have once extended across the Site. The significance of those heritage assets which have potential to be affected by the Proposed Development and the potential for previously unknown archaeological remains to survive within the Site are assessed below.

Significance of Designated Assets

- 5.1.2 The Tilbury Fort Scheduled Monument (**NHLE 1021092**) includes the buried remains of an Henrician blockhouse fort, which was replaced by a larger star fort and battery constructed in the late 17th century, which saw alterations in the 19th and 20th centuries. The fort, designed by Sir Bernard de Gomme one of the leading military architects of the period, survives as the best example of a 17th century coastal fort in Britain, exhibiting defensive principles pioneered in the Low Countries with the complicated outer works providing an example of Dutch military design which is extremely rare in England. Tilbury fort has considerable archaeological, architectural and historic interest which contribute to its high heritage significance. The setting of the fort is defined by its strategic location on the north bank of the River Thames, incorporating wide views and fields of fire across the river, originally complementing that of a sister Henrician blockhouse fort at Gravesend, and the landward defences to the rear of the fort, despite being surrounded by modern dockland and industrial development. The inter-relationship of the between the low earthen banks and brick curtain wall, position of the batteries, bastions, outer works and double moat are also part of the setting of the monument and contribute to the understanding of the asset and its significance.
- 5.1.3 The grade II* listed Officers Barracks Tilbury Fort Officers Barracks (**NHLE 1375568**) is located within the Tilbury Fort Schedule Monument, just beyond the study area. The barracks were commissioned by the Ordnance Board in 1772 and are believed to have been constructed in the site of the late 17th century officer range. The barracks originally comprised a terrace of 22, two-storey, officers houses, which were altered to provide seven officers houses during 19th century. The barracks survive as a good example of Ordnance Board housing of the late 17th century and are of additional interest due the terraced plan of the officer quarters. The asset has strong architectural and historical interest, and group value as an integral structure within Tilbury Fort. The setting of the barracks is defined by the interior of the fort and the surrounding brick and earthen defences which make a clear contribution to the high heritage significance of the asset.

Significance of Non-designated Assets

- 5.1.4 The medieval sea wall (**MEX6629**) recorded on the Essex HER towards the eastern extent of the Site would have comprised an earthen bank, which André and Chapman's map of 1777 depicts extending east-west across the Site close to the proposed tunnel shaft and headhouse. No evidence for upstanding earthwork remains were noted during the site walkover and it is likely that any evidence for the seawall within the Site survives as below ground archaeological remains. Earthen seawalls of this type are a common and well understood feature along Britain's coasts and rivers. The asset has modest archaeological and historic interest contributing to the local understand of the reclamation, management and land use of the West Tilbury Marshes from the medieval period onwards. As such the asset is considered to be of low significance.
- 5.1.5 Pillbox (**MEX31812**) is an Essex Lozenge anti-shell design unique to Essex located approximately 100m south of the Site. The pillbox survives as an unusual example of the Second World War

defensive structures along the River Thames and has modest archaeological and historic interest. The setting of the asset is considered to comprise its riverside location provide strategic views and a field of fire across River Thames and the low water line on the approach to batteries at Tilbury Fort as part of the network of defensive structures created to defend the Thames Estuary and London. The pillbox is assessed as being of low heritage significance contributing to local research objectives.

Previous Ground Disturbance

- 5.1.6 The previous ground disturbance of the Site is attributed to a lay down area constructed to the north east of Site, this involved alterations to the ground level and concrete overlain, a coal and fuel waste storage area associated with Tilbury power station was also located to the north east and involved reduction in ground level with concrete formed over. Access roads through the centre of site towards the electrical substation have possibly been constructed below natural ground level. Towards the location of the shaft site, an area of hard standing is visible, it is likely this area contains made ground beneath the concrete. Immediately east of the Site is a small field that appears to have had the ground level raised but it is unknown if the ground below the raise has been affected. East of the Site is another area of raised ground raised but it is unknown if the ground below the raise has been affected. Finally, towards the south east an area of marshland has been quarried which reduced the ground level, which was subsequently reinstated, the process of quarrying is likely to have disturbed the below ground level.

Archaeological Potential

- 5.1.7 The desk-based assessment of baseline archaeological conditions has identified archaeological remains from the Roman and Medieval periods across the Site, with modern archaeological remains towards the west.
- 5.1.8 The assessed archaeological potential of the northern tunnel headhouse and SEC site by period is summarised below:
- **Palaeoenvironmental Remains** – Study of mineral extraction sites and BGS data around the Thames estuary has highlighted presence of at least five peat layers that alternate with sand and clays. These stratigraphic layers sequence the changing sea-level and human occupation of the area during the Holocene period. The Site is therefore considered to have a moderate-high potential for the presence of palaeoenvironmental remains including organic and peat deposits as well as alluvial deposits.
 - **Palaeolithic and Mesolithic** – Archaeological remains from these periods are rare nationally with only one chance find recorded within the study area 800m to the west of the Site boundary. The Site is therefore considered to have a **low** potential for the recovery of Palaeolithic or Mesolithic remains including isolated find of stone tools.
 - **Neolithic and Bronze Age** – While chance finds of lithic artefacts have been recovered from the enclosed fields north of Tilbury Fort approximately 850m north west of the Site boundary. The assessed as having a **low** potential for the survival of Neolithic or Bronze Age artefacts or in situ occupation evidence.
 - **Iron Age and Roman** – There are three findspots of Romano British pottery found within the study area, with a settlement remains dating from the 1st-2nd century 500m east of the Site boundary. The Site is therefore considered to have a **moderate** potential for the discovery of Iron Age or Roman remains associated with the settlement to the east of the Site.
 - **Early-medieval and medieval** – During the early medieval and medieval periods the Site would have been located on low lying marshland to the south of West Tilbury. The medieval sea wall (**MEX6630**), which is not visible above ground is the only recorded archaeological feature dating from this period within the study area. The Site is assessed as having a **moderate** potential for the survival of buried medieval remains associated with the former seawall.

- **Post-medieval** – The Site remained marginal river coastal marsh until the mid-20th century it was then used for the construction of West Tilbury Power Station. 750m to the west Tilbury Fort was constructed in the 16th century and was a permanent fixture to the present. No evidence for post-medieval settlement has been recorded during the desk-based assessment and the Site is therefore assessed as having a **low** potential for the survival of post-medieval remains.
- **Modern** – The Site remained undeveloped agricultural land until the construction of the now demolished West Tilbury Power Station in the late 1950s and 1960s. The north west corner of the Site comprised part of the coal and waste fuel ash storage area of the power station and the proposed tunnel shaft and head house location were developed as hardstanding yard areas associated with the power station. The Site is therefore assessed as having a **low** potential for the survival of remains associated with power station.

5.1.9 This desk-based assessment has identified the known archaeological resource within the study area and has attempted to predict the archaeological potential of the application site. There is, however, still a risk that unexpected archaeological remains of all periods may be discovered within the application site. This risk is inherent with any development project.

Historic Landscape Character

- 5.1.10 The Site falls within the Greater Thames Estuary Character Area which consists of a remote landscape of shallow creeks, drowned estuaries, low-lying islands, mudflats and broad tracts of tidal salt marsh and reclaimed grazing marsh. The Site and study area follow a similar pattern to the character area, which is a combination of wild and remote coastal marshes towards the east and industrial and urban developments to the west (Natural England, 2013). Tilbury was mainly comprised of tidal salt marsh and reclaimed grazing marsh up until the 19th century where it saw intense development in industrial and urban landscape, with the Site located at the eastern edge of the industrial development with former tidal salt marsh to the east exploited for mineral extraction.
- 5.1.11 The Site is located within the Historic Landscape of Thurrock described as a largely urban-edge landscape bordered by former marshes along the Thames. The Site is defined as predominately comprising coastal managed wetland, with industrial to the west, coastal drained enclosure to the north and modern agricultural land to the east. The Site forms part of the industrial character on its western side as part of the former Tilbury power station and extant sealing end compound.
- 5.1.12 The northern and western boundaries of the Site are defined by an access track likely used for Tilbury Power Station, with the west of site forming the concrete surface of the now demolished Tilbury Power Station, and mineral extraction to the east. To the east the site is defined by a drainage ditch on a north-south alignment, beyond which lie restored grassland of the former mineral extraction and waste fuel ash heaps of the power station. A medieval seawall is described within the vicinity but was not visible during the site visit. The characteristically square shape of the land-parcel does reflect the line of the pre-industrial coastline. The layout of the western side of Site has not changed since the establishment of Tilbury Power Station, and the remaining layout has seen little impact from access tracks and footpaths since the post-medieval period and will not change after the development. The historic landscape character of the Site is therefore considered to be of low value and have a low sensitivity to change.
- 5.1.13 Thames forms the main artery for trade and communication between the south east of England and mainland Europe. This has led to the landscape undergoing industrial impacts especially within the post-medieval and modern periods. Mineral extraction is visible towards the east of the Tilbury section of the proposed development. Which has physically altered the landscape from coastal managed wetland to that of an industrial setting (Essex County Council and Kent County Council, 2011).

5.2 Gravesend

- 5.2.1 The desk-based assessment has identified four designated heritage assets all grade II listed buildings within the Study Area. Forty-eight non-designated heritage assets dating from the Neolithic to modern periods are recorded within the Study Area. Of these, a single non-designated heritage asset the post-medieval to modern Milton Rifle Range (TQ 67 SE 1185) extends into the Site. Two further non-designated heritage assets the Thames and Medway Canal (TQ 67 SE 20) and associated swing bridge (TQ 67 SE 49) are located immediately south of the Site boundary. The significance of those heritage assets which have potential to be affected by the Proposed Development and the potential for previously unknown archaeological remains to survive within the Site are assessed below.

Significance of Designated Assets

- 5.2.2 The Readers (**NHLE 1089019**) is a grade II listed building located approximately 750m south of the Site boundary. The building comprises a T-shaped timber-framed house with roughcast infilling and curved braces on the first floor. It is thought to have originated as a 15th or 16th century hall house with the roof retaining its smoke louvres. The heritage significance of the asset is derived from its architectural and historic interest, within its suburban corner plot setting, surrounded by mixed modern residential housing adding little to its significance. As a result, Readers is assessed as being of medium heritage significance.
- 5.2.3 54-58 Vicarage Lane (**NHLE 1089005**) is a grade II listed range of three 18th century cottages located approximately 900m south of the Site boundary. The two southern cottages were originally a farmhouse, with the northmost cottage being a later addition. The cottages have a functional relationship as a group, as well as their architectural and historic interest. The setting of the cottages is suburban within modern residential development. The asset is therefore assessed as being of medium heritage significance.
- 5.2.4 1 Chalk Road (**NHLE 1089043**) is a grade II listed building approximately 1km south of the EIA Screening Boundary and is an early 19th century cottage with weatherboarding to its northern and southern faces. Architectural features including two sash windows with intact glazing bars, doorcase with a small flat hood supported on brackets and a four panelled door, survive. Above the door is a small tablet with a mask of Dickens and the inscription “*Charles Dickens, Born 1812, Died 1870 spent his honeymoon in this house (1836)*”. The significance of the building is derived from its architectural interest and local vernacular style and the historical association with Charles Dickens and Kate Hogarth, and the attribution that early chapters of ‘*Pickwick*’ were written at the property. The setting of the asset comprises a suburban area with later houses and roads being constructed around it. The setting provides context for residential development throughout the 20th century but adds little to the significance of the asset, which is assessed as being of medium heritage significance.
- 5.2.5 The grade II listed 44 Chalk Road (**NHLE 1341493**) is situated approximately 1km south of the Site boundary. A red brick 18th century farmhouse of two storeys plus attics, tiled hipped roof with three hipped dormer windows, surviving architectural features such as moulded wooden eaves cornice, five sash windows with intact glazing bars, doorcase with rectangular fanlight and flat hood over supported on brackets provide the architectural interest of the asset. Its historic interest is enhanced by the claim that this may also have been Dickens honeymoon cottage. The setting of the asset comprises a suburban area surrounded by later modern residential buildings in addition to an industrial building 40m to the north west. The setting provides context for residential development throughout the 20th century, but adds little to the significance of the asset, which is assessed as being of medium heritage significance.

Significance of Non-designated Assets

- 5.2.6 There is one extant non-designated heritage asset within the Site identified from HER data and cartographic sources.
- 5.2.7 Milton Rifle Range (**TQ 67 SE 1185**) is located at the eastern boundary of Site and extends 980m to the east along the Eastcourt Marshes. The setting of the asset comprises an open field with access tracks and shooting ranges across the lower half of the field. The setting provides context for use of the Eastcourt Marshes from the Post-medieval period which has mostly remained open fields and agricultural land. The Site is considered to contribute to the special interest or setting of the asset as existing pylons are visible running across the south west corner of the rifle range, however the proposed development will not alter this setting.

Previous Ground Disturbance

- 5.2.8 The previous ground disturbance of the Site is attributed to the creation of Milton Rifle Range (**TQ 67 SE 1185**) and the construction of the existing Eastcourt Marshes Electricity Substation and corresponding overhead power line pylons. The topography of the Site consists of relatively flat ground across the area with a gentle sloping north to the Thames foreshore. Ground disturbance is relatively minor across the site with the impacts of the rifle range and electricity substation focused towards the northern and eastern extent of the Site. While Milton Rifle Range forms the eastern boundary of the Site, a portion of the south west corner of Milton Rifle Range will form the location of a new line of overhead power lines and corresponding pylons.

Archaeological Potential

- 5.2.9 The desk-based assessment of baseline archaeological conditions has identified no known evidence for archaeological remains predating the late post-medieval period within the Site.
- 5.2.10 The assessed archaeological potential of the southern tunnel headhouse and SEC site by period is summarised below:
- **Paleoenvironmental Remains** – Study of mineral extraction sites and BGS data around the Thames estuary has highlighted presence of at least five peat layers that alternate with sand and clays. These stratigraphic layers sequence the changing sea-level and human occupation of the area during the Holocene period. The Site is therefore considered to have a **moderate to high** potential for the presence of paleoenvironmental remains including organic and peat deposits as well as alluvial deposits.
 - **Palaeolithic and Mesolithic** – Archaeological remains from these periods are rare nationally and no heritage assets dating to the Palaeolithic or Mesolithic are recorded within the study area. The Site is therefore considered to have a **low** potential for the recovery of Palaeolithic or Mesolithic remains including isolated find of stone tools.
 - **Neolithic and Bronze Age** – One Neolithic chance find of lithic artefacts has been recovered 780m south west of the EIA Screening Boundary within the study area suggesting that the site has a **low** potential for the recovery of Neolithic or Bronze Age artefacts or in situ occupation evidence.
 - **Iron Age and Roman** – Iron Age archaeological evidence was found 780m south of the EIA Screening Boundary consisting of pottery, animal bones and structural daub (**TQ 67 SE 238**) and (**TQ 67 SE 239**). Roman archaeological remains were found 490m south west and 1km south of the Site boundary. The archaeological evidence found to the south of was associated with Chalk Villa and those to the south west were Roman material culture, however both of these concentrations are located at some distance from the Site. The Site is therefore considered to have a **low** potential for the discovery of Iron Age or Roman remains.
 - **Early-medieval and medieval** – During the early medieval and medieval periods the Site would have been located on drained marshland used for agricultural purposes east of Gravesend. Archaeological remains are recorded within the study area, with medieval ridge

and furrow observed 200m west of the Site boundary. The Site is assessed as having a **low** potential for the survival of early medieval and medieval remains.

- **Post-medieval** – The Site remained marginal river marsh until the end of the 19th century it was subsequently used to construct the Milton Rifle Range. It is therefore assessed as having a **low** potential for the survival of post-medieval agricultural or settlement remains. However, there is a **high** potential for the survival of remains associated with the earthen firing positions and 19th century operation of the Milton Rifle Range.
- **Modern** – No non-designated heritage assets are recorded within the Site. The Eastcourt Marshes Electricity Substation was built in the 20th century to the immediate west of Milton Rifle Range which sees use to the present day as part of the Metropolitan Police Specialist Training. The proposed location of the headhouse and SEC remain grassland within the enclosed marshland. The Site is therefore assessed as having a **low** potential for the survival of remains associated with Milton Rifle Range.

- 5.2.11 This desk-based assessment has identified the known archaeological resource within the study area and has attempted to predict the archaeological potential of the application site. There is, however, still a risk that unexpected archaeological remains of all periods may be discovered within the application site. This risk is inherent with any development project.

Historic Landscape Character

- 5.2.12 The Site falls within the Greater Thames Estuary Character Area which consists of a remote landscape of shallow creeks, drowned estuaries, low-lying islands, mudflats and broad tracts of tidal salt marsh and reclaimed grazing marsh. The Site and study area follow a similar pattern to the character area, which is a combination of wild and remote coastal marshes towards the east utilised as the Milton Rifle Range and industrial and urban developments to the west (Natural England, 2013). Gravesend was mainly comprised of tidal salt marsh and reclaimed agricultural land to the east, with urban and industrial development to the west of the Site. The Site is located at the eastern edge of the industrial development with reclaimed marshland used for agriculture to the east (Kent County Council 2001).
- 5.2.13 The Site is located within the Historic Landscape character area of Northern Coast and Marshland described as a balanced mix of reclaimed marsh and coastal landscape. The Site is defined as predominately comprising reclaimed marshland which extends eastward, with industrial to the west and enclosed agricultural fields to the south and. The Site forms part of the small regular enclosures derived from reclaimed marsh character which can be seen extending eastwards along the Thames foreshore.
- 5.2.14 The eastern, northern and western boundaries of the Site are defined by an access track likely used for the Eastcourt Marshes Electricity Substation and a boundary between the substation and Milton Rifle Range. To the south the site is defined by an access road on an east-west alignment, which is adjacent to the Thames and Medway Canal to the south. The characteristically rectangular shape of the land-parcel does reflect the line of the pre-industrial coastline. The historic layout of the Site has not changed since the establishment of Eastcourt Marshes Electricity Substation, and the remaining layout has seen little impact from access tracks, field boundaries and footpaths since the post-medieval period and will not change after the development. The historic landscape character of the Site is therefore considered to be of low value and have a **low** sensitivity to change.

6 Impact Assessment

6.1 The Proposed Development

6.1.1 The Proposed Development comprises:

- The boring of a new approximately 2.14km long (from headhouse to headhouse), 5m diameter tunnel crossing the River Thames, parallel to the existing tunnel;
- Installations of new XLPE cable in tunnel with two cables per phase; and
- Associated infrastructure including two new tunnel shafts and headhouses, two new cable sealing end compounds and overhead line modifications to the existing overhead lines.

6.1.2 Eastcourt Marshes Electrical Substation on the Gravesend side of the Thames and the existing sealing compound on the Tilbury side of the Thames are to remain in place and form connections for these works.

6.1.3 Potential effects arising from construction of the Proposed Development could comprise physical impacts to buried archaeological remains and changes to the setting of heritage assets.

6.1.4 The principal impacts will include excavation of the launch shaft at Tilbury and receptor shaft at Gravesend, groundworks and foundations for the new headhouses and SEC compounds, any ground reduction required to create soil storage areas or construction compound at the Gravesend Site and the introduction of new pylons and gantries.

6.1.5 The excavation of the proposed replacement tunnel through will not result in any impact as the chalk is 65 million years old and archaeologically sterile.

6.2 Tilbury – Northern Tunnel Headhouse and SEC Compound

Designated Assets

6.2.1 The Tilbury Fort Scheduled Monument (**NHLE 1021092**) is located approximately 750m west of the proposed northern headhouse and SEC site and will not experience any physical impacts as a result of construction of the Proposed Development. The Site is not considered to form part of the setting of the monument, although the existing electricity pylons are visible on the eastern skyline of the asset. The use of cranes and other plant during construction of the tunnel launch shaft and the dismantling and construction of new pylons and gantries may introduce temporary visual, aural and lighting intrusion to the wider setting of the Tilbury Fort Scheduled Monument. The magnitude of change against the existing backdrop of industrial and port activity surrounding the fort would be minimal and these temporary changes to setting would not affect the significance of the asset, or the ability to appreciate and understand the Scheduled Monument. There will be no setting impacts arising from the operation of the Proposed Development.

6.2.2 Located within Tilbury Fort, but just beyond the 1km study area, the grade II* listed Officers Barracks will similarly not experience any physical impact from the Proposed Development. In addition, the setting of the barracks is defined by its location within and integral relationship with Tilbury Fort. There is no intervisibility with the Site and construction of the proposed Development will not alter the setting of the monument either during construction or its operational use.

Non-Designated Assets

6.2.3 There are two non-designated building within the Site, with potential for physical impacts to the medieval sea wall (**MEX6629**). Historic mapping depicts the line of the seawall extending across the

Site in the general area just south of the proposed headhouse and SEC compound. No evidence for the earthwork remains of the sea wall was visible during the site walkover and is it possible that any surviving buried remains within the footprint of the Proposed Development could be partially removed or disturbed by the excavation of the proposed northern tunnel shaft. Tilbury Power Station (**MEX1032967**) was demolished in 1999, study of contemporary maps shows that the concrete floor of the power station is extant towards the western side of the Site. This area of the Proposed development is planned to be used as a lay down area, as such it is not considered that the setting, or the ability to appreciate or understand the asset will be impacted either during construction or operation of the Proposed Development.

- 6.2.4 The Second World War pillbox (**MEX31812**) located approximately 100m south of the Proposed Development will not experience any physical impacts. The site does not form part of the setting of this non-designated asset, and it is separated from the Site by a high modern concrete seawall. While it is possible that occasional temporary construction noise may be experienced at the pill box, it is not considered that the setting, or the ability to appreciate or understand the asset will be impacted either during construction or operation of the Proposed Development.

Potential Archaeological Remains

- 6.2.5 The physical impacts of the Proposed Development involve the excavation of the tunnel launch shaft, reduction in ground level for the headhouse, SEC compound and new pylon foundations, removal of existing overhead pylons with erection of new pylons. These physical impacts have potential to impact any currently unknown archaeological remains surviving within their footprint.
- 6.2.6 Principal amongst these is the potential to remove the entirety of the paleoenvironmental sequence within the proposed tunnel shaft. This may include peat deposits dating to the Holocene period which have potential to contain important evidence for sea-level change and potential human interaction with the landscape during the last 10,000 years. Understanding of the marshes around Tilbury remains limited, impact upon these which the Site lies partially upon would reduce the ability to understand their significance (Essex County Council and Kent County Council (2011)).

Historic Landscape Character

- 6.2.7 The Site itself is located in an industrial landscape to the east used for the now decommissioned and demolished Tilbury Power Station, Tilbury Substation to the north and open managed wetland marsh to the east which has seen partial utilisation for mineral extraction and material storage. It is now utilised in part as an access road to the existing sealing compound, as well as areas of industrial and unused land. As the Site is currently within a wider industrial landscape, it is unlikely that the historic landscape character will alter with the proposed works.

6.3 Gravesend – Southern Tunnel Headhouse and SEC Compound

Designated Assets

- 6.3.1 There are no designated assets located within the Site, with the four grade two listed buildings identified within the surrounding 1km study area, all located at some distance from the Proposed Development. Therefore there will be no potential for physical impacts to any designated assets.
- 6.3.2 The four listed buildings within the 1km study area, The Readers (NHLE 1089019), 54-58 Vicarage Lane (NHLE 1089005), 44 Chalk Road (NHLE 1341493) and 1 Chalk Road (NHLE 1089043), are all located between 850m-1km from the Site. All the assets are located within a suburban setting and are surrounded by a mix of modern housing. None of the assets share intervisibility with the Site, which does not form part of their setting. The use of cranes and other plant during construction of the tunnel receptor shaft and the dismantling and construction of new pylons and gantries at the Gravesend Site will not result in changes to the setting or significance of the four grade II listed buildings,

Similarly, there will be no setting impacts on these assets arising from the operation of the Proposed Development.

Non-Designated Assets

- 6.3.3 A single non-designated asset, the western extent of the post-medieval and modern Milton Rifle Range (TQ 67 SE 1185) is recorded extending across the Site. In addition, two further non-designated assets the Thames and Medway Canal (TQ 67 SE 20) and an associated swing bridge (TQ 67 SE 49) are located immediately to the south of the Site.
- 6.3.4 Excavation of the tunnel receptor shaft and ground reduction of construction of the headhouse and SEC compound has the potential to partially remove or disturb any surviving earthwork or buried remains associated with former western end of the Milton Rifle Range (TQ 67 SE 1185). The loss or disturbance of any surviving elements of the Rifle Range within the Site would represent a minor impact on this larger, well surviving and well understood non-designated heritage asset. There will be no further impact on this asset during the operation of the Proposed Development.
- 6.3.5 The Thames and Medway Canal (TQ 67 SE 20) and an associated swing bridge (TQ 67 SE 49) are located beyond the limits of the Proposed Development and will not experience any physical impacts arising from construction or operation of the Scheme. The setting of these two non-designated assets is derived from their interrelationship, the linear form of the canal and the spatial relationship with the River Thames and the former naval dockyards at Deptford and Woolwich Dockyards to Chatham Dockyard. The Gravesend site does not form part of the setting of these assets and the temporary, localised changes arising from construction plant, noise and lighting to this much larger linear asset will not affect the setting or significance of the canal or swing bridge and the ability to appreciate these assets will be unaffected by construction of the proposed development. There will be no further impact on this asset during the operation of the Proposed Development.

Potential Archaeological Remains

- 6.3.6 The physical impacts of the proposed development involve the reduction in ground level for the headhouse, groundworks required to prepare laydown and soil storage areas, excavation of the tunnel shaft and construction of foundations for new power pylons as well as the removal of existing pylons.
- 6.3.7 There is the potential for previously unrecorded archaeological remains to survive within the Site boundary. The recording of Roman salterns within the study area along the Thames foreshore and given the prevalence for salterns or 'red mounds' within the county could indicate the potential for more Roman archaeology within the Site. The recording of ridge and furrow from the medieval/post-medieval period 160m west of the EIA Screening Boundary could indicate the potential for more ridge and furrow within the Site.
- 6.3.8 The removal of existing overhead power line pylons and restringing of overhead lines to the proposed new pylons will not impact the surface earthworks or buried remains of the Milton Rifle Range (TQ 67 SE 1185).
- 6.3.9 The physical impacts have potential to remove part or the entirety of the paleoenvironmental sequence within the footprint of the southern tunnel shaft, which is likely to include peat deposits from the Holocene period. The buried alluvial sequence within the Site has the potential to and provide important evidence on sea-level change and potential human interaction with the landscape during the last 10,000 years. Understanding of the marshes around Tilbury remains limited, impact upon these which the Site lies partially upon would reduce the ability to understand their significance (Essex County Council and Kent County Council (2011)).

Historic Landscape Character

- 6.3.10 The Site itself is located in an open, managed coastal wetland landscape with an industrial landscape immediately to the west with the Metropolitan Police Speciality Training Centre at the

western edge of the Site boundary. The Site also contains elements of industry with the extant Eastcourt Marshes Electricity Substation towards the north of the Site and Thameside National Maritime Training Centre located at the south west corner of the Site. As the Site is currently within a wider industrial landscape, it is unlikely that the historic landscape character will alter with the proposed works, with the new overhead power lines and associated pylons replacing existing albeit in a slightly different location within the Site.

7 Conclusions and Recommendations

- 7.1.1 AECOM has been commissioned by National Grid to undertake a Heritage Desk-based assessment (DBA) to inform the Environmental Screening Report regarding the Proposed Development.
- 7.1.2 This DBA first sets out the heritage baseline for the Site in order to identify all known designated and non-designated heritage assets within the study area, to determine the potential for as yet unknown buried archaeological remains to be present within the Site, and to identify heritage assets within the study area that may be impacted by the Proposed Development as a result of change within their setting.
- 7.1.3 Finally, this assessment has assessed the historic landscape within the Site and surrounding study area and determined its sensitivity to change and provided an impact assessment for both built heritage assets and buried archaeological remains. The aims and purpose of the Desk-Based Assessment have been met in accordance with the ClfA Standard and guidance for historic environment desk-based assessment (ClfA 2020).

7.1 Tilbury - Headhouse and SEC Compound

- 7.1.1 There are 25 non-designated heritage assets recorded within the 1km study area around the Tilbury section of the proposed development.
- 7.1.2 There are no scheduled monuments, or designated heritage assets within the Site. There are two non-designated heritage assets within the Site, the now demolished Tilbury Power Station (**MEX1032967**) and Roman pottery findspot (**MEX6254**). Roman findspots (**MEX6630**) and (**MEX6255**), as well as a Roman settlement (**MEX6102**) were located south and east of the Site boundary respectively. There is potential for the concrete floor of the now-demolished Tilbury Power Station to be impacted, however the Proposed Development denotes this area as a lay down area, as such it is unlikely there would be any physical impacts on this asset. There is potential for unknown archaeological remains to survive within the Site related to Roman archaeology found to the east of Site. These areas of potential buried archaeological remains could undergo physical impacts during the construction of the proposed development. Any surviving features would be physically affected by the construction of the proposed development, namely the construction of the tunnel shaft, headhouse and groundworks to facilitate the construction of the proposed development. There is also potential for the continuation of the medieval sea wall (**MEX6629**) which is recorded 70m east of the EIA Screening Boundary into the Site, any surviving sections of the sea wall below ground level have the potential to be physically affected by the proposed development.
- 7.1.3 There is potential to remove part or the entirety of the paleoenvironmental sequence within the Site during the construction of the tunnel shaft, which given the proximity to the Thames foreshore would be of significance as peat deposits are noted from the Holocene period and provide important information on sea-level change and potential human interaction with the landscape during the last 10,000 years. Understanding of the marshes around Tilbury remains limited, impacts upon the marshes which the Site lies partially upon would reduce the ability to understand their significance.
- 7.1.4 There is one scheduled monument within 1km of the study area and one grade II* one listed building within 1.1km of the study which share unique setting and characteristics. Tilbury Fort (**NHLE1021092**) and Officer Barracks at Tilbury Fort (**NHLE13755688**) both located to the east of

the study area. Due to the urban nature of the landscape which surrounds the assets and the distance from the Site, the proposed development is not thought to significantly change the setting of the scheduled monument and listed building. There may be views of the proposed development from the top of the fort over the industrial landscape to the site although it is considered this would not result in a significant change to the setting.

- 7.1.5 Further assessment of potential impact upon the archaeological and paleoarchaeological resource within the Site should be undertaken in the form of intrusive evaluation and investigation. Given the high potential for made ground and overlying building surfaces i.e. concrete lay down areas, geophysical (magnetometer) survey is unlikely to provide beneficial results due to interference from the aforementioned constraints. Given the Site's location along the Thames estuary and its important palaeoenvironmental deposits, it is recommended that a series of geoarchaeological ground investigations take place in the form of boreholes. If this geoarchaeological investigation is not feasible, study of the Client's or Contractor's ground investigation data could be used to understand the presence and significance of any buried organic deposits or deposits of geological interest. Where feasible a series of archaeological intrusive evaluation can be undertaken, this evaluation will inform the understanding of the presence/absence, extent, date, depth, preservation and significance of surviving archaeological remains within the site. The results of geoarchaeological investigation and archaeological evaluation will also inform the requirement for scoping and specification of any archaeological mitigation measures to reduce the impacts of the Proposed Development.

7.2 Gravesend - Headhouse and SEC Compound

- 7.2.1 There are 54 non-designated assets recorded within the 1km study area around Gravesend section of the proposed development.
- 7.2.2 There are no designated or non-designated heritage assets within the Site. Undated but believed to be Late Iron Age/Roman salt works are recorded **(TQ 67 SE 1013)** 120m west and **(TQ 67 SE 1014)** 330m south east of the EIA Screening Boundary respectively, given the prevalence of salterns or 'red hill' sites along the Thames foreshore there is potential for as yet unknown below ground archaeology relating to this activity to be located within the site. Maritime related non-designated assets such as a possible ballast wreck **(TQ 67 SE 1044)** and concrete platforms **(TQ 67 SE 1045)** located 40m north west of the EIA Screening Boundary on the Thames foreshore will not be impacted by the proposed development. Milton Rifle Range **(TQ 67 SE 1185)** located immediately east of the EIA Screening Boundary has the potential to be affected by the proposed development, specifically the removal of existing overhead pylons and the installation of new ones directly to the south. While the asset as a whole has potential to be affected, much of the land in which the new pylons will occupy is open field, however shooting stands such as **(TQ 67 SE 1252)** which is located within Milton Rifle Range but below ground level could be affected as they have potential to be within the area of overhead cabling. Ridge and furrow **(TQ 67 DE 1019)** located 170m west of the EIA Screening Boundary has the potential to extend eastwards into the Site, albeit below current ground level.
- 7.2.3 There is potential to remove part or the entirety of the paleoenvironmental sequence within the Site during the construction of the tunnel shaft, which given the proximity to the Thames foreshore would be of significance as peat deposits are noted from the Holocene period and provide important information on sea-level change and potential human interaction with the landscape during the last 10,000 years. Understanding of the marshes around Tilbury remains limited, impact upon these which the Site lies partially upon would reduce the ability to understand their significance.
- 7.2.4 There are four grade II listed buildings within the 1km study area, 54-58 Vicarage Lane **(NHLE1089005)**, Readers Lower Higham Road **(NHLE1089019)**, 1 Chalk Road **(NHLE1089043)** and 44 Chalk Road **(NHLE131493)** which are located between 820-940m south of the Site. Due to the urban natures of the area and distance from the Site, the presence of the proposed development is not thought to significantly change the setting of the listed buildings.

- 7.2.5 Further assessment of potential impacts upon the potential archaeological resource within the Site should be undertaken in the form of non-intrusive and intrusive archaeological evaluation. A programme Geophysical (magnetometer) survey followed by archaeological trial trenching in order to further understand the potential for survival of previously unrecorded archaeology remains within the Site and to particularly confirm the presence/absence of remains associated with the nearby salterns found to the west and south east of the Site. This potential scope of works should be undertaken within the EIA Screening Boundary on visible green space and not where the current electrical substation is situated. The overhead power line removal and new power line installation should be undertaken under archaeological watching brief as its ground impact is likely to be less than that of the headhouse, construction of laydown and storage areas and the excavation of the tunnel shaft. The tunnel shaft excavation has potential to impact on important geoarchaeological evidence of the Thames Estuary, and should be excavated under geoarchaeological watching brief. The results of the archaeological evaluation and watching brief would inform the need for, and appropriate scope of any detailed archaeology mitigation works (e.g. archaeological excavation or further archaeological monitoring). The requirement for, and timing of, any further archaeological works will be determined in consultation with the County Archaeologist following the results of this initial desk-based assessment.
- 7.2.6 Further assessment of potential impact upon the archaeological and paleoarchaeological resource within the Site should be undertaken in the form of intrusive evaluation and investigation. Given the high potential for made ground and overlying building surfaces i.e. concrete lay down areas, geophysical (magnetometer) survey is unlikely to provide beneficial results due to interference from the aforementioned constraints. Given the Site's location along the Thames estuary and its important palaeoenvironmental deposits, it is recommended that a series of geoarchaeological ground investigations take place in the form of boreholes. If this geoarchaeological investigation is not feasible, study of the Client's or Contractor's ground investigation data could be used to understand the presence and significance of any buried organic deposits or deposits of geological interest. Where feasible a series of archaeological intrusive evaluation can be undertaken, this evaluation will inform the understanding of the presence/absence, extent, date, depth, preservation and significance of surviving archaeological remains within the site. The results of geoarchaeological investigation and archaeological evaluation will also inform the requirement for scoping and specification of any archaeological mitigation measures to reduce the impacts of the Proposed Development.

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Appendix A Tilbury Gazetteers of Heritage Assets

Gazetteer of Designated Heritage Assets

Asset ID (NHLE)	Designation	Grade	Name	Period	Description	NGR
1375568	Listed Building	II*	Officers Barracks Tilbury Fort	Believed to have been rebuilt on the site of the late C17 officers' range, itself rebuilt in 1742, and is a good and rare example of Ordnance Board housing at this time. It is also of interest for its use of the terrace plan for providing officers' lodgings. Part of one of the finest and most complete late C17 forts in England, it is listed as a free-standing building independent from the Scheduled fortifications and attached structures.	Post-medieval	TQ 65154 75336
1021092	Scheduled Monument	N/A	Tilbury Fort	A late 17th century coastal fort, designed at a time when artillery had become the dominant feature of warfare and therefore built with massive low earthworks, resilient to the shock of bombardment, instead of stone fortifications. The layout and construction was geared to the optimum siting of cannon at the forward batteries which, in conjunction with batteries on the opposing bank of the Thames, could create a field of fire spanning the estuary providing defence for the river itself and the capital. The systems of bastions and complicated outworks defending the batteries from the rear is principally a Dutch design, extremely rare in England, and Tilbury is the best preserved and most complete example of the type.	Post-medieval	TQ 65152 75504

Gazetteer of Non-Designated Heritage Assets

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
MEX6025	Burial	West Tilbury	Roman burials with iron and bronze bracelets found 1910 at West Tilbury. Approximate location given	Roman	TQ 66000 77000
MEX6047	Road; Ditch	Tilbury Fort, West Tilbury	The earliest road and causeway was located on the redan outwork. There was no dating evidence but a map of 1588 shows a north-south road here running to the ferry which was originally beside the Henrician blockhouse. "It may well have been the route to the ferry from West Tilbury village before the 16th century". Two posts were found below the road, which "presumably were associated with the earlier use of the marsh". There was a substantial ditch on both sides of the road.	Medieval	TQ 65147 75477
MEX6052	Battery	Tilbury Fort	By 1905 "Tilbury had been provided with two 6in breach loading converted guns in the south-east bastion and four 12-pounder quick firing on the curtain, their concrete emplacements being built over earlier RML positions". The guns stayed until after World War II. The fort was used as a mobilisation store (part of the London Mobilisation Centre scheme) between 1889 and 1903. A 19th century date as well as 20th century that were part of the foundations for the redevelopment of the fort.	Modern	TQ 65147 75477
MEX6102	Settlement; Hut Circle; Wood; Floor; Oven; Trackway	East Tilbury Foreshore	Below 'present' high tide level, remains of settlement of hut circles, associated with much 1st-2nd century pottery. In 1920 3 adjacent huts and fragmentary remains of a 4th nearby were visible. The two largest circles had 3 rings of stakes forming a frame for wattlework which was still preserved below the mud. Between the 2 inmost stake rings were the remains of a stone ring, a similar ring seemed to have been outside the outer stake ring. One hut had traces of a partition, another had a small circular platform in the middle, probably a support for a central pole. The latter hut had a piece of floor-planking, close by this were foundations for an oven with hard clay walls, no indication of its function however. The smallest circle appeared to have an entrance marked by two thick posts. In and around the huts were fragments of clay daub for covering walls. The stone rings can't have gone up to a great height. Many roofing tile fragments may indicate roofing. East of the huts, a shallow channel ran north east-south west with traces of flanking stakes. This may have been a former trackway from the old river edge. The foreshore for c100yds either side of the huts was covered with pottery, including 1st-2nd century Samian. Most pottery was "of native type, with marked late Celtic elements"-eg cordons, bosses, incised linear patterns-"and represents the production of native manufacturers working under Roman influence". No wasters were noticed, there was no evidence that pottery was made on the site. The site "may have been a landing-place for traffic from Kent or elsewhere", the amount of pottery "seems excessive for the ordinary requirements of a small hut settlement".	Roman	TQ 67290 75645
MEX6254	Findspot	West Tilbury - Foreshore	Found 1968(?), Romano British pottery rim sherd.	Roman	TQ 66600 75500
MEX6255	Findspot	West Tilbury	Roman Samian ware found in 1912 on banks of Thames, c1 mile east of Tilbury fort. Evidently to be connected with site at East Tilbury (see TQ67-008, 1694). Much pottery found in 1912, including Samian, 'Salopian' and 'Durobrivian' wares. Most of them belonged to the 2nd half of the 1st century. In number this exceeds many important forts.	Roman	TQ 66700 75600

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
MEX6469	Findspot	Find from Tilbury Fort, West Tilbury	Worked flint found, possibly Palaeolithic. A Palaeolithic implement found at Tilbury dock in 1913 now in the British Museum is possibly from this same site.	Palaeolithic	TQ 65200 75300
MEX6567	Findspot	West Tilbury Marsh	Neolithic flint axe from West Tilbury marsh. In Thurrock Museum. Also at Thurrock, polished flint axe from the Thames at Tilbury.	Neolithic	TQ 65200 76000
MEX6627	House	Tilbury – Wick House	Wick House.	Unknown	TQ 66461 76046
MEX6629	Sea Defences	Tilbury	Medieval sea wall.	Medieval	TQ 66552 75754
MEX6630	Findspot	Tilbury Foreshore	Roman pottery reported from foreshore along frontage. Notable collection of RB Burial material by P Benton of Southend-on-Sea..	Roman	TQ 66500 75400
MEX6632	Saltern; Red Hill	West side of East Tilbury Marshes	Potential red hill, Briquetage and sherds	Unknown	TQ 67131 76518
MEX31803	Spigot Mortar Emplacement	Spigot Mortar Base, NW Bastion, Tilbury	The NW bastion of Tilbury Fort has a spigot mortar pedestal positioned just 2' from the northern wall. The wall is only 56" high and the pedestal has been built so that the pintle is 6" below the top of it - the 29mm mortar would have been able to fire northwards across the parapet. The pintle is typically in fine condition but the iron cage inside the pedestal is now showing through the top as the concrete has deteriorated.	Modern	TQ 65147 75477
MEX31804	Spigot Mortar Emplacement	Spigot Mortar Base, SE Bastion, Tilbury Fort	The SE bastion of Tilbury Fort has two pre-WWII 6" gun pits and the eastern pit has been converted to a spigot mortar position. The pit is constructed of concrete and is 12' in diameter. In the centre a 7' square x 2' high concrete platform has been constructed. On top of this a standard spigot mortar pedestal has been built so that the stainless steel pintle is 6" below the level of the parapet. Thus the mortar could have fired across the parapet onto the eastern approaches and the Thames. The iron cage inside the pedestal is now showing through due to deterioration of the concrete	Modern	TQ 65147 75477
MEX31805	Road Barrier	Road Barrier (destroyed), Near Level Crossing, Fort Road, West Tilbury	Contemporary records state, "Blocks and sockets. Near Level Crossing Fort Road. This is thought to mean Fort Road. However, the road now crosses the railway via a bridge constructed 70 yards to the NE. The level crossing no longer remains and no blocks or sockets were found at the time of the site visit. An aerial photograph taken in April 1944 clearly shows this road barrier crossing Fort Road. Five anti-tank cubes can be seen on the W side of the road between a wide ditch and the carriageway, and two more are between the carriageway and a similar ditch on the E side. All the cubes form a straight line. The ditches are extensive across the nearby terrain and were clearly excavated as anti-tank barriers and anti-glider ditches	Modern	TQ 65302 76379

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
MEX31806	Tett Turret?; Alan Williams Turret?	Turret (destroyed), Allotments, Fort Road	Turret. Allotments, Fort Road. Map ref. 096951" (Mil.Ed.). These allotments were to the NE of the former level crossing which no longer exists and a new road bridge now crosses the site of the allotments. It is not known which type of turret this entry refers to.	Modern	TQ 65336 76429
MEX31812	Pillbox	Pillbox, South of Tilbury Power Station	An unusual pillbox standing on the mud at the river's edge. A 28' long x 15' wide double-ended octagon with the entrance on the W side - but built 3' high on top and across the middle is a 22" thick wall. This was probably intended as an extra firing position. This wall projects some 5' each side of the pillbox. The entire structure is now sinking into the mud which has filled the interior.	Modern	TQ 66320 75360
MEX39665	Oyster Beds	Oyster Beds east of Tilbury Power Station	A linear series of oyster beds appearing on vertical aerial photography from 1953 and 1955 (RAF 1953 series is low level and shows good detail).	Unknown	TQ 67001 76281
MEX39674	Aircraft Obstruction	Anti-glider ditches SE of Bowaters Farm	Spread of anti-glider ditches to the North and North-East of Tilbury Power Station.	Modern	TQ 66053 76835
MEX41440	Blockhouse; Fort; Chapel; Gatehouse; Bastion Outwork; Battery; Road; Ditch;	Tilbury Fort	16th C, rebuilt 1672 in quadrangular form with salient angle bastions and a double moat. Much of the rampart walls are of 17th century brick but the only, more or less, unaltered buildings are the south gatehouse and a small chapel. The former is 2-storied and has an inscription. The chapel on the north side of the fort is small, 17th century built brick. Built in 1682 against the Dutch and French, primarily utilitarian, but also for display. The south gateway is similar to one at Plymouth Citadel, the type derives from 17th C France. Site of a blockhouse of Henry VIII, c1540, was the scene of the review of troops by Elizabeth I in 1588. Under Charles II it became a regular fort, armed and bastioned, in 1667. Its armament was reduced in 1716, by 1859 it had been reduced to 32 guns. It was extended in 1861, the 17th century powder tower was demolished to be replaced by a new magazine and a new battery was installed. By 1867 it was being re-armed with heavy, rifled guns - a process that was not finished until 1888. Under the urging of General Gordon (Commander, Royal Engineers from 1866), new earthworks were built to take brick embrasures though not all were occupied, it seems. By 1905 the fort had been provided with 2 6" converted breech-loaders and 4 12-pounder quick-firing guns, which remained until after World War II. In the 1890s the fort was one of the mobilisation centres for the London Defence Positions, existing ordnance stores being used	Post-medieval	TQ 65147 75477
MEX1032122	Findspot	East or West Tilbury	Fragment of a Roman lamp with lion relief. Site not plotted, exact location unknown.	Roman	TQ 66000 77000
MEX1032745	Pipeline	Stanford Le Hope STW Water Pipeline	A watching brief was carried out along the length of the pipeline which stretched approximately 7km from a point to the north-east of Tilbury Fort to the sewage works off Broad Hope Road, north-east of Stanford Le Hope. the width of the pipeline easement was 20m. No surviving archaeological remains were encountered. the pipeline passed	Modern	TQ 663 761

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
			close by several sites of archaeological importance. In several places the topsoil strip revealed areas that had been heavily disturbed by modern activity.		
MEX1032967	Coal Fired Power Station; Oil Fired Power Station	Tilbury Power Station	Located on north bank of Thames Estuary and forms part of Thames corridor industrial landscape. Two power stations A and B, each with full complement of ancillary buildings. Tilbury A is similar in layout to many mid twentieth century power stations with boilers and related plant located in long rectangular building; attached to one side is the parallel Turbine Hall. Site laid out to face Thames, with offices and control rooms in range around quadrangle attached to south end of much larger boiler house. Coal and oil was delivered by ships to a reinforced concrete jetty built parallel to shore. Tilbury B dwarfs the earlier station. When built Tilbury B was cited as a prototype of the forthcoming generation of 2000MW power stations. Architecturally similar to other power stations of the period. Overall layout similar to Tilbury A with taller Boiler House orientated N/S to west of adjoining Turbine Hall and with Offices and Control Rooms at south end. Tilbury A first planned by County of London Electricity Supply Co in 1947 and completed for CEGB in 1958. Tilbury B completed 1969. The boilers in A and B were built to burn coal but were soon adapted to burn heavy oil.	Modern	TQ 65987 75917
MEX1036402	Landing Stage; Ferry Terminal	Tilbury landing stage and passenger terminal	Description of passenger Ferry terminal building from 1928.	Modern	TQ 67300 75100
MEX1037738	Farm; Open Site	Biosolids Dryer at Tilbury sewage works	A desk based assessment and Borehole survey were carried out in advance of a proposed biosolid dryer at Tilbury. No archaeological remains were uncovered and the impact on the surrounding archaeology was considered negligible however they did identify paleoenvironmental remains and by previous association there is the possibility for the survival of bronze Age features. The deposits were identified at a depth of 4.00meters. They were not located in the report or indicated on a map. A Watching brief revealed made ground on top of a peat layer and alluvial deposits. Archaeological features were encountered. These consisted of the remains of wall foundations and fence posts, most probably associated with the farm (Marsh Farm) that occupied this site prior to the construction of the water treatment works. Marsh Farm is mapped on the 1777 map.	Post-medieval	TQ 65541 75611
MEX1038594	Officers' Quarters	Officers Barracks Tilbury Fort	Terrace of approximately 22 C18 officers' houses within Tilbury Fort.	Post-medieval	TQ 65154 75336
MEX1040412	Pond	Tilbury Pond Wildlife Site, Tilbury	Archaeological monitoring of trial pits and groundworks for a pond and bund revealed no archaeological finds or features. A thin layer of peat was present across the site which conforms to the general deposit model along the marshland of the Thames Estuary	Unknown	TQ 6595 076700

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
MEX1040428	Pond	Tilbury Wildlife Pond Site, Tilbury	Archaeological monitoring of trial pits and groundworks for a pond revealed no archaeological finds or features, although a modern pit could be part of a WWII anti-glider ditch.	Unknown	TQ 65911 76626
MEX1042105	Marsh	Marsh	An area of much improved grazing marsh sited to the north of Tilbury Fort. The part of the marsh adjacent to the fort is designated as part of the scheduled area of the fort. It includes the former site of Tilbury market place, which was sited adjacent to the ferry crossing and the World's End inn. The marsh also contains ditches linked to the forts water-filled moat and is bisected by the road to the fort.	Medieval to Post-medieval	TQ 65164 75759
MEX1041248	Military Camp	D-Day Assembly Area, Tilbury	D-Day assembly area.	Modern	TQ 64626 76615

Appendix B Gravesend Gazetteers of Heritage Assets

Gazetteer of Designated Heritage Assets

Asset ID (NHLE)	Designation	Grade	Name	Period	Description	NGR
1089005	Listed Building	II	54-58, Vicarage Lane	Post-medieval	The 2 southern cottages were originally a farmhouse. The northern cottage appears to have been added. 2 storeys brown and red brick. Hipped tiled roof with 3 hipped dormers. Moulded wooden eaves cornice and brick stringcourse. 3 sashes with glazing bars intact and some blanks. Cambered head linings to ground floor windows. Louvred shutters to No 56. 3 simple cambered doorcases. Modern 2 storey brick extension to rear.	TQ 67128 73078
1089019	Listed Building	II	Readers, Lower Higham Road	Medieval	A T-shaped timber-framed house with roughcast infilling and curved braces on the 1st floor. Probably a C15 or C16 Hall house as the roof retains its smoke louvres. The central protruding 2 storey extension has a gable end, now tiled, with a casement window and Tudor arched stone doorcase with blank spandrels. Outside chimneystack. Right side modern extension.	TQ 67593 73188
1089043	Listed Building	II	1, Chalk Road	Post-medieval	This is the cottage most usually said to be the one where Charles Dickens and Kate Hogarth spent their honeymoon in 1836. Early C19. 2 storeys faced with weatherboarding. Tiled roof. 2 sashes with glazing bars intact. Doorcase with small flat hood over supported on brackets. 4 panelled door. Over this is a tablet with a mask of Dickens and the inscription "Charles Dickens, Born 1812, Died 1870 spent his honeymoon in this house (1836). Here also were written some early chapters of "Pickwick".	TQ 67003 73055
1341493	Listed Building	II	44, Chalk Road	Post-medieval	2 storeys and attics red brick once painted. Brick stringcourse. Hipped tiled roof has 3 hipped dormers, Moulded wooden eaves cornice. 5 sashes with glazing bars intact. Doorcase with rectangular fanlight and flat hood over supported on brackets. This is another house for which a claim has been made that it was the Dickens honeymoon cottage.	TQ 67134 73010

Gazetteer of Non-Designated Heritage Assets

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
TQ 67 SE 1251	Smock Mill	Denton Mill, Gravesend (former site)	Denton Mill was a probable smock mill built to grind corn, constructed before 1840. It was demolished prior to 1897.	Post-medieval	TQ 6641 7427
TQ 67 SE 1252	Shooting Stand	Shooting Butts at former Milton Rifle Ranges, Shorne Marshes	In advance of a new 950m security trench, in April 2013 fieldwork was done along the proposed ditch by Archaeology South-East particularly at the intersection between the security trench and the old shooting butts at the end of Milton Rifle Ranges. The proximity to Shornemead Fort and the old rifle range (built 1859/60) led to predominant finds of bullets of a range of calibres of British Army issue. The work also uncovered some post-medieval pottery and brick fragments (both post-Medieval).	Post-medieval	TQ 6834 7437
MKE113306	Findspot	Hoard	In 1961, during the excavation of a Romano-British building: Layer 3 shows that the hollow site was levelled with rubbish from elsewhere. The amount of early pottery shows that this is not a gradual accumulation of rubbish in situ; it represents not the demolition of a building but the clearance of an old rubbish dump. Mr. R. Reece has suggested that a forgotten coin-hoard was scattered in the process; the hoard, he suggests, had been buried about 360. By c.395 the tiny coins would have become so corroded as to escape notice. Unusual however amongst the irregular coins are the number of 'Falling horseman' copies, and especially the numbers under	Roman	TQ 67600 72980

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
			10 mm. in diameter. Since the archaeological evidence is consistent with these coins all being from one deposit, it is best to assume that we are dealing with a hoard probably of regular coins and copies, deposited about 360, and redeposited and scattered at a later date. This would remove the copies from the list of individual finds, returning the site to numismatic normality.		
TQ 67 SE 343	Bridge	Bridge No. 3 over the Thames and Medway canal	Site of swing bridge no. 3 on the Thames and Medway Canal, carrying Mark Lane over the canal. The canal was later filled in to the West of the bridge. No remains visible in the 2005 coastal survey, there is a street built over the site.	Post-medieval	TQ 6640 7413
TQ 67 SE 345	Swing Bridge	Bridge no. 5, Thames and Medway canal	Site of swing bridge no. 5 on the Thames and Medway Canal carrying a footpath over the canal to the Lower Higham Rd. to the South. The bridge house formerly stood on the North side of the canal and the foundations can be seen (1995). A new bridge may be constructed on the site. A modern wooden bridge. No more house remains are visible.	Post-medieval	TQ 6824 7385
TQ 67 SE 15	Ditch, Inhumation, Pit, Villa and Baths	Chalk Roman Villa	A Roman building, possibly a villa, excavated in 1962 and found to have been destroyed by fire during the late 3rd century AD. Also found were several pits including the graves of 3 infants and a rubbish tip with up to mid 1st century AD pottery, some of which may have been Iron Age. East of this site a chalk wall, a hypocaust and a number	Roman	TQ 6763 7298

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
			of tiles had been excavated in 1959. This site was later built over but at a later date, remains of a complex Roman bath house with hypocausts was discovered nearby, west of Castle Lane.		
TQ 67 SE 18	Inhumation	Romano-British burial found AD 1959	A human skull and fragments of Roman pottery, probably 2nd c., were uncovered during building operations on the site of the house known as West Filborough at Lower Higham Road, Chalk. The pottery was placed in Gravesend library. This find was made in 1959 at appx. TQ 67727310, when footings for the house on the south side of Darenth Drive were being cut in the former orchard of West Filborough.	Roman	TQ 6772 7310
TQ 67 SE 346	Air Raid Wardens Post	Air raid warden post, Gravesend	Concrete air raid wardens post, structure appears complete, but with fittings removed. Now incorporated into a shed.	Modern	TQ 6729 7351
TQ 67 SE 36	Findspot	Roman pottery findspot	A heap of 2nd century pottery, including Samian ware, was found between two layers of alluvium during earth-moving in Denton Marshes.	Roman	TQ 667 739
TQ 67 SE 41	Findspot	Mesolithic or Neolithic flintwork, . Denton	Tranchet axe. Find is in Herne Bay Museum. Archaeological evaluation prior to construction of Denton Relief Road in 1999 produced 3 pieces of worked flint one of which suggested Mesolithic or neolithic origin.	Early Mesolithic to Late Neolithic	TQ 665 739
TQ 67 SE 44	Findspot	Roman beaker found at Chalk	Poppy-head beaker, as 'black fine-grained coarse ware'. A fragment of a second is in	Roman	TQ 676 730

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
			chestnut brown sandy fabric, burnished and fired light grey-brown. The treatment of the base is characteristic of those from the Upchurch Marshes, among which sandy fabric is occasionally found.		
TQ 67 SE 49	Swing Bridge	Swing bridge on Thames and Medway Canal	This bridge is over a section of the Thames and Medway Canal which is still in water. There is a large cast iron counter weight on the landward N end of the bridge but there is no sign of cables or gearing for operating the bridge. As it appears to be only an accommodation bridge it was probably opened by hand. The bridge has been restored.	Post-medieval to Modern	TQ 6757 7395
TQ 67 SE 89	Searchlight Battery	Second World War searchlight battery, formerly interpreted as a Bronze Age settlement	A WW2 searchlight installation visible as two adjacent curvilinear embanked enclosures with diameters of c.12.5m. Both have two opposing entrances and a slight outer ditch. The north-easterly enclosure had a slight central mound about 1m across which is thought to be the sound locator. This emplacement also had an embanked entrance with offset banks (perhaps sandbags) creating a zig-zag entrance to the NE for emergency air raid protection. The southern enclosure housed the searchlight. Subsequently levelled and visible as a cropmark , appearing as two incomplete ditched curvilinear enclosures with no trace of an inner bank. Immediately to the south of the searchlight emplacement was a single weapons pit for a LAMG (Light	Modern	TQ 6691 7360

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
			Anti-aircraft machinegun) to protect the searchlight.		
TQ 67 SE 238	Pit	Late Iron Age Pit, Gravesend	A large late iron age pit, 3.5 m across with step sides. It was not fully excavated. It contained fragments of late iron age pottery, some structural daub and animal bones, some showing signs of butchery	Late Iron Age	TQ 6686 7330
TQ 67 SE 239	Field System	Late Iron Age - Roman Field Boundaries, Gravesend	Sections of ditches representing a 1st century field system. A single ditch was found containing late 2nd to 3rd century Roman pottery, possibly indicating the agricultural use of the area through the 1st to 3rd century. Due to the scale of the archaeological work, the extent of the ditches could not be determined	Late Iron Age to Roman	TQ 6687 7330
TQ 67 SE 242	Manor House	Medieval Manor House (Site of) Gravesend	Evidence of a medieval manor house was discovered in the form of a double cellared structure of chalk walls against the exposed natural chalk face, but with a flint wall along the western and northern sides. These may represent different phases of construction. At a later date, between the 16th and 17th centuries, the building was extended to the east incorporating an additional cellar. The new southern wall extension was constructed using both brick and dressed chalk. The few finds from the backfill of both cellars date the buildings destruction to between 1730 and 1780. The building was replaced by West Court (TQ 67 SE 242) built in 1739	Medieval to Post-medieval	TQ 6671 7338

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
TQ 67 SE 286	Findsport	Prehistoric evidence from Lion Business Park Near Gravesend Kent	Work involved the excavation of ten shallow trenches and five deep test pits. Finds included pieces of worked flint and fragments of burnt unworked flint, animal bones, waterlogged plant remains and carbonised plant remains, charcoal and Neolithic/Bronze Age pottery sherds. This worked followed on from a geoarchaeological assessment and survey of the site.	Later Prehistoric	TQ 66655 73732
TQ 67 SE 1104	Farmhouse (Listed Building)	No.54-58 (1700 to 1975)	Work involved the excavation of ten shallow trenches and five deep test pits. Finds included pieces of worked flint and fragments of burnt unworked flint, animal bones, waterlogged plant remains and carbonised plant remains, charcoal and Neolithic/Bronze Age pottery sherds. This worked followed on from a geoarchaeological assessment and survey of the site.	Post-medieval to Modern	TQ 6712 7307
TQ 67 SE 1114	Hall House (Listed Building)	Readers	A T-shaped timber-framed house with roughcast infilling and curved braces on the 1st floor. Probably a C15 or C16 Hall house as the roof retains its smoke louvres. The central protruding 2 storey extension has a gable end, now tiled, with a casement window and Tudor arched stone doorcase with blank spandrels. Outside chimneystack. Right side modern extension.	Medieval to Modern	TQ 6759 7318
TQ 67 SE 1102	House (Listed Building)	No. 1 Chalk Road Gravesend	This is the cottage most usually said to be the one where Charles Dickens and Kate Hogarth spent their honeymoon in 1836.	Post-medieval	TQ 6700 7305

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
			Early C19. 2 storeys faced with weatherboarding. Tiled roof. 2 sashes with glazing bars intact. Doorcase with small flat hood over supported on brackets. 4 panelled door. Over this is a tablet with a mask of Dickens and the inscription "Charles Dickens, Born 1812, Died 1870 spent his honeymoon in this house (1836). Here also were written some early chapters of "Pickwick".		
TQ 67 SE 241	Manor House and Farm House	Former site of West Court	Manor house built in 1739, extended in the later 19th century at the eastern end and with wooden bays added to its south facing façade. The house had three bays facing to the south into gardens and orchards with outbuildings to the northwest. These outbuildings included a granary, oasthouse, barn and cartsheds. The house was occupied until 1984 after which it fell into disrepair, was vandalised and suffered two fires before finally being demolished in 1991.	Post-medieval to Modern	TQ 66755 73366
TQ 67 SE 1082	Farmhouse (Listed Building)	No.44 (1700 to 1799)	C18 farmhouse. 2 storeys and attics red brick once painted. Brick stringcourse. Hipped tiled roof has 3 hipped dormers, Moulded wooden eaves cornice. 5 sashes with glazing bars intact. Doorcase with rectangular fanlight and flat hood oversupported on brackets. This is another house for which a claim has been made that it was the Dickens honeymoon cottage.	Post-medieval	TQ 6713 7301

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
TQ 67 SE 1196	Battle Headquarters	Denton Sewage Works Battle Headquarters, Mark Lane, Gravesend	Second World War Battle Headquarters (for Defended Locality DL21) at Denton Sewage Works, Mark Lane, Gravesend. Adjacent to the Denton Heavy Anti-aircraft gun battery, this formed part of the anti-invasion defences and had probably been established in 1940. It would have involved the adaptation of sewage works premises but the nature of this is unknown. The Battle Headquarters, manned by the Home Guard, would have been decommissioned by 1944. There are no known remains.	Modern	TQ 6680 7380
TQ 67 SE 1156	Searchlight Battery	Maltings Second World War searchlight position, Lower Higham Road, Chalk, Kent	Second World War anti-aircraft searchlight position in a former field a few m. N of The Maltings, Lower Higham Road, Chalk, near Gravesend. Of unknown date origin and longevity, it would have been removed by no later than 1945. The site is now occupied by part of the NW College of Technology. No longer extant.	Modern	TQ 6661 7328
TQ 67 SE 1161	Roadblock	Lower Higham Road Second World War road block, Chalk	Second World War road block on the Lower Higham Road between Church Lane and Castle Lane, Chalk. This was part of the local anti-invasion defences. No longer extant.	Modern	TQ 6806 7319
TQ 67 SE 301	Saltern and Mound	Probable and possible salterns, Shorne Marshes	Mounds, probably a saltmounds, and associated banks, possibly evaporation channels. Some still visible on 2016 aerial photographs.	Undated	TQ 6880 7411
TQ 67 SE 217	Railway Station	Site of Denton Halt	Site of Denton Halt railway station, now demolished. Debris from the station was	Modern	TQ 6642 7408

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
			dumped into the disused Thames and Medway canal.		
MKE84361	Farmstead	West Court	A regular multiyard farmstead, no longer extant.	Post-medieval	TQ 6674 7344
MKE84362	Farmstead	Great Clane Lane	A regular multiyard farmstead, no longer extant.	Post-medieval	TQ 6708 7314
MKE84363	Farmstead	Yard north of Readers	Regular courtyard with working agricultural buildings on three sides and with additional detached elements to the main plan. No longer extant	Post-medieval	TQ 6759 7321
TQ 67 SE 342	Railway Station	Site of Milton Range halt	Site of Milton Range halt, concrete platform visible from the road.	Post-medieval to Modern	TQ 68 73
TQ 67 SE 382	Ditch	Romano-British ditch, east of Allen's Mead, Gravesend	A short section of Romano-British ditch was the only feature found during evaluation of land at Dalefield Way. The ditch measured 2.49m wide and 1.15m deep. The ditch contained a single primary fill 2308 and two secondary fills (SF) 2306 & 2307, which each contained frequent rounded and sub-rounded chalk. SF2306 contained pottery, fired clay, slag and struck flint with the pottery being dated to the Romano-British period.	Roman	TQ 6702 7336
TQ 67 SE 1044	Wreck	An oval stone bank running at an angle from the foreshore to the water. About 20m x 1.5 m. and 0.5 m high. Possibly cargo or ballast from a vessel	An oval stone bank running at an angle from the foreshore to the water. About 20m x 1.5 m. and 0.5 m high. Possibly cargo or ballast from a vessel.	Undated	TQ 67190 74355

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
TQ 67 SE 1045	Platform	Two concrete platforms near the Sea Training Centre, Gravesend	Two concrete squared platforms 2.5m x 2.5m, 0.6 m high. Possibly wartime remains, base for navigational beacons.	Modern	TQ 67215 74349
TQ 67 SE 1047	Post Built Structure	Row of small posts, foreshore by Eastcourt Marshes	A row of small wooden posts running from the foreshore into the water. About 3m long. Posts may be squared, but it is hard to be certain as they are quite abraded. 12 posts are still visible, their height up to 0.02m, and they are about 0.1m in diameter.	Undated	TQ 68250 74569
TQ 67 SE 1048	Hard	Possible Hard, Shorne Marshes	Level area retained by angled posts and made up by irregular small boulders. May be the remains of a hard standing for vessels to beach on.	Modern	TQ 68457 74627
TQ 67 SE 1001	Findspot	Roman finds from evaluation at Gravesend WTW	Romano-British pottery and other finds of the period were recovered, suggesting dumping on marshy ground of domestic refuse from nearby settlement. Finds included Samian, possible terra nigra and coarse wares, probably dating to about AD 100, as well as bone, shell and building material. No signs of rolling nor of any cut feature.	Roman	TQ 66601 73998
TQ 67 SE 1003	Feature	Roman/Prehistoric remains and possible Roman feature, Denton	Archaeological evaluation during road building located Roman and prehistoric remains in a small possibly Roman feature.	Roman	TQ 6650 7391
TQ 67 SE 1024	Site	Ship breaking activity by Gravesend	Derelict boats along shore, signs of ship breaking going on. At the mapped point no derelict boats are visible.	Post-medieval to Modern	TQ 66281 74348

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
TQ 67 SE 1019	Ridge and Furrow	Ridge and furrow, near Gravesend	Ridge and furrow. Area built over by the Metropolitan police training centre.	Undated	TQ 67163 74196
TQ 67 SE 1004	Windmill	Windmill, Gravesend	Windmill, shown on a chart of 1852. Built over with modern works.	Post-medieval	TQ 6648 7419
TQ 67 SE 1005	Wharf	Denon Wharf, Gravesend	Denton Wharf, shown on a chart of 1852. No access onto the wharf area. It is now a container yard although area still appears to be a wharf.	Post-medieval	TQ 6662 7423
TQ 67 SE 1014	Salt Works	Salt workings	Salt workings, evident on documentary evidence and photographs from the Environment Agency 2000.	Undated	TQ 67735 73841
TQ 67 SE 1013	Salt Works	Salt workings near Gravesend	Salt workings, evident on documentary evidence and photographs from the Environment Agency 2000. Area built over with a Metropolitan Police training centre.	Undated	TQ 67222 74171
TQ 67 SE 1018	Quay	Quay, near to the 'Ship & Lobster', Denton	Quay, near to the 'Ship & Lobster', Denton indicated on the 1st edition OS map. The quay is still in use, and has probably been rebuilt.	Post-medieval	TQ 66549 74324
TQ 67 SE 1040	Jetty	Jetty, near to the 'Ship & Lobster', Denton	Jetty, near to the 'Ship & Lobster', Denton indicated on the 1st edition OS map. The 19th century jetty is demolished. A new concrete and steel jetty/pier has been built directly on its western side. Remains of the old jetty are visible in the form of two parallel rows of timber posts running into the water (about. 5m -6m width, and 20m	Post-medieval	TQ 66584 74344

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
			length). A rubble slipway is visible between the old and the new jetty		
TQ 67 SE 1032	Causeway	Causeway, Gravesend	Causeway marked on the 3rd edition OS map. A wood and steel causeway still in use, in good condition.	Modern	TQ 66722 74339
TQ 67 SE 1033	Pile	Mooring post on foreshore by Shorne Marshes	Post marked on the 3rd edition OS map. Three squared piles in a triangular setting with two smaller cross timbers lying on the foreshore surface in between the posts. The posts show signs of wear, especially in the middle from ropes. Up to 1.5 m high, and 0.3m x 0.3m.	Modern	TQ 68209 74549
TQ 67 SE 277	Enclosure	Cropmarks, Westcourt Marshes	Four broadly circular cropmarks, possibly related to a putative Bronze Age enclosure, identified from aerial photographs c. 100m directly to the west 4 x 25m polygons assigned on the GIS each centred on one crop mark. The report suggests that these cropmarks may relate to four features identified on a 1995 aerial photograph. Reviewed and re-interpreted as WW2 searchlight battery TQ 67 SE 89.	Bronze Age	TQ 66833 73601
TQ 67 SE 278	Structure	Brick Tank	A brick built structure, 2.0m x 1.0m x 0.40m, possibly used as a water tank (?) Probably the same structure indicated on the 1932 OS map and labelled 'tank'.	Undated	TQ 6705 7324
TQ 67 SE 20	Thames and Medway Canal	The Thames and Medway Canal. Originally intended as a means of avoiding coastal attacks on shipping.	The Thames and Medway Canal. Originally intended as a means of avoiding coastal attacks on shipping. It was a particularly expensive undertaking and never	Post-medieval	TQ 69963 71859

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
			successful, the original motivation having passed by the time of completion and all budgets being exceeded in the process. Eventually, a railway was built utilising the tunnel and the canal was effectively and subsequently actually cut into two sections. The northern half remained in use for some time whilst the southern length quickly fell out of use.		
TQ 67 SE 1209	Anti Aircraft Battery	Denton Heavy anti aircraft battery, Mark Lane, Denton, Gravesend, Kent	Second World War heavy anti aircraft battery for 4 x 4.5-in. guns in a field south of the North Kent railway and east of Mark Lane at Denton, Gravesend. It formed part of the Thames South grouping of anti-aircraft gun defences. Built in 1938, it consisted of four standard octagonal concrete emplacements arranged on the points of an imaginary trapezium, to which was centred a rectangular concrete command post, having both surface and contained operational elements. The domestic site appears to have been about 100m NE of the battery. Decommissioned in 1945, it became derelict and the last remnants were removed in c. 1985.	Modern	TQ 6640 7391
TQ 67 SE 1185	Building	Milton 19th/20th century rifle range, Eastcourt Marshes, Gravesend	Continued use of the 1862 military Milton Rifle Range, on Eastcourt Marshes, east of Gravesend. It consists of a succession of low earthen mound firing points, a target mound and markers' gallery, as well as a weather shelter. The butts were modified in the 1890s and perhaps again later. It continued in use for military rifle training	Post-medieval	TQ 6793 7415

Asset ID (Pref ID)	Type	Name	Description	Period	NGR
			until around 1980 and perhaps afterwards, when there was certainly private use. It is now the firing range element of the Metropolitan Police Training Facility, with substantial survivals of the original structures.		

Appendix C Gazetteer of Events

Event ID	Name	Organisation	Location	NGR
EEX41441	SALV EXCAV by Pratt,J, 1973	J Pratt	Tilbury Fort	TQ 6510 7545
EEX41442	SALV EXCAV by Wilkinson,PM, 1980	PM Wilkinson	Tilbury Fort	TQ 6510 7545
EEX52855	Stanford Le Hope STW Water Pipeline	Field Archaeology Group - ECC		TQ 669 789
EEX53549	West Powder Magazine Roof, Tilbury Fort	Field Archaeology Group - ECC		TQ 651 754
EEX54327	Borehole survey at Tilbury waste water treatment works	Cambridge Archaeological Unit		TQ 655 755
EEX56725	Tilbury C power Station: geoarchaeological watching brief, historic borehole review and walk over survey	Wessex Archaeology		TQ 6587 7574
EEX6048	SALV EXCAV by Wilkinson, PM, 1980	PM Wilkinson		TQ 6510 7545
EEX59539	Tilbury II Archaeological Evaluation	Wessex Archaeology		TQ 6518 7600
EEX55618	Archaeological Watching Brief at the site of the Biosolids Dyer project	Oxford Archaeology		TQ 655 756
EEX55947	Tilbury Wildlife Pond Site	Field Archaeology Group - ECC		TQ 659 767
EEX55950	Tilbury Wildlife Pond site	Field Archaeology Group - ECC		TQ 659 766
EEX55585	Tilbury Power Station: Archaeological Evaluation and Monitoring Interim Report	Essex County Council		TQ 654 762
EEX56482	Thurrock Unitary Authority WWII site survey by Fred Nash September 2012	Essex County Council		TQ 6530 7637
EEX59528	A report on geoarchaeological monitoring of geotechnical site investigation	Museum of London Archaeology Service		TQ 6509 7522

Event ID	Name	Organisation	Location	NGR
EKE3947	Chalk Roman Villa	Ministry of Works		TQ 6760 7298
EKE3948	Chalk Roman Villa	Ministry of Works		TQ 6760 7298
EKE3949	Excavation at Chalk, 1974-5	Ministry of Works		TQ 6760 7298
EKE3951	Excavation at Chalk, 1978/9	Springhead Excavation Group		TQ 6760 7298
EKE8295	Comma Oil & Chemicals Limited, Gravesend - Report On Soil Investigation	Evans & Langford		TQ 6635 7389
EKE8432	Watching brief at 7 Manor Close, Chalk	Unknown	7 Manor Close	TQ 67643 72980
EKE8607	Evaluation of land adjacent to North West Kent College playing fields	Essex County Council Field Archaeology Unit	Dering Way, Gravesend	TQ 6687 7329
EKE8633	Watching Brief at Comma Works	Archaeology South-East	Mark Lane	TQ 6637 7394
EKE8724	Watching Brief and Borehole Survey, Denton Relief Road, Gravesend	Oxford Archaeology		TQ 66554 73855
EKE8749	Evaluation at Westcourt Marshes, Gravesend	Museum of London Archaeology		TQ 67076 73487
EKE8797	Investigation at Damigos Road, Gravesend	Pre-Construct Archaeology	Damigos Road	TQ 6675 7335
EKE9270	Evaluation at Lion Business Park Near Gravesend	Oxford Archaeology		TQ 66642 73750
EKE9777	Desktop study of proposed development on Eastcourt Marshes	Unknown	Gravesham	TQ 67901 74130
EKE9779	Report on condition of ground sub-surface at Westcourt Marshes, Gravesend, for Fort Knight plc prior to construction	Geotechnics-Materials Limited		TQ 67041 73587

Event ID	Name	Organisation	Location	NGR
EKE9780	Ground Investigation off Lower Higham Road, Gravesend	Soils Ltd	Lower Higham Road	TQ 66915 73387
EKE9781	Ground Investigation for the Denton Relief Road, Gravesend	Babtie		TQ 66592 73721
EKE9782	Borehole survey at Denton Marshes, Gravesend	Oxford Archaeology		TQ 66656 73781
EWX6586	Field Evaluation at Gravesend WTW	Wessex Archaeology	Gravesend Wastewater Treatment Works, Denton, Kent	TQ 667 740
EWX6597	Watching brief during construction, Gravesend WTW	Wessex Archaeology	Gravesend Wastewater Treatment Works, Denton, Kent	TQ 6672 7398
EWX6628	Evaluation of the line of Denton Relief Road	Institute of Archaeology, University of London		TQ 6656 7375
EWX9136	Desk based assessment at Eastcourt Marshes	Victor Smith		TQ 6780 7420
EWX9136	Desk based assessment of Westcourt Marshes	Museum of London Archaeology		TQ 6693 7364
EWX9176	Desk based assessment of Westcourt Marshes, Gravesend	Museum of London Archaeology		TQ 6693 7364
EKE10278	Historic Environment of the North Kent Coast: Rapid Coastal Zone Assessment Survey Phase 1	Wessex Archaeology		TR 010 753
EKE10622	Evaluation at Westcourt Marshes, Gravesend	Museum of London Archaeology		TQ 6691 7341
EKE11241	Watching brief along the Thames and Medway Canal, Gravesend	Alan Ward		TQ 6642 7413
EKE11511	Evaluation at Damigos Road	LBH Wembley	Damigos Road	TQ 6675 7336
EKE12218	Desk based assessment of the Thames and Medway Canal	Museum of London Archaeology		TQ 6996 7186
EKE13035	Desk based assessment of land north of Dalefield Way, Gravesend	Canterbury Archaeological Trust		TQ 6681 7361

Event ID	Name	Organisation	Location	NGR
EKE13239	Historic landscape characterisation and historic seascape characterisation, Hoo Peninsula Historic Landscape Project	Nicola Bannister		TQ 7988 7665
EKE13337	Test pitting as part of a Paleoenvironmental Evaluation, Isle of Grain (2008)	Archaeology South-East		TQ 7745 7470
EKE14761	Archaeological survey of mineral extraction sites around the Thames Estuary	Kent County Council		TQ 7887 7117
EKE15020	Hoo Peninsula, Kent. Hoo Peninsula Historic Landscape Project	English Heritage		TQ 7810 7537
EKE15021	Hoo Peninsula, Kent. Hoo Peninsula Historic Landscape Project	English Heritage		TQ 7855 7550
EKE15400	Hoo Peninsula, North Kent Coast, Thames Estuary:45 A Paleoenvironmental Review of the Development of the Peninsula	English Heritage		TQ 7940 7581
EKE15826	Archaeological Evaluation Report, Land at Dalefield Way	CgMs Consulting		TQ 6708 7336
EKE15872	Dalefield Way, Denton, Gravesend, Kent, Archaeological Evaluation	Thames Valley Archaeological Services		TQ 6704 7356
EKE16356	Archaeological survey, monitoring and excavation at RSPB Shorne Marshes	Archaeology South-East		TQ 6871 7449
EKE17269	Desk-based assessment (component of Environmental Statement): Grain to Shorne Gas Pipeline	National Grid		TQ 7745 7470
EKE17316	Fieldwalking programme: Grain to Shorne Gas Pipeline	Canterbury Archaeological Trust		TQ 7745 7470
EKE17318	Magnetometry survey along route of Grain to Gravesend gas pipeline	Stratascan		TQ 7745 7470

Event ID	Name	Organisation	Location	NGR
EKE21323	Gravesend Waste Water Treatment Works, desk based assessment	Wessex Archaeology		TQ 6672 7399

Appendix D Plates

Tilbury Site Visit Photos



Plate 1: Tilbury Fort gatehouse looking north.



Plate 2: The grade II* listed Officers Barracks within Tilbury Fort, looking northeast.



Plate 3: View eastwards towards the proposed northern headhouse and SEC compound from the Tilbury Fort Scheduled Monument



Plate 4: View west, back across the Scheduled Monument towards Tilbury Fort and the grade II* listed Officers Barracks from Bill Mercy Creek.



Plate 5: View of the non-designated Second World War pillbox looking southeast.



Plate 6: View of the proposed headhouse and SEC compound location, looking north.



Plate 7: View from the public right of way, west across the southern part of the Site towards the Tilbury Fort Scheduled Monument, which is obscured by the modern container port facility.

Gravesend Site Visit Photos



Plate 8: A view northwest along the Thames and Medway Canal from swing bridge (TQ 67 SE 49)



Plate 9: View from the canal towpath, across Milton Rifle range towards the proposed location of the southern headhouse and SEC compound.



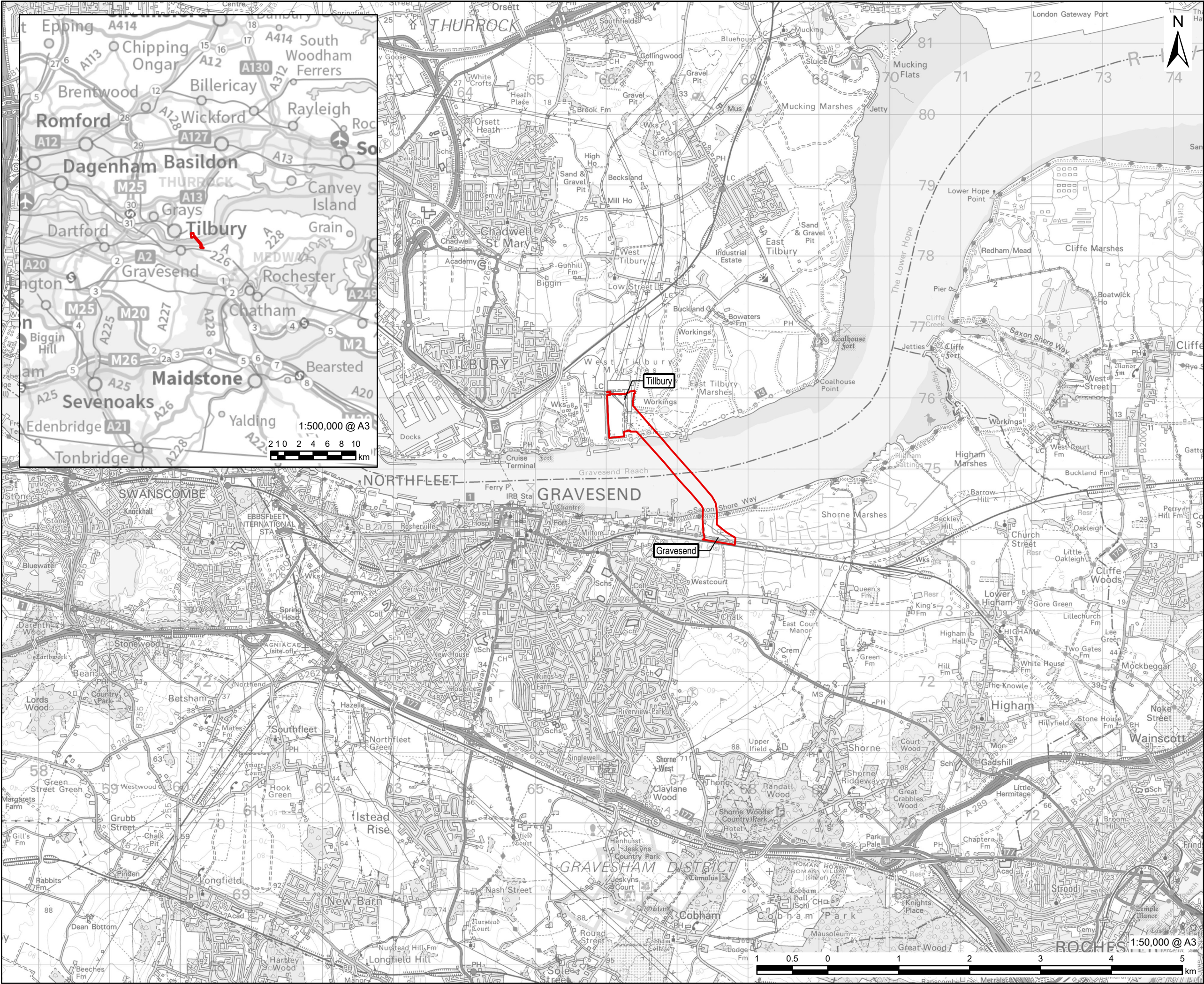
Plate 10: View of the proposed southern headhouse and SEC compound site from public access just south of the Site boundary.



Plate 11: View southeast back towards the Thames and Medway Canal and swing bridge. Medway Canal and swing bridge.

Appendix E Figures

- Figure 1 – Site Location Plan
- Figure 2 – Tilbury Heritage Assets
- Figure 3 – Tilbury Events
- Figure 4 – Gravesend Heritage Assets
- Figure 5 – Gravesend Events
- Figure 6 – Andre and Chapman Map of Essex 1777
- Figure 7 – West Tilbury Tithe Map 1838
- Figure 8 – Ordnance Survey 2nd Edition Map 1897
- Figure 9 – [George Ruscett] Levels Map of Gravesend 1694
- Figure 10 – Gravesend Tithe Map 1840
- Figure 11 – Ordnance Survey 2nd Edition Map 1898
- Figure 12 – Ordnance Survey 3rd Edition Map 1908



AECOM

PROJECT
TKRE National Grid

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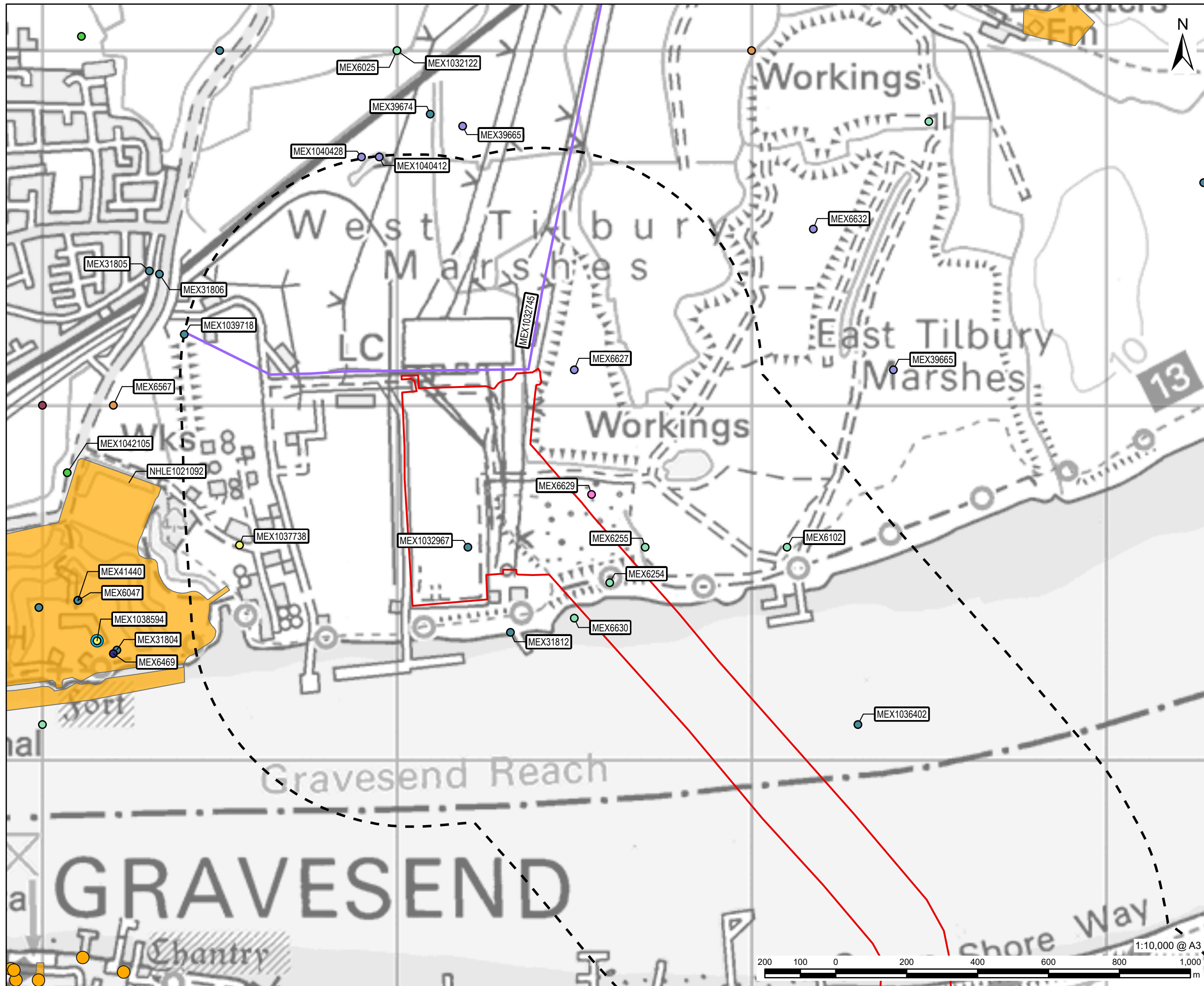
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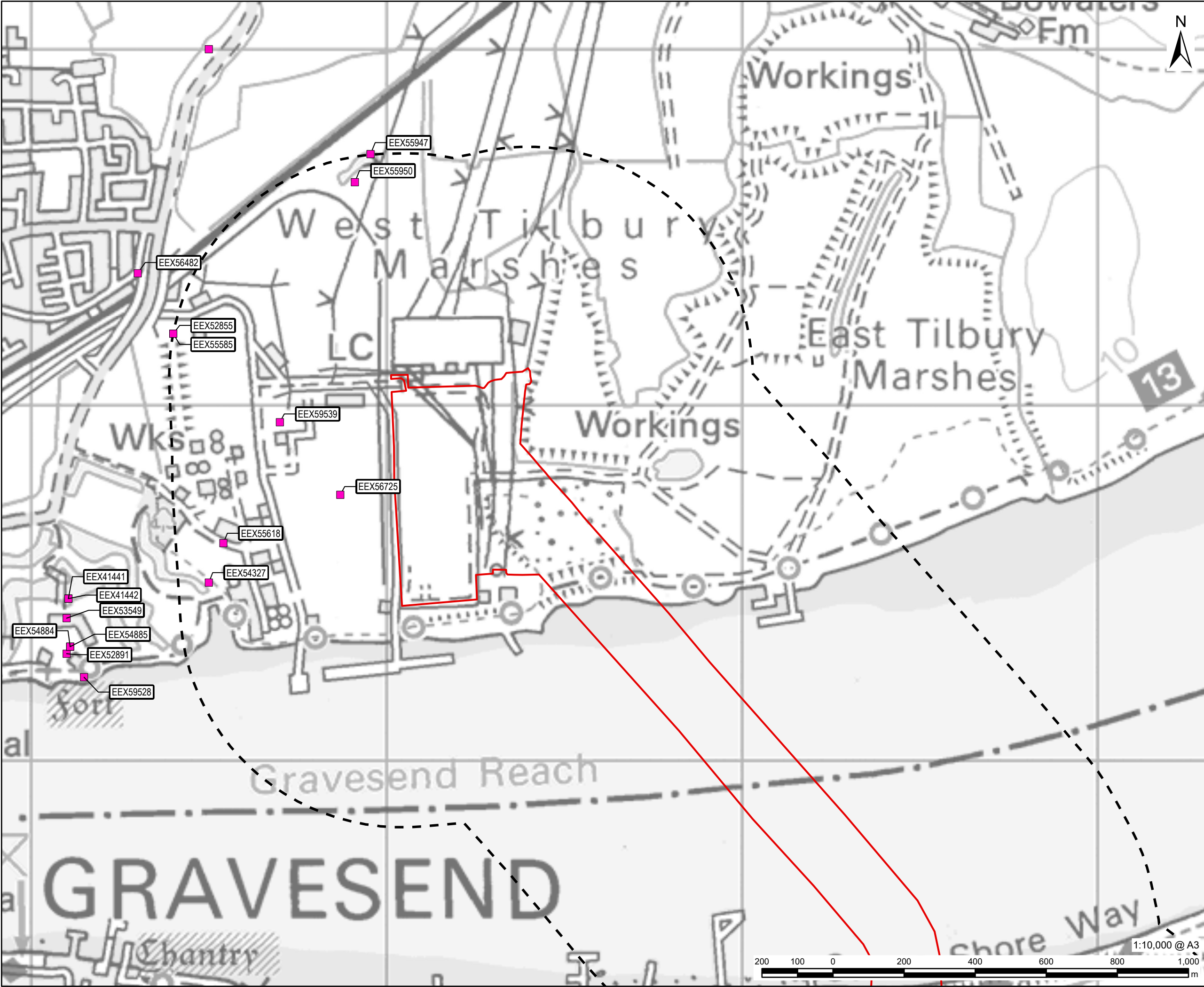
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FIGURE TITLE
Site Location Plan

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Figure 1



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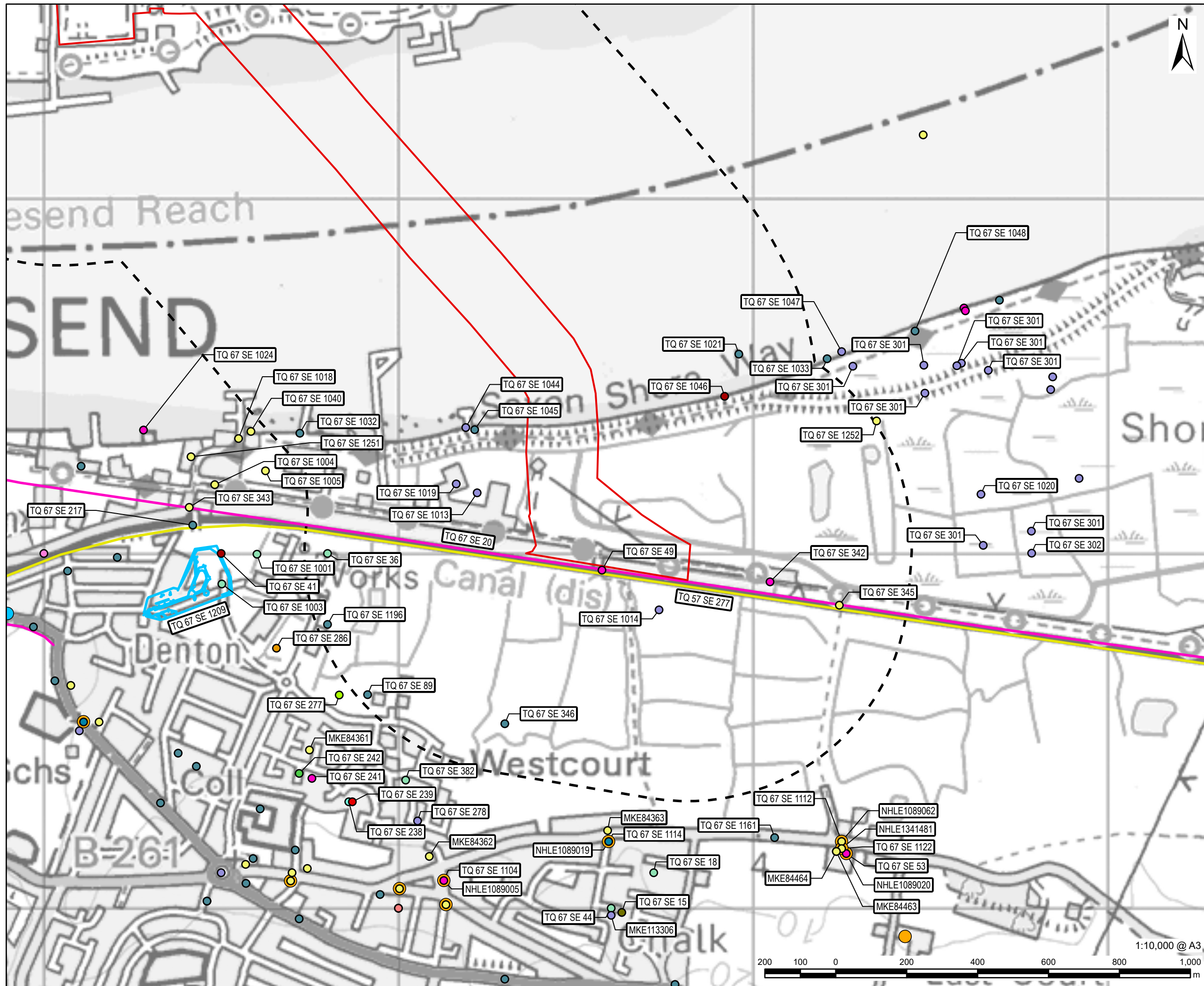
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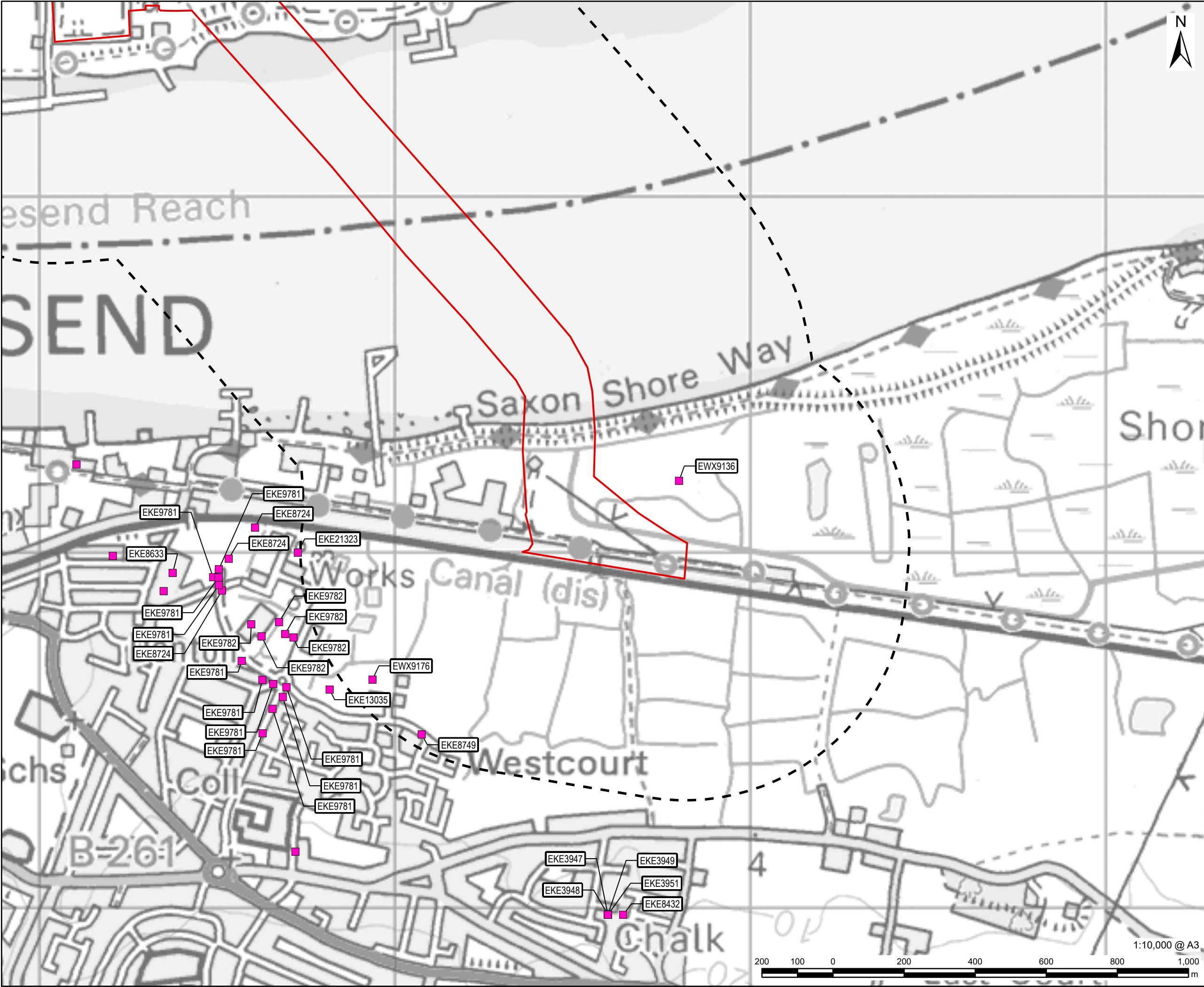
Tilbury (Essex) events data

FIGURE NUMBER

Figure 3



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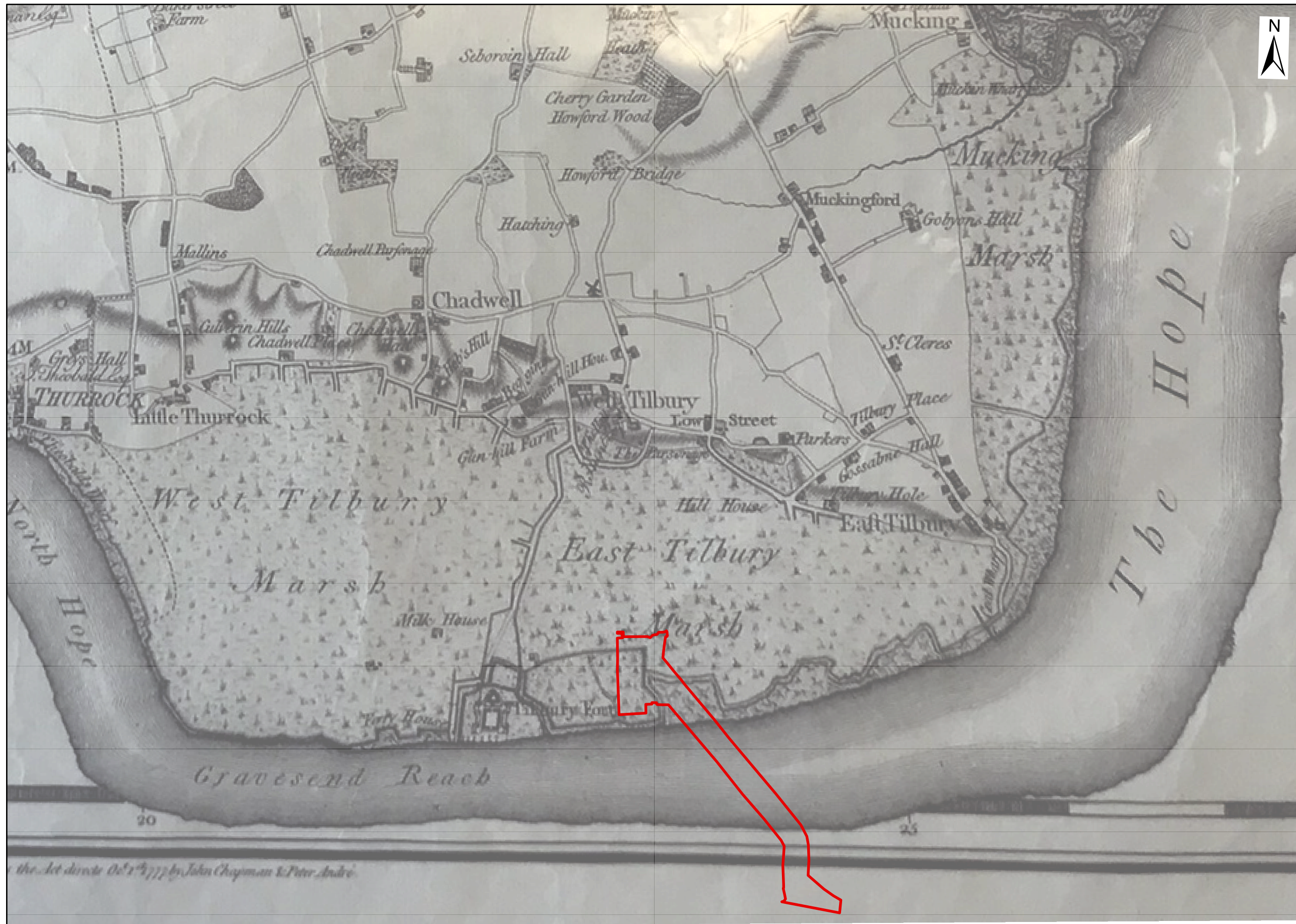
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FIGURE TITLE
Gravesend (Kent) events data

FIGURE NUMBER
Figure 5



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FIGURE TITLE
Andre and Chapman Map of Ess
1777

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Figure 6



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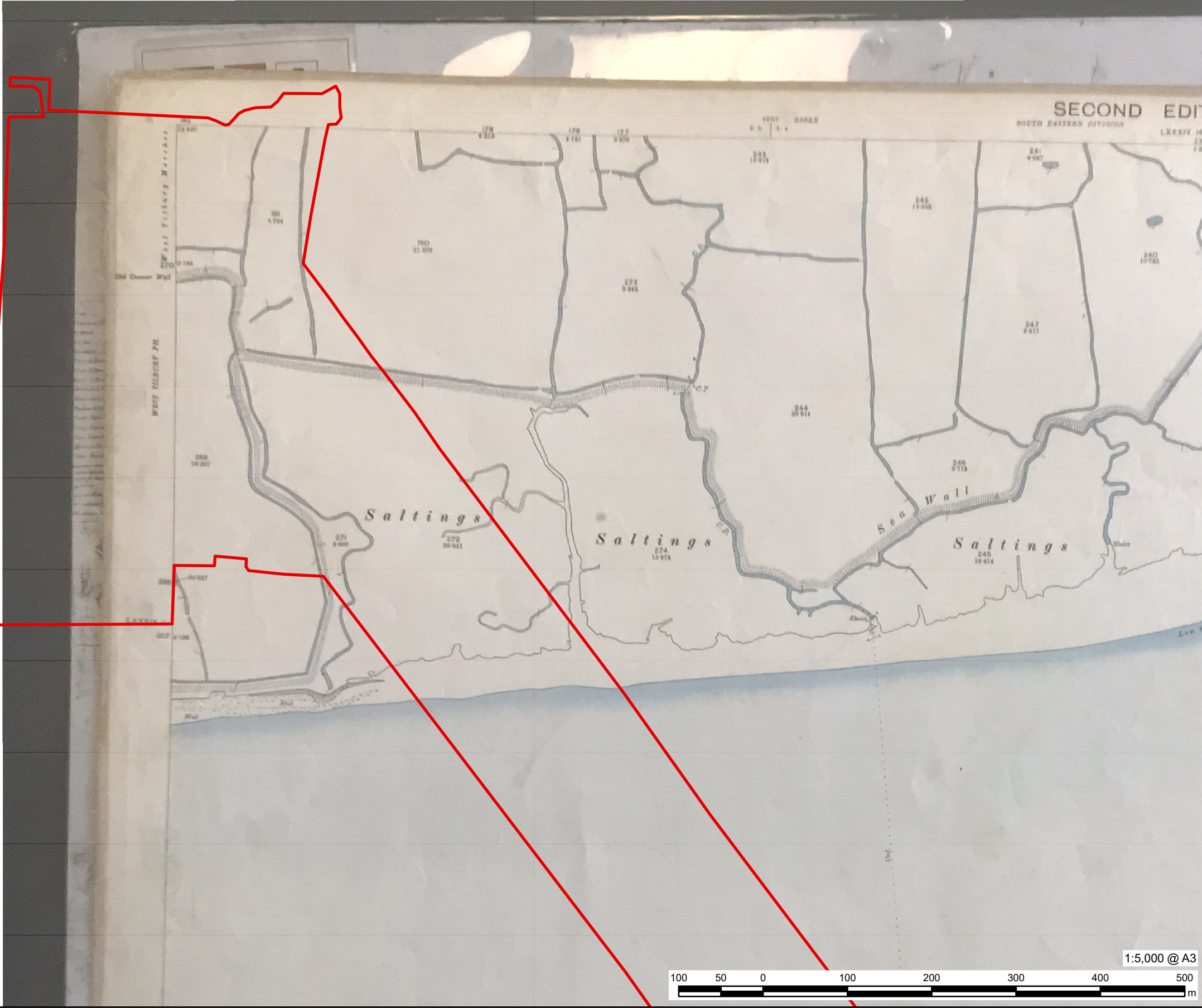
FIGURE TITLE

West Tilbury Tithe Map 1838

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Figure 7

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FIGURE TITLE

Ordnance Survey 2nd edition Map 1897

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Figure 8



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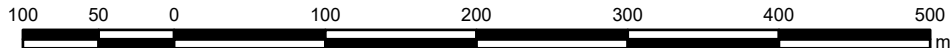
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FIGURE TITLE
[George Ruscett] Levels map of Gravesend 1694

FIGURE NUMBER
Figure 9



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FIGURE TITLE

Gravesend Tithe Map 1840

FIGURE NUMBER

Figure 10



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FIGURE TITLE

Ordnance Survey 3rd Edition 1908

FIGURE NUMBER

Figure 12

Appendix E – Water Framework Directive Screening

TKRE Cable Tunnel Replacement Project

Appendix E - WFD Screening Assessment

nationalgrid

National Grid Electricity Transmission

June 2023

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1 Introduction

- 1.1.1 National Grid Electricity Transmission (hereafter referred to as ‘National Grid’) owns and operates the national high-voltage electricity transmission system throughout England and Wales. The key role of the transmission system is to connect the electricity generators’ power stations with the local distribution networks of the regional electricity companies. National Grid holds the Transmission Licence for England and Wales and is thus obligated to develop and maintain an efficient, co-ordinated and economical system of electricity transmission and to facilitate competition in the generation and supply of electricity, as set out in the Electricity Act 1989.
- 1.1.2 National Grid’s operations are dictated by the latest Future Energy Scenarios (FES) and Electricity Ten Year Station (ETYS) reports. In recent years, these reports have begun forecasting a large amount of renewable and low carbon energy generation, connecting into the transmission network in the east coast of England, together with three interconnectors from the continent. Through these forecasts, National Grid Electricity System Operator (ESO) has identified that the Tilbury to Grain and Tilbury to Kingsnorth (TKRE) 400 kilovolt (kV) circuits will be significantly overloaded in their current capacity and require upgrading.
- 1.1.3 Each year, the ESO undertakes an assessment of the options National Grid has available for meeting forecasted energy demands (the Network Options Assessment, NOA). This assessment comprises economic analysis to understand the balance between managing power flows across network boundaries. In the most recent NOA (2021/22), the ESO has recommended investment in upgrading the TKRE 400 kV circuits giving the project a ‘proceed’ signal with an Earliest in Service Date (EISD) of 2028. This was reconfirmed in the NOA refresh published July 2022.
- 1.1.4 The TKRE 400 kV circuits are currently predominantly overhead line, with a section installed within a deep tunnel beneath the River Thames. As the Transmission Licence Holder with responsibility for the TKRE circuits, National Grid are required to upgrade the existing circuits.

Options Appraisal

- 1.1.5 In 2022, National Grid undertook a Strategic Options Appraisal to inform the selection of a preferred option for the upgrade of the TKRE circuits. Three options were initially identified:
- including the installation of new cables within the existing tunnel;
 - the installation of new cables within the new tunnel; and
 - the installation of a new overhead line across the River Thames.
- 1.1.6 The installation of new cables within the existing tunnel was not feasible due to the health and safety risks. The installation of a new overhead line across the River Thames, given its location and scale, would have had greater permanent environmental impacts. On balance, it was considered that the installation of new cables within a new tunnel was the most viable preferable option overall.

1.2 Proposed Development

- 1.2.1 The TKRE Cable Tunnel Replacement Project (hereafter referred to as ‘the Proposed Development’) relates to the replacement of the existing cable tunnel section under the River Thames, of the TKRE 400 kV circuits only. It is proposed that a new bored tunnel under the River Thames is constructed, and new XLPE cables installed as well as new associated new infrastructure either side comprising:
- New bored cable tunnel approximately 2.14 km tunnel (headhouse to headhouse) that will be 4 m in diameter, and approximately 50 m below ground (or Thames bed level) (see example shown in Photo 1);

- Two new headhouses (see example shown in Photo 2);
- Two Sealing End Compounds (SECs) (see example shown in Photo 3); and
- Overhead line re-stringing to connect the overhead lines to the new SECs.



Photo 1 XLPE Cables installed in a deep bore tunnel



Photo 2 Indicative tunnel head house



Photo 3 Existing Tilbury Tunnel Headhouse and SEC.

- 1.2.2 The proposed new Tilbury Tunnel Headhouse and SEC is on an area of existing hardstanding in Tilbury, Thurrock, approximate grid reference TQ 66317 75873 on land owned on all sides by the Port of Tilbury, London.
- 1.2.3 The proposed Gravesend Tunnel Headhouse and SEC is located within a vegetated area which is part of the Canal and Grazing Marsh, Higham Local Wildlife Site, designated for its grassland habitats and on land owned by National Grid at approximately TQ 67455 74158. To the north of the Proposed Development is the existing cable tunnel and associated headhouse and SEC. The land immediately east is owned by the RSPB and is partially leased and used as a Police Training Centre for rifle shooting. The land immediately west comprises of the Thameside Campus (National Maritime Training Centre), Metropolitan Police Specialist Training Centre MPSTC and Thames and the Medway Canal Association. Please refer to Figure 1 in Appendix A of the Environmental Screening Report (ESR).

1.3 Construction works

Bored Cable Tunnel Construction

Tilbury

- 1.3.1 The indicative tunnel alignment is shown on Figure 2 in Appendix A of the ESR. A tunnel boring machine (TBM) will be utilised for the construction of the tunnel, commencing from the Tilbury side and drive south underneath the River Thames. A Main Compound would be required at Tilbury to facilitate the construction of the drive shaft for the TBM. A smaller, satellite compound would be required at Gravesend to facilitate the receiving and removal of the TBM.
- 1.3.2 The Main Compound at Tilbury would require an area of approximately 6000m² and comprise of project offices, welfare facilities, spoil storage for both shaft sinking and tunnelling operations, shaft ring and tunnel ring storage areas, workshop to maintain tunnelling equipment and parking facilities. There would be no concrete batching on site, with shaft and tunnel rings being delivered as pre-cast units.
- 1.3.3 The depth of the shaft is expected to be approximately 50m and will require a total of 450 m² working area that includes a 400 m² spoil storage area. Once the shaft construction is complete, the

tunnelling phase would commence. Staff numbers would increase for this phase and tunnelling would continue 24 hours a day until complete. Storage of the tunnel segments would require an area of 1500 m².

- 1.3.4 The tunnelling method cannot be confirmed until the appointment of the main contractor. However, based on the information obtained to date it is highly likely that construction using a TBM would be used to cut a channel through the chalk. The tunnel would then be constructed with precast concrete segments behind the TBM.
- 1.3.5 For the spoil handling, the required area is based on the type of tunnelling machine selected. For an Earth Pressure Balance machine (EPB) the spoil typically surfaces as a paste and can be stockpiled prior to removal from site. Some treatment of the chalk may be required to meet the requirements of the end location of the spoil, before it leaves site.
- 1.3.6 If a slurry machine is used, a processing plant is required to separate the arisings from the bentonite and then the processed material stored in the same way as the EPB machine prior to removal from site. If this method is used, the separation plant would require a footprint of 4000 m².
- 1.3.7 The excavated material from construction of the tunnel would be approximately 49,100 m³. The excavated material from the construction of each shaft would be approximately 10,250 m³ per shaft (one at either end). This results in approximately 69,600 m³ of spoil which will need to be removed from site. The composition of the spoil is currently being investigated which will determine its suitability for reuse.
- 1.3.8 National Grid have a zero waste to landfill target by 2026, which will come into force during the construction phase of the Proposed Development and so will apply. Numerous potential opportunities are being explored for the reuse of the spoil materials which include:
 - the infill and restoration of saline lagoon at RSPB Cliffe Pools providing benefits to aquatic invertebrates and located approximately 5.5km east of the Proposed Development in on the south side of the River Thames (National Grid's preferred choice);
 - the infill of similar lagoons on neighbouring land owned by commercial operator, Brett Aggregates;
 - use as construction material for the various other large developments up and coming in the Tilbury area; and
 - to support other habitat restoration and wetland projects in the Tilbury area.

Gravesend

- 1.3.9 The reception shaft would be located on the Gravesend side and spoil storage would be at a similar size to that of the Tilbury side. The reception shaft would be the same diameter as the drive shaft.
- 1.3.10 The reception shaft is only required for the removal of the TBM, once the drive has been completed. For this, a crane and fleet of lorries will be required. Their size is dependent on the TBM chosen and how much it can be broken down into smaller parts. Typically, a TBM can be split in to three parts.
- 1.3.11 The Reception Shaft Compound would serve as a satellite compound to the main site and so would be smaller, at approximately 400m² and comprise of welfare facilities, a small office area and spoil handling for the shaft construction works.

Sealing End Compound (SEC) and Terminal Pylon

- 1.3.12 An SEC is required either side of the River Thames to achieve the transition from an OHL to an underground connection. The new SECs have been sited as close to the existing OHL as possible to prevent the requirement for any new extent of OHL. Two new terminal pylons will be required either side; this forms the commencement of the 400kV OHL.
- 1.3.13 Pylon erection will be by either a Mobile Hydraulic Crane, or with a derrick to erect the pylon in small sections. Pylon erection will require a large laydown and assembly area of approximately 50m x 50m (within the 200m² area mentioned above for topsoil removal) for laying out and assembling the steelwork into the lifting sections. Steelwork will be delivered to site on trucks and assembled in sections around the pylon base. A tractor with a light crane or tele-handler may assist in the moving of and erecting steelwork on the ground. The first panel will be lifted by the crane and manoeuvred into position over the foundation stubs and fixed into place by locating the connecting bolts. Once in place the panel will be stayed to hold its position. Subsequent sections will be assembled using a controlled lift and staying sequence with each panel or boxed section bolted in turn to the previous erected panel until the pylon is complete/secured.

Removing of Existing Infrastructure

- 1.3.14 Existing pylons 4VG043, 4VG044 and 4VG045A at Tilbury will require removal, or reconfiguration/replacement. These pylons are shown on Figure 2 (Appendix A of the ESR). Pylon dismantling and removal can be carried out using a variety of methods depending on the pylon type, location and access. Potential methods include using a crane, felling or a Winch and Derrick.
- 1.3.15 As the pylon is dismantled and laid down in sections a hydraulic shearer mounted on a 360-degree excavator or gas torches will be used to break up the pylon into small sections and load into skips for disposal, reuse or recycling.

Reinstatement

- 1.3.16 The land used temporarily to support the construction of the tunnel will be reinstated to its former, or better than former condition.

Construction Environmental Management

- 1.3.17 An important measure to avoid significant effects is effective management during design and construction. Measures proposed to be included in an Outline Construction Environmental Management Plan (CEMP). Adherence to the requirements of the Outline CEMP will be undertaken by National Grid during the detailed design and construction phase. National Grid will undertake assurance audits and inspections throughout the construction phase to ensure that the Contractor is in compliance with the Outline CEMP and other applicable requirements.

Construction Programme

- 1.3.18 Construction at the site would take place from 2025, when the site is mobilised, and run until 2028, when the Proposed Development is commissioned.

2 Water Framework Directive Overview

- 2.1.1 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, commonly referred to as the Water Framework Directive (WFD), aims to protect and enhance the water environment.
- 2.1.2 The WFD takes a holistic approach to sustainable management of the water environment by considering interactions between surface water, groundwater and water-dependent ecosystems. Ecosystem conditions are evaluated according to interactions between classes of biological, chemical, physico-chemical and hydromorphological elements known as 'Quality Elements'.
- 2.1.3 Under the WFD, 'water bodies' are the basic management units, defined as all or part of a river system or aquifer. Waterbodies form part of a larger 'river basin district' (RBD), for which 'River Basin Management Plans' (RBMPs) are used to summarise baseline conditions and set broad improvement objectives. RBMPs are produced every six years, in accordance with the river basin management planning cycle. The current RBMPs at the date of this assessment are the 2019 Cycle 3 plans.
- 2.1.4 In England, the Environment Agency (EA) is the competent authority for implementing the WFD, although many objectives are delivered in partnership with other relevant public bodies and private organisations, for example local planning authorities, water companies, rivers trusts, and private landowners and developers.
- 2.1.5 The EA is also responsible for managing flood risk and other activities on Main Rivers. Local planning authorities or drainage boards are responsible for consenting certain activities on Ordinary Watercourses. Local planning authorities are responsible for highways drains, and landowners are responsible for ditches and watercourses and also piped watercourses and culverts. While the EA is ultimately responsible for the WFD on any water body, local authorities are required to plan and consent WFD related activities on Ordinary Watercourses.
- 2.1.6 As part of its regulatory and statutory consultee role on planning applications and environmental permitting (under the Environmental Permitting Regulations (England and Wales) 2016), the EA and WFD-partnering organisations, must consider whether proposals for new developments have the potential to:
- Cause a deterioration of any quality element of a water body from its current status or potential; and / or
 - Prevent future attainment of good status or potential where not already achieved.
- 2.1.7 Regulation 17 of the Water Environment Regulations 2017 (i.e. the WFD) states that, like other public bodies, local authorities have a statutory duty to "have regard to the River Basin Management Plan" and "any supplementary plans" covering proposed activities when exercising its functions. Local authorities must therefore reflect water body improvement priorities as outlined in RBMPs.
- 2.1.8 In determining whether a development is compliant or non-compliant with the WFD objectives for a water body, the EA and partnering organisations must also consider the conservation objectives of any Protected Areas (i.e. Natura 2000 sites or water dependent Sites of Special Scientific Interest) and adjacent WFD water bodies, where relevant.

3 Approach and Methodology

- 3.1.1 There are no fixed methods for a WFD assessment. The nature of the water environment and the breadth of the legislation mean that assessments are tailored to proposals on a case-by-case basis.
- 3.1.2 The following general guidance is available which has been applied for this assessment:
- Environment Agency (2016a). Water Framework Directive risk assessment. How to assess the risk of your activity¹;
 - Environment Agency (2016b). Protecting and improving the water environment. Water Framework Directive compliance of physical works in rivers²; and
 - The Planning Inspectorate (2017). Advice Note Eighteen: The Water Framework Directive³.
- 3.1.3 A stepwise approach consisting of screening, scoping and impact assessment phases is generally followed in order to: (a) rationalise the levels of WFD assessment and impact mitigation that are required; and (b) verify that proposals meet the requirements of the WFD. The general approach is described by The Planning Inspectorate (2017) and briefly summarised below.
- 3.1.4 This WFD comprises Screening and Scoping assessments, identifies requirements (if any) for WFD impact mitigation commitments in the planning submission, and identifies requirements for further WFD impact assessment at future design stages.

Stage 1 Screening

- 3.1.5 Screening identifies the zone of influence of a proposed development, and if proposed activities pose a risk to the water environment. It is used to identify if there are activities that do not require further consideration for WFD objectives, for example activities which have been ongoing since before the current RBMP plan cycle and which have thus formed part of the baseline.

Stage 2: Scoping

- 3.1.6 Scoping is used to identify any potential impacts of the proposed activities to specific WFD receptors and their water quality elements. This involves review of WFD impact pathways, shortlisting which WFD water bodies and quality elements could or could not be affected by proposed activities, and collecting baseline information from the relevant RBMP on the status and objectives for each water body.

Stage 3: Impact Assessment

- 3.1.7 This involves rationalised assessment of water bodies and quality elements that could be affected by proposed activities, in order to identify any areas of WFD non-compliance. Proposed activities are reviewed in terms of both positive and negative impacts, and the baseline mitigation measures, enhancements, and contributions to the WFD objectives described in the RBMP. Any proposed activities with potentially deleterious impacts are reviewed simultaneously with their corresponding mitigation proposals, to determine a net effect on WFD objectives.

Mitigation Commitments

- 3.1.8 Proposed mitigation activities relied upon to demonstrate compliance at any of the stages referred to above must be appropriately defined and sufficiently secured. Mitigation could be secured through planning licence conditions, Development Consent Orders, or other legally binding methods.

¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/522426/LIT_10445.pdf

² Environment Agency, 2016. Protecting and improving the water environment. Water Framework Directive Compliance of the physical works in rivers. Document available on request from the Environment Agency.

³ <https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-18/#:~:text=It%20establishes%20a%20legislative%20framework,and%20groundwater%20throughout%20the%20EU.>

Regulation 19 Derogation

- 3.1.9 Where the potential for deterioration of water bodies is identified, and it is not possible to mitigate the impacts to a level where deterioration can be avoided, additional assessment is needed in the context of WFD Regulation 19, which covers procedures for WFD derogation. (Regulation 19 is also commonly referred to as Article 4.7 of the original EU Directive).
- 3.1.10 Regulation 19 is a 'last resort' planning and legal process, and it is a matter for the Secretary of State to consider whether derogation under Regulation 19 is justified. An applicant would be required to provide detailed and often complex evidence to justify its case that the following four stringent tests have been met:
- Test (a): All practicable steps are to be taken to mitigate the adverse impacts on the water body concerned.
 - Test (b): the reasons for modifications or alterations are specifically set out and explained in the RBMP.
 - Test (c)(1): There is an overriding public interest in the Proposed Development and/or Test (c)(2): its benefits outweigh the benefits of the WFD objectives (i.e. that the benefits of the project to human health, human safety or sustainable development outweigh the benefits of achieving the WFD objectives).
 - Test (d): The benefits of the project cannot be achieved by a significantly better environmental option (that are technically feasible and do not lead to disproportionate cost).
- 3.1.11 In addition, the Development must not permanently exclude or compromise achievement of the WFD objectives in other bodies of water within the same RBD and must be consistent with the implementation of other environmental legislation. In applying Regulation 19, steps must also be taken to make sure that the new provisions guarantee at least the same level of protection as the existing legislation.

Desk Study

- 3.1.12 A desk-based study was carried out to capture information pertaining the Proposed Development that is not attainable through site survey. Reviewal of relevant information relating to the study area was undertaken to develop a baseline for WFD catchments, watercourses and surrounding areas. The following data sources were used for the desk study:
- Environment Agency WFD data⁴;
 - Ordnance Survey maps⁵;
 - Geology⁶ and soil data⁷;
 - Aerial photography⁸;
 - Natural environment maps and designations on the MAGIC website⁹;
 - Hydrological information¹⁰;
 - Environment Agency Ecology & Fish Data Explorer¹¹; and
 - NBN Atlas¹².

⁴ <https://environment.data.gov.uk/catchment-planning> (accessed 04/05/2023)

⁵ <https://www.bing.com/maps/> (accessed 04/05/2023)

⁶ <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/> (accessed 04/05/2023)

⁷ <https://www.landis.org.uk/soilscapes/> (accessed 04/05/2023)

⁸ <https://www.google.co.uk/maps> (accessed 04/05/2023)

⁹ <https://magic.defra.gov.uk/MagicMap.aspx> (accessed 04/05/2023)

¹⁰ <https://www.ceh.ac.uk/data> (accessed 04/05/2023)

¹¹ <https://environment.data.gov.uk/ecology/explorer/> (accessed 04/05/2023)

¹² <https://www.ecosia.org/search?q=nbn%20atlas&addon=chrome&addonversion=5.1.3&method=topbar> (accessed 04/05/2023)

3.2 Limitations and Assumptions

3.2.1 The following assumptions and limitations apply at this early stage of the Proposed Development:

- No site visits have been undertaken and thus the screening assessment is based on readily available online data;
- It is not known precisely where any arisings from the tunnel will be disposed of and so specific locations and any receptors to this potential impact source cannot be considered at this stage. It is possible that this material will be used to support wetland habitat creation (e.g. at the RSPB Cliffe Pools site just east of the Gravesend site). Although the storage, dewatering, handling, transportation and deposition of excess spoil will need to be carefully managed, its use to support habitat creation should result in a long term and permanent beneficial effect;
- Appropriate chemical testing will be undertaken of any excess spoil to ensure it is non-hazardous (which is likely given the depth of the tunnel) and can be re-used or deposited safely at the chosen location;
- There is no detailed information on construction method statements and so it has been assumed that standard good practice measures will apply with the effectiveness based on professional judgment;
- It has been assumed that there will be no construction works or development directly in the intertidal and sub-tidal environs (noting that the tunnel will be below the bed of the Thames by c. 50 m). If, for example, material is transported to the RSPB site at Cliffe Pools, this material may be conveyed by barge across the Thames Estuary. However, it is understood that there are existing jetties that can be used for this purpose; and
- There is currently no Drainage Strategy for the future operational above ground installations. Neither site will be extensive, but there remains a small risk from pollutants found in diffuse urban runoff, especially from hydraulic oils that may be present in electrical equipment such as transformers and switchgear. However, it is assumed that a suitable Drainage Strategy prepared in accordance with good practice and local planning policy shall be prepared at a later stage. This Drainage Strategy will consider water quality risk from urban runoff from the proposed above ground installations and will ensure that appropriate treatment trains based on sustainable drainage measures (where possible) or other proprietary chemical spillage containment measures are incorporated into the design.

4 Baseline

4.1 Study area

- 4.1.1 For the assessment of potential impacts on WFD water bodies, taking into account the nature of the Proposed Development, a study area considering the immediate environments of the above ground working areas was assessed in addition to the Thames Estuary. At this stage, it is not known where any arisings from the tunnel will be disposed of and so specific locations and any receptors to this potential impact source cannot be considered. However, the current preferred option is to support wetland habitat creation at the RSPB Cliffe Pools site, which would likely result in beneficial impacts. Impact sources and receptors have been considered at the appropriate scale taking into account site-specific conditions.

Tilbury

- 4.1.2 The Tilbury site situated just north of the Thames estuary at an approximate elevation of around 5 m AOD. To the east of the former power station concrete base in the southern portion of the Site, there is an overwide drain that runs generally north to south. This may be connected to the Thames via a sluice gate or other similar structure, with tide locking events a contributing factor to the overwide nature of the drain. To the southeast the land has been extensively worked with large areas of bare ground that may be being used for the storage of aggregates and other materials. This has led to significant changes to natural land drainage, that would likely have been coastal marsh in the past before the creation of river flood defences. Another linear drainage feature runs north to south to the east of West Road, then east to west to the north of an access road and the area of ash deposition for the former power station. To the east of this area of ash placement, another linear drainage feature is located. These two features are also over wide and it is not evident from online aerials and digital mapping whether they have any flow or connectivity with the Thames Estuary. Rather than being drains, they may alternatively be artificial linear ponds and wetland features that are a product of past land use change.

Gravesend

- 4.1.3 The Gravesend site is around 200 m south of the Thames Estuary and at an elevation of just above sea level at approximately 4 m above ordnance datum (AOD)¹³. It is bordered by a series of drainage ditches that are part of Eastcourt Marshes. These are designated as Main Rivers by the Environment Agency. From a review of online aerial imagery, the existing substation site appears to be surrounded by a drain, although to the west it appears to be increasingly dry and not connected to the Thames Estuary. To the east, approximately 20 m from the nearest point of the sub-station site, the drain is approximately a few metres wide and it enters a structure through flood embankments along the southern margin of the Thames Estuary. There appears to be a small ditch connecting the site with the drain, and this may be where surface water runoff is discharges. It is also unclear whether there is a free-flowing connection between the drain and the estuary, with large structures visible on either side of the Thames flood embankments and it being more likely that there are tidal flap gates that impound the flow in the ditch at high tide. Approximately 100 m south of the site is the Thames and Medway Canal. This canal was used until 1934 but is now disused and only an isolated open reach approximately 3 km long still exists. As this water feature is upstream of the site it is unlikely to be impacted.
- 4.1.4 The Gravesend site is within a Nitrate Vulnerable Zone (NVZ), which is a designated area where land and water resources are susceptible to nitrate pollution, primarily from agricultural sources such as fertilisers and manure. However, this designation is not relevant to the assessment of impacts as the Proposed Development is not going to be a significant source of nitrogen, and thus would not be considered any further. The Site is not within a Drinking Water Protected Area (surface water) or Safeguard Zone (surface or groundwater).

¹³ <https://maps.nls.uk/> (accessed 04/04/2023)

4.2 Catchment characteristics

Topography, land use and rainfall

- 4.2.1 Generally, the topography of both sites is flat, with elevations typically ranging from 4 m and 7 m AOD for the Tilbury site and 3 m to 7 m for the Gravesend site. Elevations increase slowly moving away from the River Thames, however the South Essex lowlands in which the sites are located are generally flat with small undulations in the landscape.
- 4.2.2 The Gravesend site is located just to the west of a rifle range (Milton Rifle Range) that has been there for at least 60 years, and is partially leased and used as a Police Training Centre for rifle shooting. The land immediately west comprises of the Thameside Campus (National Maritime Training Centre), Metropolitan Police Specialist Training Centre MPSTC and Thames and the Medway Canal Association.
- 4.2.3 The Tilbury Site is greenfield that was marshland in the past. A public right of way footpath passes close to the west of the proposed site. Land to the west is all brownfield industrial land. This includes concrete hardstanding where industrial buildings once stood, a ship cargo terminal and a sewage treatment works. There is also a concrete factory slightly northwest of the site. An existing electricity substation is just south of the site. Recent land use to the north and east of is primarily industrial waste landfill along with disposal of ash from Tilbury Power Station.
- 4.2.4 Land to the south of the proposed Gravesend site and the railway line is designated as the South Thames Estuary and Marshes SSSI. This continues along the southern bank of the Thames, where it is also designated as the Thames Estuary and Marshes Ramsar and SPA site (>500 m from the Site). There are no statutory ecological designations applying to the north bank of the Thames Estuary.
- 4.2.5 Climate data for the study area has been obtained from the Met office website¹⁴. The closest historical weather monitoring station is Gillingham Football Club located close to the Medway River approximately 10 km to the southeast. Based on average rainfall data from this monitoring station for the period 1991-2020 the study area is expected to receive approximately 600 mm per year. This is well below the UK average from the same period of 1,116 mm. This demonstrates that the area can be categorised as dry in comparison to most of the United Kingdom.

Geology

- 4.2.6 The geology of both the Tilbury and Gravesend sites and the indicative tunnel alignment have the same geology. Both sites are on historical alluvial floodplains. This means that there are Superficial deposits of Alluvium which may consist of Clay, Silt, Sand & Peat. These are generally quite wet and have naturally high groundwater. The alluvium deposits sit above Chalk which may consist of Lewes Nodular Chalk Formation, Seaford Chalk formation or Newhaven Chalk Formation¹⁵.
- 4.2.7 Both sites and the proposed tunnel sit above a highly productive Principal Aquifer called the White Chalk subgroup.
- 4.2.8 A review of local borehole records for the Tilbury site suggests that the Chalk is c. 25 m below ground level (bgl) with superficial deposits of alluvium above (clays, silt, and peats).
- 4.2.9 Borehole records for the southern Gravesend site show that the superficial deposits also consist of clays, silt, and peats but also gravel layers before reaching the Chalk at around 25 m bgl.

¹⁴ <https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-synoptic-and-climate-stations> (accessed 04/05/2023)

¹⁵ <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/> (accessed 04/05/2023)

4.3 Water bodies

4.3.1 Within the study area there are the following WFD water bodies¹⁶ presented on Figure E1:

- Thames Middle water body (GB530603911402);
- South Essex Thurrock Chalk Water Body (GB40601G401100) (Tilbury site); and
- North Kent Medway Chalk Water Body (GB40601G500300) (Gravesend site).

4.3.2 Although the Tilbury site is nominally located within the Mardyke Operational Catchment, and Essex South Management Catchment, and the Gravesend site is located within the Medway Lower Operational catchment, they are not hydrologically connected to these WFD watercourses. Rainfall at the sites does not contribute to the Mardyke water body (GB106037028200), with surface water runoff ending up in the Thames Estuary directly (i.e. Thames Middle water body (GB530603911402)). There is no WFD water body classified for this part of the operational catchment and thus no WFD status for any watercourse present. Similarly, the Gravesend site is within the Medway Lower Operational Catchment, and the Medway Management Catchment, but the site drains via coastal and modified ditches directly to the Thames Estuary. Both sites are effectively in the Thames Middle water body catchment, although given the very different nature of the Thames Estuary the WFD classification for this water body would not be a suitable proxy for the small coastal drainage ditches present on the sites.

4.3.3 Approximately 100 m south of the Gravesend site is the Thames and Medway Canal. This canal was used until 1934 but is now disused and only an isolated open reach approximately 3 km long still exists. The disused Thames and Medway Canal is not a designated artificial WFD water body and will not be considered any further by this WFD Screening Assessment.

Thames Middle Water Body

4.3.4 The Thames Estuary at this location is tidal and is identified under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 and Thames River Basin Management Plan (RBMP) as the Thames Middle water body (ID GB530603911402). It is included in the Tidal Thames Operating Catchment and the Thames TraC Management Catchment.

4.3.5 The Cycle 3 (2019) WFD classifications for the Thames Middle water body is provided in Table 1. The Thames Middle is a large heavily modified transitional water body (TraC) with a surface area of 44.2 km². Under cycle 3 (2019) of the Thames RBMP it is currently at Moderate Ecological Potential (but Good in regard to fish, invertebrates, macroalgae and phytoplankton) and failing to meet Good Chemical Status. The Reasons for Not Achieving Good (RNAG) Ecological Status are listed on the catchment data explorer website (CDE)¹⁷ as diffuse pollution from urban development, contaminated sediments, landfill leaching, sewage discharge and physical modifications. This water body had the objective of achieving Moderate Ecological Status by 2015, due to disproportionate costs and burdens and good status being prevented by an artificial/ heavily modified designated use.

Table 1: WFD summary for the Thames Middle Water Body (GB530603911402)

WFD Parameter	Status / Summary
Water Body Type	TraC
Water Body Area (km ²)	44.161 km ²
Water Body Length (km)	N/A
Hydromorphological Designation	Heavily modified
Current Overall Status	Moderate Ecological Status
Ecological Status	Moderate

¹⁶ <https://environment.data.gov.uk/catchment-planning> (accessed 04/05/2023)

¹⁷ <https://environment.data.gov.uk/catchment-planning> (04/05/2023)

WFD Parameter	Status / Summary
Biological Quality Elements	Moderate
Physico-chemical Quality Elements	Moderate
Supporting elements (Surface water)	Moderate
Chemical	Fail
Priority Hazardous Substances	Fail
Priority Substances	Good
Other pollutants	Good
Objective	Moderate by 2015

Source: <https://environment.data.gov.uk/catchment-planning/WaterBody/GB530603911402>. Last accessed May 2023.

- 4.3.6 To achieve WFD compliance it is also important to consider the conservation objectives of any relevant Protected Areas. These tend to be sites designated under legislation that has implemented European Union directives in the past (and which remain following the UK exit).
- 4.3.7 The South Thames Estuary and Marshes SSSI is located approximately 600 m to the east along the Thames Estuary. It is a water dependant designated site with a diversity of habitats including grazing marsh, saltmarsh and mudflats. In addition, the Thames Estuary and Marshes Ramsar and Thames Estuary and Marshes Special Protection Area (SPA) are also roughly 600 m to the east (refer to Figure E1). However, the risk from water pollution effects to these designated sites will be limited by available dilution and dispersion of any potential contamination in the estuary, as well as potential tidal influences on the impact pathway. Other downstream designated sites include Mucking Flats and Marshes SSSI (2.3 km to the northeast), which at this distance is less likely to be affected by water.

South Essex Thurrock Chalk Water Body (GB40601G401100)

- 4.3.8 The Cycle 3 (2019) WFD classifications for the South Essex Thurrock Chalk Water Body (GB40601G401100), which lies beneath the Tilbury site is provided in Table 2.

Table 2: WFD summary for the South Essex Thurrock Chalk Water Body (GB40601G404400)

WFD Parameter	Status / Summary
Water Body Type	Groundwater
Water Body Area (km ²)	33.573
Water Body Length (km)	N/A
Hydromorphological Designation	N/A
Overall Status	Poor
Status Objective	Good by 2015
Quantitative status	Poor
Chemical status	Poor
Supporting elements – prevent and limit	Active
Supporting elements – Trends assessment	No trend

Source: <https://environment.data.gov.uk/catchment-planning/WaterBody/GB40601G401100> Last accessed May 2023.

North Kent Medway Chalk Water Body (GB40601G500300)

- 4.3.9 The Cycle 3 (2019) WFD classifications for the North Kent Medway Chalk Water Body (GB40601G500300), which lies beneath the Gravesend site is provided in Table 3.

Table 3: WFD summary for the North Kent Medway Chalk Water Body (GB40601G500300)

WFD Parameter	Status / Summary
Water Body Type	Groundwater
Water Body Area (km ²)	233.666
Water Body Length (km)	N/A
Hydromorphological Designation	N/A
Overall Status	Poor
Status Objective	Good by 2050
Quantitative status	Poor
Chemical status	Poor
Supporting elements – prevent and limit	Active
Supporting elements – Trends assessment	Upward trend

Source: <https://environment.data.gov.uk/catchment-planning/WaterBody/GB40601G500300>. Last accessed May 2023.

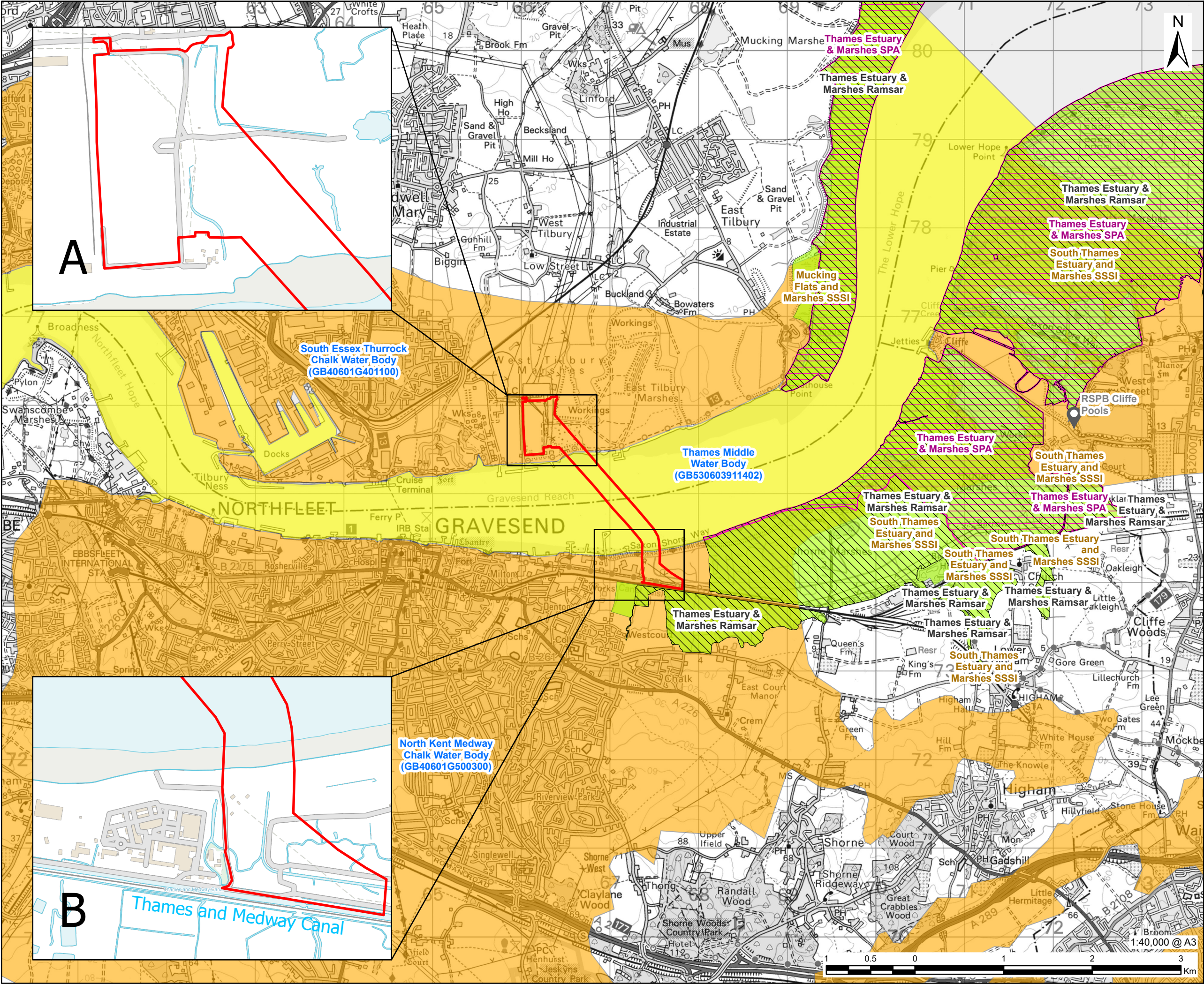
Notable species

- 4.3.10 Historic records of fish, macroinvertebrate and aquatic macrophyte species within the last ten years are available from the Environment Agency through their routine monitoring programme. Details of relevant Environment Agency monitoring sites are summarised in Table 4:

Table 4: Location of relevant Environment Agency monitoring sites

Site name (ID)	Water body	Site National Grid Reference	Distance from site	Year last surveyed	Group monitored
River Thames (156465)	River Thames	TQ 64900 74600	2.78 km upstream	2022	Phytoplankton
River Thames (157197)	River Thames	TQ 69350 75600	2.83 km downstream	2022	Phytoplankton
Denton Wharf Beam Trawl (38691)	River Thames	TQ 66646 74338	0.85 km upstream	2019	TraC Fish
Source: https://environment.data.gov.uk/ecology/explorer/ Last accessed May 2023					

- 4.3.11 There was one fish monitoring site within the River Thames (site ID: 38691) approximate 850m upstream of the site. All fish recorded were common coarse or minor species, they included *Gadus Morhua* (Atlantic cod), *Solea Solea* (Common sole), *Trisopterus Luscus* (Whiting) and *Platichthys Flesus* (European flounder). No protected or notable fish species identified.
- 4.3.12 There were no records for phytoplankton within 2 km of the site crossing of the Thames. In addition, the EA held no records for macroinvertebrates and macrophytes within 2 km of the site.
- 4.3.13 Historical records of species sightings are available as open-source data on NBN Atlas. A search of the database was conducted within a 2 km radius of the crossing of the River Thames. There are no historic records of the protected white clawed crayfish *Austropotamobius pallipes*, or the invasive American signal crayfish *Pacifastacus leniusculus*, nor any other notable macroinvertebrate or fish species.



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LEGEND

- EIA Screening Boundary
- Ramsar
- Special Protection Area
- Site of Special Scientific Interest
- Ecological Status
- Moderate Ecological Status
- Poor Overall Status
- RSPB Cliffe Pools

NOTES

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Inserts A and B showing the position of drains and ditches in close proximity to the above ground development sites.

ISSUE PURPOSE

FINAL

PROJECT NUMBER

60677311

FIGURE TITLE

WFD Screening Report

FIGURE NUMBER

Figure E1

5 Potential impacts and mitigation

5.1 Potential construction phase impacts and mitigation

- 5.1.1 The proposed development includes a new 2.14 km tunnel (from headhouse to headhouse) underneath the River Thames and associated infrastructure either side of the river. Shaft headhouses and sealing end compounds will be located either side of the proposed pipeline in close proximity to the River Thames. The shaft headhouse located on the north bank looking downstream is approximately 450 m from the estuary and the shaft headhouse on the south bank are less than 200 m from the River Thames. There will also be the construction of new overhead lines and electrical pylons at both sites.
- 5.1.2 Impacts on surface (and ground) water quality due to deposition or spillage of soils, sediments, oils, fuels, or other construction chemicals may occur during construction works. However, through careful management and the implementation of best practice mitigation measures (e.g. as described in General Pollution Prevention guidance documents, Construction Industry and Research Associated guidance C692, C650, C648 etc.) these risks can be effectively managed and significant environmental effects on nearby drainage ditches (direct impacts) or the Thames Estuary (indirect impacts) should not occur.
- 5.1.3 There is the potential for a temporary increase in the volume and rate of surface water runoff from bare earth or new impervious areas, changes in surface water flow paths, or dewatering of excavations including the tunnel construction. The temporary storage, potential dewatering and transportation of very large quantities of arisings from the tunnelling operations will require a large area and a robust surface water runoff strategy with measures to filter fine sediments and control the risk of chemical contamination.
- 5.1.4 Runoff control and filtration would be used on site to prevent sediment runoff into the Thames (indirectly via other watercourses) or unnamed watercourses in the vicinity of each site (directly but noting that flow pathways to the Thames are far less certain from the Tilbury site given extensive workings of the land to the southeast of the site). This would apply to sediment stored from construction of both Tilbury and Gravesend sites and sediment removed as part of the shaft and tunnel excavation. Material removed by tunnel boring machines (TBM) will surface in a mostly liquid form mixed with bentonite to ease removal from the tunnel and this will most likely require a separate plant, that will require adequate space and storage volume. The estimated total volume of excavated material is 69,600 m³. The duration of temporary stockpiling of material will be minimised and any material stored will be done in line with best practice to ensure no leeching takes place (e.g. provision of geotextile liners). Areas where excavated material is transferred into removal HGVs must also be planned with best practice procedures to prevent runoff of sediment heavy water. HGV removal of material is expected to happen Monday to Friday and Saturday mornings. Where slurry treatment or spoil bins are used best practice should be followed to prevent spills or leaks. The type of removed material will depend on which type of TBM is chosen for the project (e.g. either Earth Pressure Balance or Slurry Machines).
- 5.1.5 It is also expected that during shaft construction there will be a need to implement a dewatering strategy. Should the need arise for any discharge of dewatered groundwater from the sites as a result of construction works, this would be discussed with Thames Water/Environment Agency and any attenuation and treatment requirements agreed depending on the discharge strategy.
- 5.1.6 Depending on the type of TBM selected, different chemicals will be used. General chemicals include, tail sealant, main bearing grease, hydraulic oil. Although generally insoluble in water with good qualities of biodegradation, they must be prevented from discharge into watercourses and on site. Additionally, the annulus of the TBM needs to be grouted to ensure equal loading of the tunnel rings, this is usually done with a bentonite or pea-gravel based grout. With regard to tunnelling through the

Chalk aquifer, chemicals to be used must be non-toxic, inert and be fast setting to minimise the risk of contamination. An annulus grout that is well suited for the chalk must be chosen and engagement must be taken with the Environment Agency. It is also expected that the Contractor will use good Industry Practice in the operation of the TBM during the tunnelling works. In addition, the tunnel will be concrete lined but using pre-cast concrete blocks delivered to site to avoid the need for a concrete batching plant on site.

- 5.1.7 At immediate risk from sediment laden runoff or chemical spillages are the drains and ditches in and around the two sites. Based on the initial baseline assessment, these water features are likely to be of low importance. The Thames Estuary, which is likely to be classed as a high or very high importance water feature, is only at risk indirectly, via these drains and ditches. Connectivity from the Tilbury Site to the Thames is less obvious and there may not in fact be a discharge. This is important as it is the north bank where shaft and tunnel arisings are to be temporarily stored and processed. The Thames also has a high dilution and dispersion potential and is naturally a more turbid aquatic environment where fauna and flora are adapted to higher suspended sediment levels.
- 5.1.8 The key issue is the permanent disposal of the material removed from the tunnel during construction. At present there is no firm proposals for what will be done with this material. Discussions have been held with the RSPB about using excavated material in the formation of wetlands at RSPB Cliffe Pools roughly 4.5 km east of the Gravesend site. If this is the case, the re-use of the material (assuming suitable for re-use) will potentially contribute to the creation of new habitat, which is likely to be a significant beneficial effect on the water environment. However, there remains uncertainty regarding this and if alternative proposals are made, this screening assessment may need to be reviewed.
- 5.1.9 It is estimated that around 200 staff will work on the project in multiple shifts during construction of the tunnel. Welfare facilities for these staff across both sites will need to be provided, included management of foul waste and water supply. It is unknown at this stage whether either compound can connect to a public sewer or mains water supply, although where this is not possible there are alternative options. For foul waste, due to the temporary nature of the works it is assumed that foul waste would be stored in a tank and regularly emptied by a suitable waste management contractor for disposal off-site. The number of staff that will be on site for the Headhouse and SEC construction is currently unknown.
- 5.1.10 At this stage it is assumed that existing site access routes will be used for temporary works and in the long term for permanent access, and that there will be no construction of new, or widening of existing accesses across watercourses. Should this be required the design of the crossings should be clear-span where possible or any culverting proposed following the hierarchy of least impacting culvert design and incorporating proportionate measures to mitigate impacts. This may include some compensatory enhancement of drainage ditches nearby as it is not possible to mitigate for all the impacts through the design of culverts alone. Any compensatory mitigation should be on a 'like for like' basis. It is also assumed that there will be no works along the Thames Estuary including any temporary or permanent works below Mean High Water Spring Tide (other than tunnelling operations below ground).

5.2 Potential operation phase impacts and mitigation

- 5.2.1 During operation there will be new impermeable surfaces at both sites and an increase in surface water runoff. Runoff from the roofs of new buildings and accesses will contain diffuse urban pollutants. However, the use of sustainable drainage systems (SuDS) or proprietary measures (if well maintained) where SuDS are not possible can be effective in reducing water quality risks from urban runoff. A Drainage Strategy will be required to ensure surface water runoff will be managed so that there is no increase in flood risk as a result of the Proposed Development.
- 5.2.2 Some new infrastructure on the sites such as electrical switchgear/transformers may contain oil or other environmentally harmful chemicals. This equipment will likely be self-bunded or bunded to a

minimum 110% capacity to ensure that should a chemical leak occur it is contained on site where it can be removed in a suitable way.

- 5.2.3 During operation both sites will be unmanned, and although they will have welfare facilities for infrequent site visits, usage will be very low. It is assumed at this stage that any foul waste will be connected to the nearest public sewer.

6 WFD Screening

- 6.1.1 The purpose of the WFD screening stage is to identify a zone of influence of the Proposed Development and to determine whether that influence has the potential to adversely impact upon WFD water body receptors. The screening stage also identifies specific activities of the Proposed Development that could affect receptor water bodies' WFD status and carries them forward to subsequent stages of the assessment process. Water body receptors that are screened out are not carried forward, and justification is provided.

6.2 Screening of WFD water bodies

- 6.2.1 The Proposed Development interacts with a number of WFD surface water and groundwater bodies. WFD Screening of these water bodies is provided in Table 5.
- 6.2.2 The purpose of the WFD screening stage is to identify a zone of influence of the Proposed Developments and to determine whether that influence has the potential to adversely impact upon WFD water body receptors; this approach has been taken in this assessment and is outlined in this section.

Table 5: Screening of WFD water bodies potentially impacted by the Proposed Development

Water Body	Screening Outcome	Justification
Thames Middle Water Body (GB530603911402)	In	The new cable tunnel will be beneath the Thames Estuary by c. 45-50 m. However, construction works will be taking place in close proximity to this water body along both banks or close to drains and ditches that ultimately discharge to the Thames Estuary.
South Essex Thurrock Chalk Water Body (GB40601G401100) (Tilbury site)	In	The construction of the tunnel may disturb groundwater in the underlying WFD groundwater bodies.
North Kent Medway Chalk Water Body (GB40601G500300) (Gravesend site)	In	The construction of the tunnel may disturb groundwater in the underlying WFD groundwater bodies.

Screening of components and activities

- 6.2.3 The Proposed Development comprises a number of activities that present a potential risk to the WFD status of the water body identified in the previous section. The screening assessment of components and activities pertaining to the Proposed Development is provided in Table 6.
- 6.2.4 At this stage there are multiple assumptions and limitations are discussed earlier under 'Limitations and Assumptions' earlier. Therefore, re-evaluation of activities that remain uncertain may be required at a later date.

Table 6: Screening of the Proposed Development's activities

Activity		Description	Screening Outcome
Thames Middle Water Body (GB530603911402)			
Shaft Construction		Shaft constructed to 50 m deep with a 450 m ² working area and 45 m working area diameter (both Tilbury and Gravesend sides)	In – Temporary hardstanding and impermeable areas could increase surface runoff and lead to risks of sediment and chemical contamination from site materials and chemical spillages. Excavated materials will need to be appropriately stored, processed and potentially dewatered, to avoid sediment pollution.
Tunnelling for new cable		The new cable tunnel will be approximately 2.14 km long (from headhouse to headhouse) and 4 m in diameter	In - Excavated materials will need to be appropriately stored, together with standard construction risks to avoid adverse impacts to the Thames Estuary.
Dewatering		Dewatering of groundwater may be required during construction. Abstracted water would likely be discharged to watercourses such as the Thames Estuary.	In – A strategy would need to be outlined to ensure that discharge of abstracted water does not impact the quality of the River Thames and any associated Protected Areas within the zone of influence.
Movement of sediment by barge (if proposed)		If it is proposed to transport tunnel arisings by barge then there will be loading and unloading operations from existing jetties and the temporary movement of barges up and down the Thames.	In – Although barge movements for sediment transport are temporary, they have the potential to mobilise sediment that could effect benthic communities. The effects of this impact are largely dependent on the scale and duration of the activities, and the sensitivity of the locations where barges will be operating. This component has been screened in for now on a precautionary basis.
Surface water runoff (operation)		During operation there will be new impermeable surfaces, although the Tilbury site is located on existing hardstanding. This could increase the volume and rate of surface water runoff. Runoff from the roofs of new buildings and accesses will contain diffuse urban pollutants.	Out – The risk will be very low by virtue of the nature and size of the development, as well as any impact on the Thames being indirect. The Thames also has a very large dilution capacity. Furthermore, the use of SuDS or proprietary measures (if well maintained and where SuDS are not possible) can be effective in reducing water quality risks from urban runoff.
Chemical spillages (operation)		Some new infrastructure on the sites such as electrical switchgear/transformers may contain oil or other environmentally harmful chemicals.	Out – Only relatively small quantities of oils or other potentially harmful chemicals will be used on stored on site. This equipment will likely be self-bunded or bunded to a minimum 110% capacity to ensure that should a chemical leak occur it is contained on site where it can be removed in a suitable way. It is expected that the sites will be operated in accordance with an Environmental Management System that will help managed any risks of water pollution.
Foul drainage (operation)		During operation both sites will be unmanned, and although they will have welfare facilities for infrequent site visits, usage will be very low.	Out – Only small quantities of foul drainage will be generated and if this is not connected to the public foul sewer it can be effectively managed by other standard on-site options.
South Essex Thurrock Chalk Water Body (GB40601G401100) (Tilbury site)			
Shaft Construction		Shaft constructed to 50 m deep with a 450 m ² working area and 45 m working area diameter	In – Groundwater could be encountered and so dewatering will need to be carried out.
Tunnelling for new cable		The new cable tunnel will be approximately 2.14 km long (from headhouse to headhouse) and 4 m in diameter	In – Groundwater could be encountered and so dewatering will need to be carried out. Excavated materials will need to be appropriately stored, together with standard construction risks to avoid adverse impacts to the Thames Estuary.
Main Construction Compound		Will require around 6000 m ² area to house project offices, welfare facilities, spoil storage area, shaft ring and tunnel ring storage areas, workshops and parking facilities	In – Bare soil areas could increase surface runoff and lead to risks of sediment and chemical contamination from site materials and chemical spillages. The temporary laydown area is expected to all be kept within the existing hardstanding on the Tilbury site. Excavated materials will need to be appropriately stored, processed and potentially dewatered, to avoid sediment pollution.
Removal of existing infrastructure		Existing pylon (TQ 66357 76002) will need to be removed using a crane, felling or winch and derrick	Out - Groundwater will not be encountered.

Activity	Description	Screening Outcome
Sealing end and Construction of Terminal Pylon	A SEC is required either side of the River Thames to achieve the transition from an OHL to an underground connection. Pylon erection will be by either a Mobile Hydraulic Crane, or with a derrick to erect the pylon in small sections	Out – Groundwater will not be encountered.
Dewatering during construction	Dewatering of groundwater may be required during construction e.g. shafts. Abstracted water would then be discharged to watercourses	In – A strategy would need to be outlined to ensure that discharge of abstracted water does not impact the quality of the River Thames and any associated Protected Areas within the zone of influence.
North Kent Medway Chalk Water Body (GB40601G500300) (Gravesend site)		
Shaft Construction	Shaft constructed to 45-50 m deep with a 450 m ² working area and 45 m working area diameter	In – Groundwater could be encountered and so dewatering will need to be carried out.
Tunnelling for new cable	Shaft required for removal of TBM. Crane and lorries will be required and their size is dependant on the TBM used. Foundations or potential ground improvements may be required to support the heavy machinery.	In – Groundwater could be encountered and so dewatering will need to be carried out. Excavated materials will need to be appropriately stored, together with standard construction risks to avoid adverse impacts to the Thames Estuary.
Shaft Compound	An approximately 400 m ² area is required to house welfare facilities for the contractors on site, small office areas and spoil handling for shaft construction works	In – New hardstanding areas could increase surface runoff and lead to risks of sediment and chemical contamination from site materials and chemical spillages.
Dewatering during construction	Dewatering of groundwater may be required during construction e.g. shafts. Abstracted water would then be discharged to water courses	In – A strategy would need to be outlined to ensure activities do not impact groundwater supply and nearby groundwater dependant environments

7 Next Steps

- 7.1.1 This WFD Screening Assessment has considered whether there is a risk of adverse impacts from the construction and operation of the Proposed Development on WFD water bodies, including: the Thames Middle transitional water body (GB530603911402), and the South Essex Thurrock Chalk (GB40601G401100) (Tilbury site) and North Kent Medway Chalk groundwater bodies (GB40601G500300) (Gravesend site).
- 7.1.2 The potential impacts all relate to construction works and are linked to tunnelling operations, and the expected large volume of shaft and tunnel arisings that will need to be processed and disposed of. Although these works will be temporary, and good practice mitigation measures can be effective in managing pollution risks to each WFD water body so that non-compliance with WFD objectives is less likely, it is recommended that a WFD Scoping Assessment is carried out.
- 7.1.3 The WFD Scoping Assessment will qualitatively assess the risk to each WFD parameter for all three water bodies in the context of additional design information, and consultation with the Environment Agency. Additional WFD water bodies may need to be considered depending on the disposal site for tunnel arisings.

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