

National Grid
Cable Tunnel Replacement
Project

Environmental Statement
Volume II
Chapter 3 Project Description

December 2023



Quality information

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3 Project Description

3.1 Introduction

3.1.1 This chapter of the Environmental Statement (ES) provides an overview of the Tilbury to Grain and Tilbury to Kingsnorth (TKRE) Cable Tunnel Replacement Project (hereafter the Proposed Development). It outlines the main components of the Proposed Development including details of its design, construction and operation.

3.2 Overview

3.2.1 The Proposed Development comprises the **boring of a new tunnel** and the following above-ground components at both ends of the new tunnel:

- **A new cable sealing end compound (SEC):** consisting of:
 - **a new tunnel headhouse** which will cover the shaft into the tunnel;
 - **a new overhead line gantry structure** which will connect the overhead line downlead conductors and transfer them to six sealing end structures; and
- **Modifications to the existing overhead line (OHL):** The new OHL conductors will be connected to the existing TKRE 400kiloVolt (kV) OHL conductors via new terminal pylons. The old OHL conductors and existing pylons will be either replaced, refurbished or removed.

3.2.2 It should be noted that modifications to the existing overhead lines are consented via Section 37 of the Electricity Act 1989 and, although described in this ES, do not form part of the Town and Country Planning Act planning application. The Department for Energy Security and Net Zero are the determining body.

3.3 The Proposed Development

Cable Tunnel

3.3.1 The new cable tunnel will be approximately 2.2km long (from headhouse to headhouse), 4m in internal diameter (4.5m external diameter) and with the alignment illustrated in Figures 3.1 and 3.2. The depth of the tunnel is approximately -34m above Ordnance Datum (AoD) to - 32mAoD, and approximately three to four tunnel widths below the river bed.

3.3.2 Twelve new cross linked polyethylene (XLPE) cables will be installed in the new tunnel, once bored, to match the required 3325 megavolt amperes (MVA) maximum rating.

3.3.3 Due to advances in cable technology, XLPE is now being used in preference to the use of fluid filled cable (like those installed in the existing tunnel). In these modern cables, the central conductor is insulated by means of a cross linked polyethylene material, which is extruded around the conductor. The absence of fluid in the cable insulation enables a more mechanically robust overall cable construction. XLPE cables require less maintenance, with no ancillary fluid equipment to monitor and maintain¹. For example, sulphur hexafluoride (SF₆)², typically used in electricity transmission and distribution to insulate live electrical parts and to switch the flow of electrical current on and off, is **not required** to be used in this project.

¹ National Grid (2015). Undergrounding high voltage electricity transmission lines. Available at: https://www.nationalgrid.com/sites/default/files/documents/39111-Undergrounding_high_voltage_electricity_transmission_lines_The_technical_issues_INT.pdf.

² National Grid (2022). What is SF₆? Sulphur hexafluoride explained. Available at: <https://www.nationalgrid.com/stories/energy-explained/what-is-sf6-sulphur-hexafluoride-explained#:~:text=What%20is%20SF6%20used%20for,in%20electricity%20transmission%20and%20distribution.&text=Medium%2D%20and%20high%2Dvoltage%20electrical,electrical%20current%20on%20and%20off.>

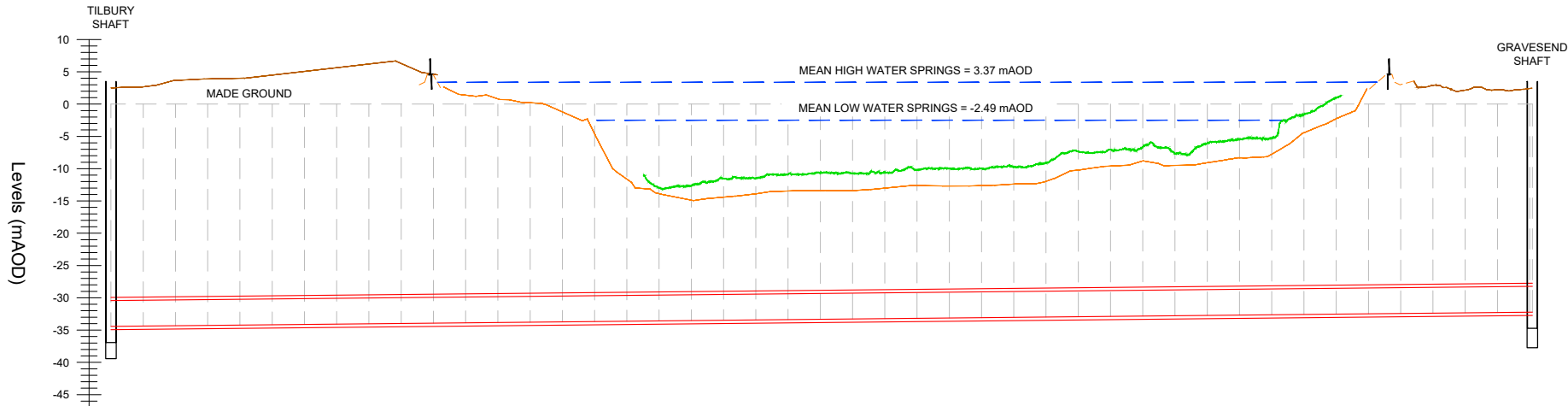
- 3.3.4 Each cable needs to be well-spaced from others for adequate heat dissipation which will be achieved by forced air ventilation.

Table 3-1: New Bored Cable Tunnel - Summary of Key Characteristics

New Bored Cable Tunnel - Summary of Key Characteristics	
Length of tunnel	Approximately 2.2km (headhouse to headhouse)
Width of tunnel (diameter)	4m (internal) 4.5m (external)
Depth of tunnel	Approximately -34mAoD to - 32mAoD
Design life	120 years

Plate 3-1: Example of XLPE Cables installed in a deep bored tunnel





CHAINAGE	0.000	50.000	100.000	150.000	200.000	250.000	300.000	350.000	400.000	450.000	500.000	550.000	600.000	650.000	700.000	750.000	800.000	850.000	900.000	950.000	1000.000	1050.000	1100.000	1150.000	1200.000	1250.000	1300.000	1350.000	1400.000	1450.000	1500.000	1550.000	1600.000	1650.000	1700.000	1750.000	1800.000	1850.000	1900.000	1950.000	2000.000	2050.000	2100.000	2150.000	2200.000
INVERT / TUNNEL LEVEL (mAOD)	-34.434	-34.384	-34.334	-34.284	-34.234	-34.184	-34.134	-34.084	-34.034	-33.984	-33.934	-33.884	-33.834	-33.784	-33.734	-33.684	-33.634	-33.584	-33.534	-33.484	-33.434	-33.384	-33.334	-33.284	-33.234	-33.184	-33.134	-33.084	-33.034	-32.984	-32.934	-32.884	-32.834	-32.784	-32.734	-32.684	-32.634	-32.584	-32.534	-32.484	-32.434	-32.384	-32.334	-32.284	-32.234
HORIZONTAL GEOMETRY	L =1696.924																													R: 350.000 L: 316.621							L =190.616								
VERTICAL GEOMETRY	Ch =0.000 LVI = -34.434mAOD	G =0.100% L =2204.161																																											Ch =2204.161 LVI = -32.230mAOD

Long Section
Vertical Scale 1:500
Horizontal Scale 1:5000

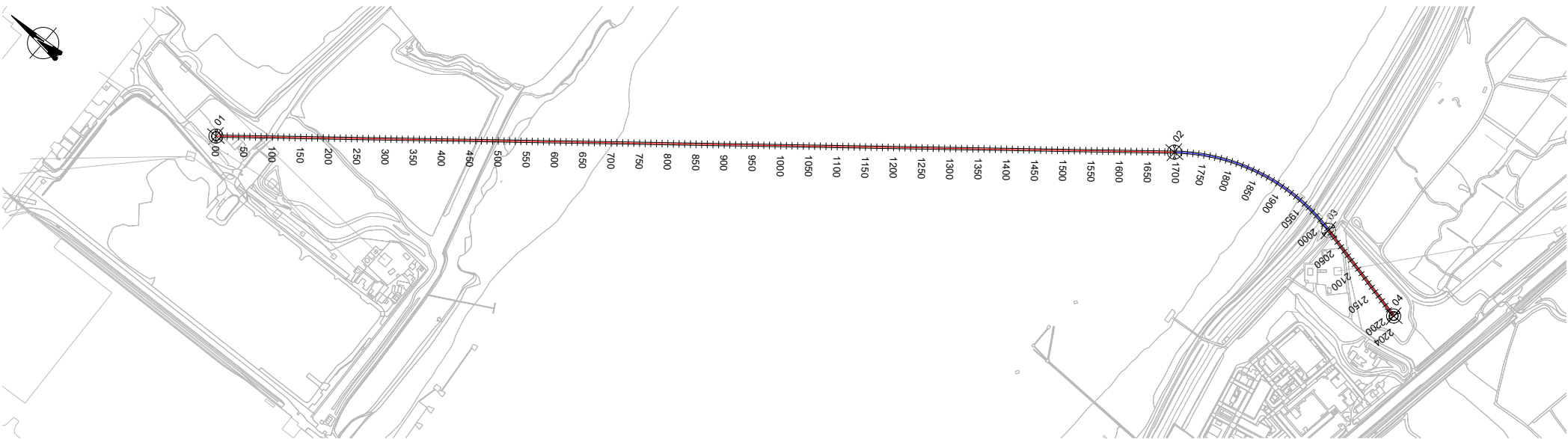
NOTES

- All dimensions in metres unless stated otherwise
- Levels are in metres above Ordnance Datum (mAOD)
- Shaft locations and tunnel route taken from drawings
PDD-100116-DDR-007/30003364-MSE-XX-XX-DR-Y-10011
- New Tilbury Site Constraints
PDD-100116-DDR-007/30003364-MSE-XX-XX-DR-Y-10012
- New Gravesend Site Constraints
PDD-100116-DDR-008/30003364-MSE-XX-XX-DR-Y-10013
- River Thames Site Constraints
- Tunnel depth derived from bathymetry data

LEGEND

- River bed level taken from Fugro bathymetry survey
- River bed level taken from Port of London Authority drawing
PLA 337 - H.O.Ref. No. 113-337-141 Date 27/03/2019
- Ground level taken from Centara Surveys drawings
108567_03_00 - Baker Hicks - Tilbury
108567_03_01 - Baker Hicks - Gravesend
- Water levels taken from Port of London Authority drawing
PLA 337 - H.O.Ref. No. 113-337-141 Date 27/03/2019
- Proposed Tunnel

SOP table		
SOP	Easting	Northing
01	566298.973	175876.623
02	567391.568	174578.244
03	567466.435	174281.611
04	567427.615	174094.990
CAD check		SM



Plan View
Scale 1:5000

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Master Scheme No:	Sub-Scheme No:	Site:
100116	-	RIVER THAMES

Scheme Name:
TKRE GRAIN-TILBURY AND KINGSNORTH-TILBURY
400kV UPRATING

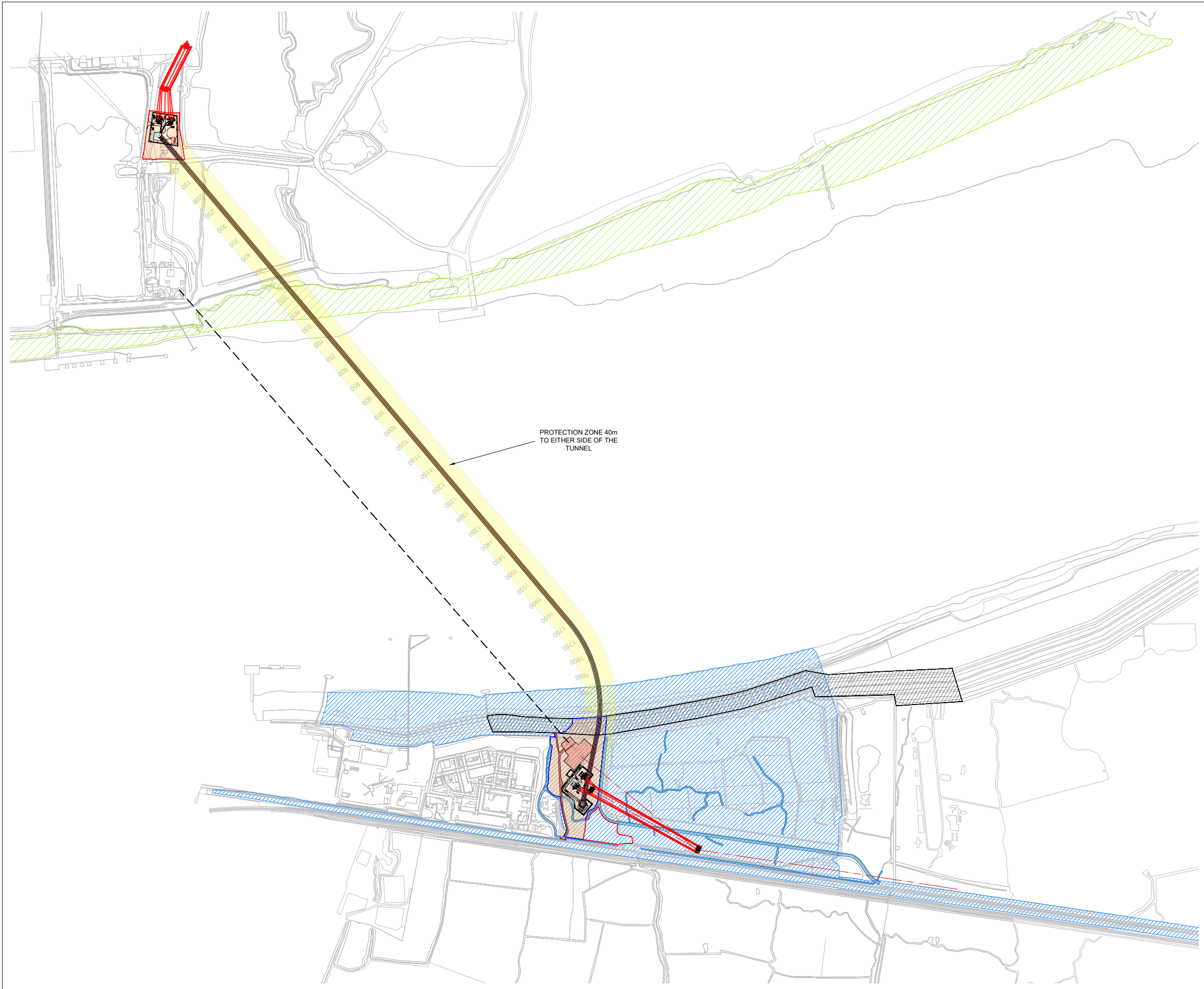
Document Title:

PLAN & PROFILE TUNNEL ALIGNMENT

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BT	DRAWING	AS SHOWN	A1	1 of 1	P03

National Grid Document Number:
PDD-100116-LAY-145

FEED Document Number:
30003364-MSE-XX-XX-DR-Y-10067



Location Plan
Scale 1:5000

NOTES

TO BE READ IN CONJUNCTION WITH DRAWINGS:

PDD-100116-LAY-155 / 30003364-MSE-XX-XX-DR-Y-10083 - GRAVESEND TEMPORARY WORKING AREA LEASE

PDD-100116-LAY-156 / 30003364-MSE-XX-XX-DR-Y-10084 - GRAVESEND OVERHEAD LINE PERMANENT EASEMENT

PDD-100116-LAY-157 / 30003364-MSE-XX-XX-DR-Y-10085 - GRAVESEND TUNNEL PERMANENT EASEMENT

PDD-100116-LAY-158 / 30003364-MSE-XX-XX-DR-Y-10086 - GRAVESEND COMBINED EASEMENT, LEASE AND LAND PURCHASE

- KEY**
- EXISTING TUNNEL
 - CENTRELINE OF EXISTING OHL
 - WATER COURSE
 - TUNNEL PROTECTION ZONE 165,130m²
 - FLOOD DEFENSES
 - EXISTING SEALING COMPOUND
 - LOCAL NATURE RESERVE
 - RSPB NATURE RESERVE METROPOLITAN POLICE FIRING RANGE
 - NATIONAL GRID LAND
 - 15m INTERNAL DIAMETER SHAFT WITH 50m TEMPORARY WORKING AREA
 - PROPOSED TUNNEL ROUTE
 - TILBURY PERMANENT LEASE AREA 11,808m²
 - THIRD PARTY ACCESS

P01	First Issue	KD	TD	AM	25-07-2023
Rev	Description	Cre'd	Chk'd	App'd	Date

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Master Scheme No:	Sub-Scheme No:	Site:
100116	-	RIVER THAMES

Scheme Name:
TKRE GRAIN-TILBURY AND KINGSNORTH-TILBURY 400kV UPGRATING

Document Title:
**RIVER THAMES
TUNNEL EASEMENT**

Created by:	Date:	Checked by:	Date:	Approved by:	Date:
KD	25-07-2023	TD	25-07-2023	AM	25-07-2023
Development Eng:	Document Type:	Scale:	Format:	Sheet(s):	Rev:
BT	DRAWING	AS SHOWN	A1	1 of 1	P01

National Grid Document Number:
PDD-100116-LAY-159

FEED Document Number:
30003364-MSE-XX-XX-DR-Y-10087

Tilbury

Tilbury Sealing End Compound

- 3.3.5 The new Tilbury SEC is proposed to be developed 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, and which was formerly Tilbury Power Station. To the north of the proposed SEC is the existing Tilbury Substation. The land east is part of Ingrebourne Valley's Goshems Farm restoration project, raising the land on an historical landfill back to high quality, arable farmland. The existing Tilbury SEC, serving the existing tunnel is approximately 290m south of the proposed Tilbury SEC. The River Thames is approximately 400m south of the permanent footprint of the proposed Tilbury SEC.
- 3.3.6 The Tilbury SEC will occupy an area of approximately 7,339m² / 0.73ha. During construction, a larger area of approximately 81,430m² / 8.14ha will be required during installation to accommodate construction equipment and storage areas.
- 3.3.7 The two new overhead line gantry structures within the Tilbury SEC will have a maximum height of approximately 13m.
- 3.3.8 The SEC will contain:
- 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;
 - 1 water tank for fire fighting purposes
 - 6 Surge Arresters for protection of underground cables;
 - 6 earth switches; and
 - Tilbury headhouse.
- 3.3.9 The Tilbury SEC will be surrounded by a 2.4m mesh or palisade security fence topped with an electric pulse fence to a height of 3.4m.
- 3.3.10 Six new carparking spaces will be provided, to the east of the new headhouse, with three EV charging posts (comprising two charge outlets per post). One of the spaces will be a disabled parking bay.
- 3.3.11 The roads within the SEC will be tarmacked, however all other surfacing will comprise of gravel or other free draining stone material with a Type 3 sub-base.

Tilbury Tunnel Headhouse

- 3.3.12 The Tilbury headhouse will be situated within the Tilbury SEC. The purpose of the Tilbury headhouse is to:
- allow controlled safe and secure access into the tunnel shafts;
 - provide 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.
- 3.3.13 The Tilbury headhouse will occupy an area of up to 481.75 m² / 0.048ha (based on an indicative footprint of 23.5 m x 20.5 m and have an approximate maximum building height of approximately 10m above ground level). This will be confirmed during the detailed design stage.

3.3.14 The new headhouse at Tilbury will accommodate:

- Ventilation plant for the tunnel and shafts;
- A control room, with tally room, communications control, panels, mechanical plant and control panels;
- Low Voltage (LV) Switch Room;
- 110V Battery / Uninterruptible Power Supply Room;
- Main fans room;
- Shaft access via a staircase (but with space allocation for a lift, and lift motor room (if required));
- Changing and shower room; and
- Water Closet (WC).

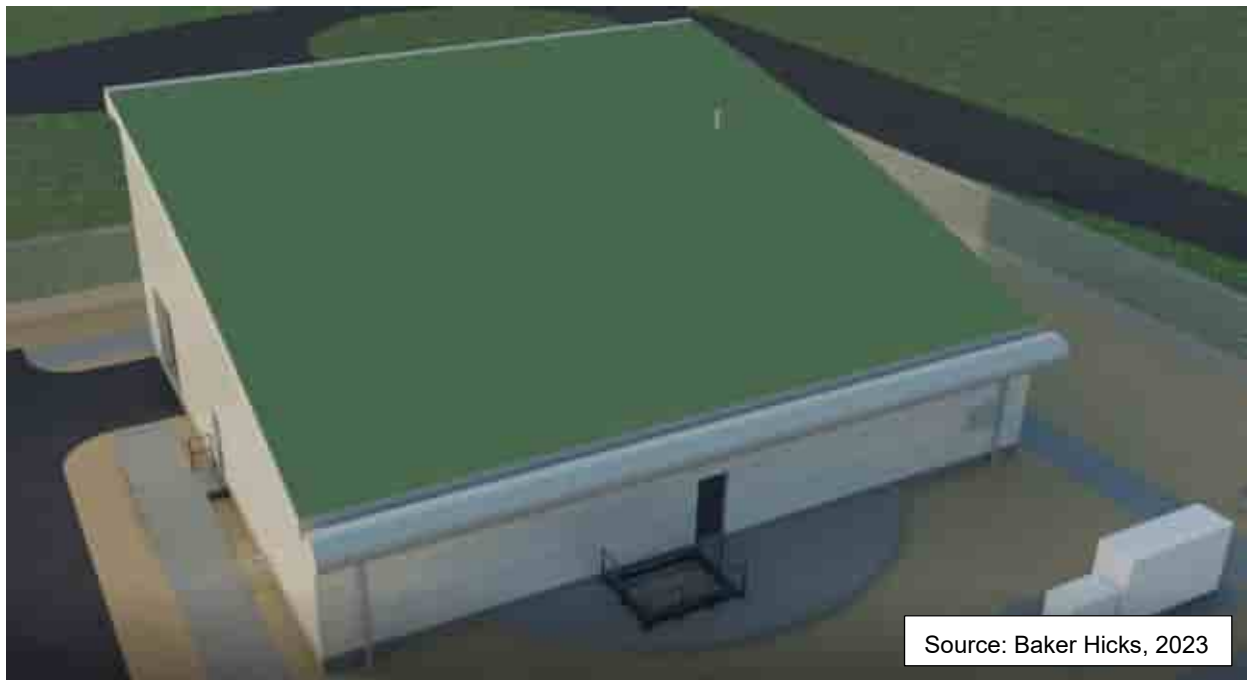
3.3.15 Externally, the new headhouse will have:

- a biodiverse roof;
- a temporary generator (hardwired to the LV Switch Room);
- an access hatch for cable feed; and
- a pedestrian access path.

3.3.16 The details of the ventilation equipment have not yet been finalised, however the headhouse will be acoustically insulated (where required) in line with BS8233:2014 to ensure operational noise levels are acceptable.

3.3.17 An indicative visualisation of the proposed headhouse at Tilbury is shown in Plate 3-4.

Plate 3-2: Indicative visualisation of the proposed Tilbury Headhouse



Source: Baker Hicks, 2023

3.3.18 The exteriors and internal layout of the headhouse are shown on the Planning Drawings, referenced below:

- PDD-100116-LAY-046 - Tilbury SEC Site Plan;
- PDD-100116-LAY-047 - Tilbury Headhouse - Outline Ground Floor Plan;
- PDD-100116-LAY-049 - Tilbury Headhouse - Outline Roof Floor;

- PDD-100116-LAY-180 - Tilbury Headhouse - Proposed Site Sections;
- PDD-100116-ELE-003 - Tilbury Headhouse - Outline Elevations; and
- PDD-100116-LAY-050 - Tilbury Headhouse - Outline Sections.

3.3.19 Planning Drawing PDD-100116-LAY-046 is included below as Figure 3-3 to illustrate the layout of the Tilbury SEC.

Tilbury Headhouse Utility Provision

Incoming Water Supply

- 3.3.20 A mains water supply will be required for each headhouse to facilitate amenity features such as sinks, basins, showers and toilets. Installation of below ground mains water shall be in accordance with Southern Water guidance.
- 3.3.21 At Tilbury, a connection from the existing water main is proposed that will deliver potable water to the new headhouse.

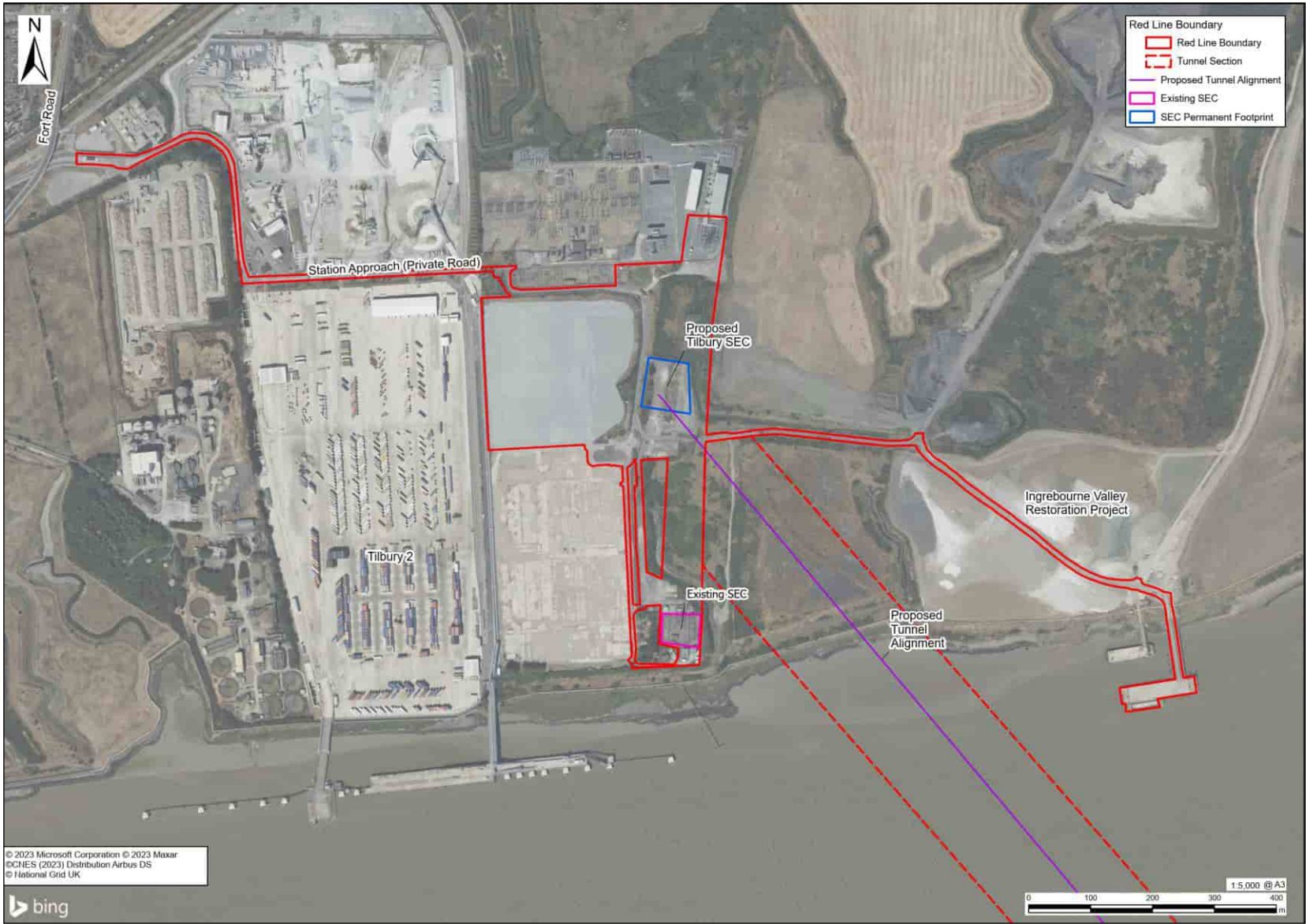
Foul Water Drainage Design

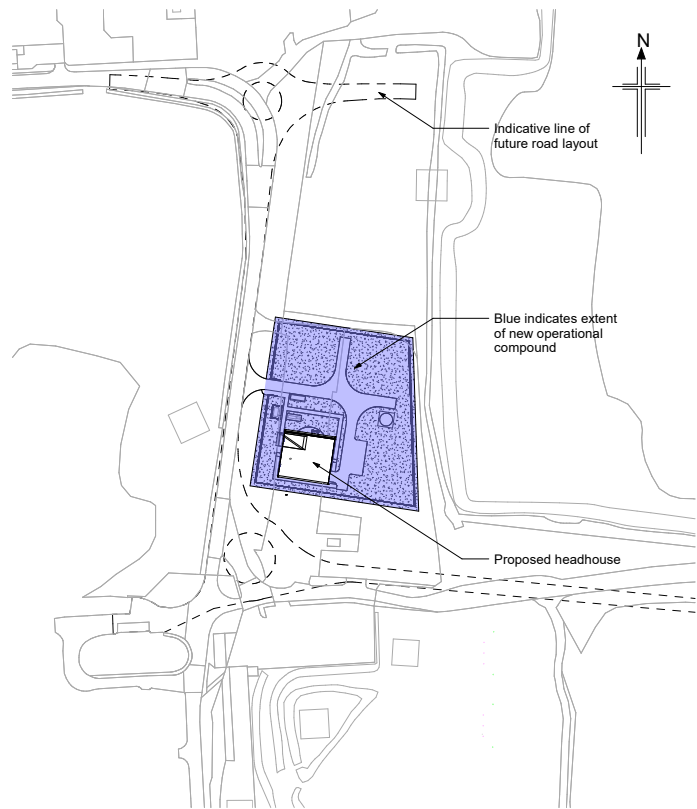
- 3.3.22 The Tilbury SEC will not be permanently manned and as such the preference will be to discharge foul water to the existing sewer. The Ground Penetrating Radar (GPR) survey results suggest there are no public foul sewers available, therefore a 9000 litre underground cess pit will be installed at the proposed Tilbury SEC. More information can be found in the Drainage Management Plan (Document Reference 30003364-BHK-XX-XX-RP-C-02060).

Operational Access to the Tilbury SEC

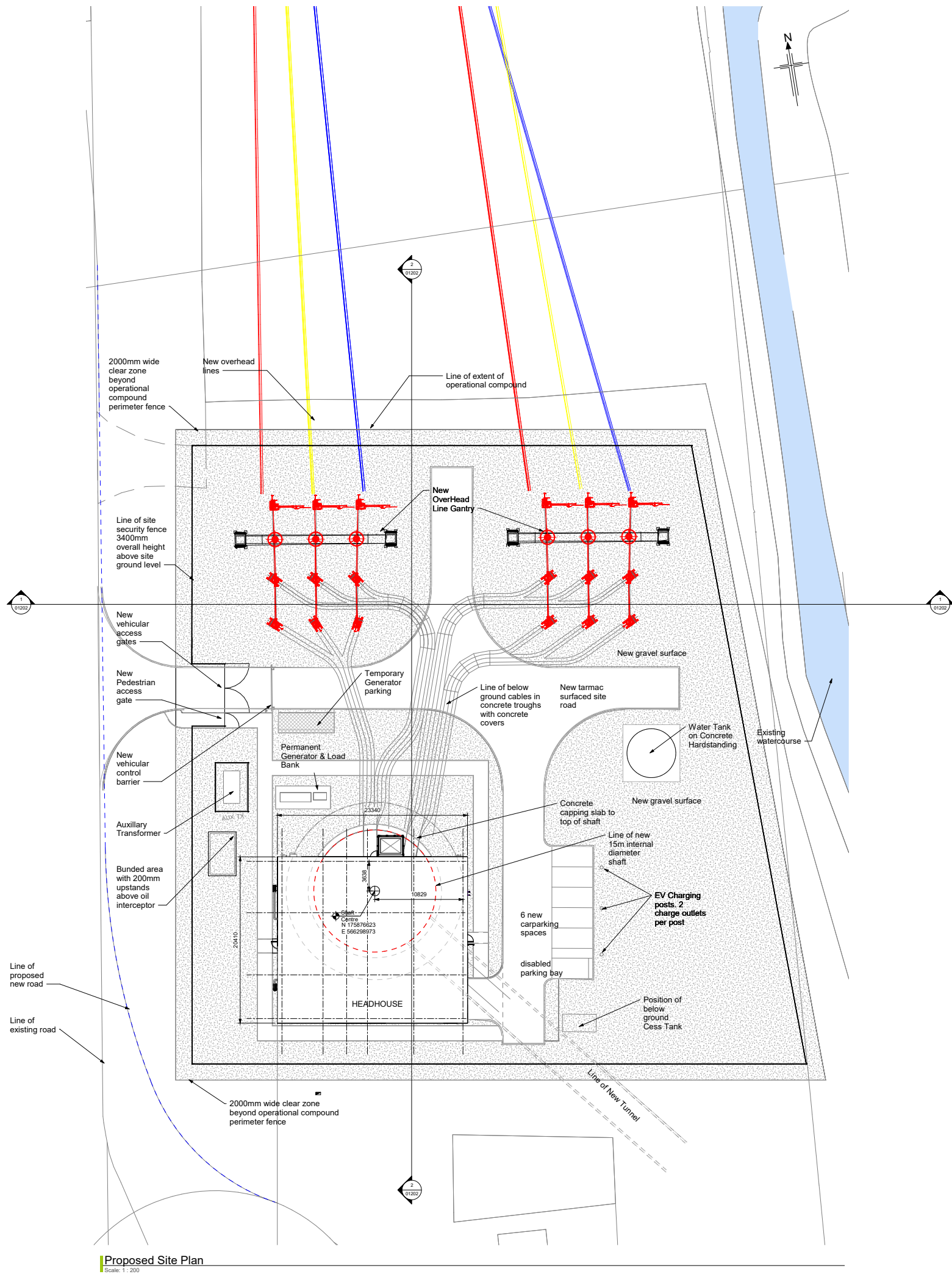
- 3.3.23 The proposed Tilbury SEC will be accessible from an existing private road belonging to Port of Tilbury. This private road connects to Fort Road and then the A1089 Ferry Road and the wider Strategic Road Network (SRN).
- 3.3.24 No new permanent access roads will be required for operational access in to the proposed Tilbury SEC. One new bellmouth will be required from the existing private road.
- 3.3.25 Temporary access changes are required to facilitate the construction of the cable tunnel and Tilbury SEC and these are described in Section 3.7.

Plate 3-3: Tilbury Proposed Sealing End Compound Location Plan





Key Plan - Extent of Compound
Scale 1:1250



Proposed Site Plan
Scale 1:200

NOTES

1. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED
2. ALL LEVELS ARE IN METERS ABOVE ORDNANCE DATUM (mAOD)
3. FOR GRAVESEND SHAFT SEE PDD-100116-LAY-122
4. SHAFT CENTRE POINT AT East = 566298.973, North = 175876.623
5. ROAD AND FOOTPATH ALIGNMENTS SHOWN ARE INDICATIVE ONLY
6. SVP - SOIL & VENT PIPE
RWP - RAINWATER PIPE
UPS - UNINTERRUPTED POWER SUPPLY

REFERENCE DRAWINGS

PDD-100116-LAY-109 - CSE Layout with cable termination arrangement (Tilbury Side)

PDD-100116-LAY-122 - TILBURY SHAFT GENERAL ARRANGEMENT

PDD-100116-LAY-036 - TILBURY COMPOUND LEVELS

0 2 4 10 20
Scale 1:200 @ A0 (1:400 @ A3)

PDD	Updated to include water tank	REV	JK	NS	16/10/23
REV	Initial Issue	REV	JK	JK	20/09/23
Rev	Description	Rev	Rev	Rev	Date

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Master Scheme No: 100116 Sub-Scheme No: - Site: NEW TILBURY CSEC

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Document Title: Tilbury Headhouse - Planning - Site Plan

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National Grid Document Number: PDD-100116-LAY-046

FEED Document Number: 30003364-BHK-XX-XX-DR-A-01200

3.3.26 A summary of the key characteristics of the Tilbury SEC is outlined in Table 3-3.

Table 3-2: Summary of the key characteristics of the Tilbury SEC

Factor	Tunnel Headhouses	Sealing End Compound
Permanent footprint	481.75 m ² / 0.048 ha	7339 m ² / 0.73 ha
Temporary working area	47,200 m ² / 4.72 ha	
Max. heights	Approximately 10m	Approximately 13m (overhead line gantry structures)
Technology / infrastructure	• Ventilation fans for tunnel • 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; • 6 earth switches; and • 1 water tank for fire fighting purposes
Exterior lighting	External lighting will be within the compound area for ease of access and maintenance at night. The lighting system will include sensors based on motion and day light availability and will be LED with a downward spill. Given the very low frequency of maintenance visits (12 to 24 visits per year), the use of external lighting is considered minimal.	
Access	During operation, the Tilbury headhouse and SEC will be accessed via 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).	
Fencing	The SEC will be surrounded by a 2.4m mesh or palisade security fence. Electric fencing is required around its entirety with a minimum height of 3.4 m.	
Headhouse Roof	Biodiverse roof	

Gravesend

Gravesend Sealing End Compound

- 3.3.27 The proposed Gravesend SEC will be 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 SEC is the existing SEC serving the existing tunnel. The land immediately east is owned by the Royal Society for the Protection of Birds (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.
- 3.3.28 The Gravesend SEC will occupy an area of approximately 6,328m² / 0.6328ha, however a larger area of approximately 37,000 m² / 3.7 ha will be required during installation to accommodate construction equipment and storage areas.
- 3.3.29 Subject to final detailed design, the two new overhead line gantry structures within the Gravesend SEC will have a maximum height of approximately 13m.
- 3.3.30 The Gravesend 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.
- 3.3.31 Nine new carparking spaces will be provided, six to the west of the new headhouse, and three to the north, just outside of the SEC.
- 3.3.32 The roads within the SEC will be tarmacked, however all other surfacing will comprise of gravel or other free draining stone material with a Type 3 sub-base.

Gravesend Tunnel Headhouse

- 3.3.33 The Gravesend headhouse will be situated within the Gravesend SEC. The purpose of the Gravesend headhouse is to:
- allow controlled safe and secure access into the tunnel shafts;
 - to locate mechanical and electrical equipment; and
 - to house control equipment for the cable circuits.
- 3.3.34 The Gravesend headhouse will occupy an area of approximately 230m² / 0.023ha (based on an indicative footprint of 15 m x 16 m) and have an approximate maximum building height of 8 m above ground level. This will be confirmed during the detailed design stage.
- 3.3.35 The new headhouse at Gravesend will accommodate:
- Tunnel dampers room with access hatch for shaft hoist;
 - Electric room; containing Low Voltage (LV) switch gear, communication panels, Motor Control Centre (MCC) panels;
 - Tally Room;
 - 110V Battery / Uninterruptible Power Supply Room;
 - Shaft access via a staircase;
 - Changing and shower room; and
 - WC.
- 3.3.36 Externally, the new headhouse will have:
- a biodiverse roof;

- a temporary generator (hardwired to the electrical room); and
- a pedestrian access path.

3.3.37 An indicative visualisation of the proposed headhouse at Gravesend is shown in Plate 3-4.

Plate 3-4: Indicative visualisation of the proposed Gravesend headhouse Source: Baker Hicks, 2023



3.3.38 The exteriors and internal layout of the headhouse are shown on the Planning Drawings, referenced below:

- PDD-100116-LAY-053 Gravesend SEC - Site Plan;
- PDD-100116-LAY-054 Gravesend Headhouse - Outline Ground Floor Plan;
- PDD-100116-LAY-056 Gravesend Headhouse - Outline Roof Floor Plan;
- PDD-100116-LAY-184 Gravesend Headhouse - Proposed Site Sections;
- PDD-100116-ELE-005 Gravesend Headhouse - Outline Elevations; and
- PDD-100116-LAY-057 Gravesend Headhouse - Outline Sections.

3.3.39 Planning Drawing PDD-100116-LAY-053 is included below as Figure 3-3 to illustrate the layout of the Gravesend SEC.

Gravesend Utility Provision

Incoming Water Supply

3.3.40 A mains water supply will be required for each headhouse to facilitate amenity features such as sinks, basins, showers and toilets. Installation of below ground mains water shall be in accordance with Southern Water guidance.

3.3.41 At Gravesend, an existing clean water pipeline running parallel to the road that is assumed to connect to Eastcourt Marshes Sealing End Compound Site was identified - a connection from the existing water main is proposed that will deliver potable water to the new headhouse.

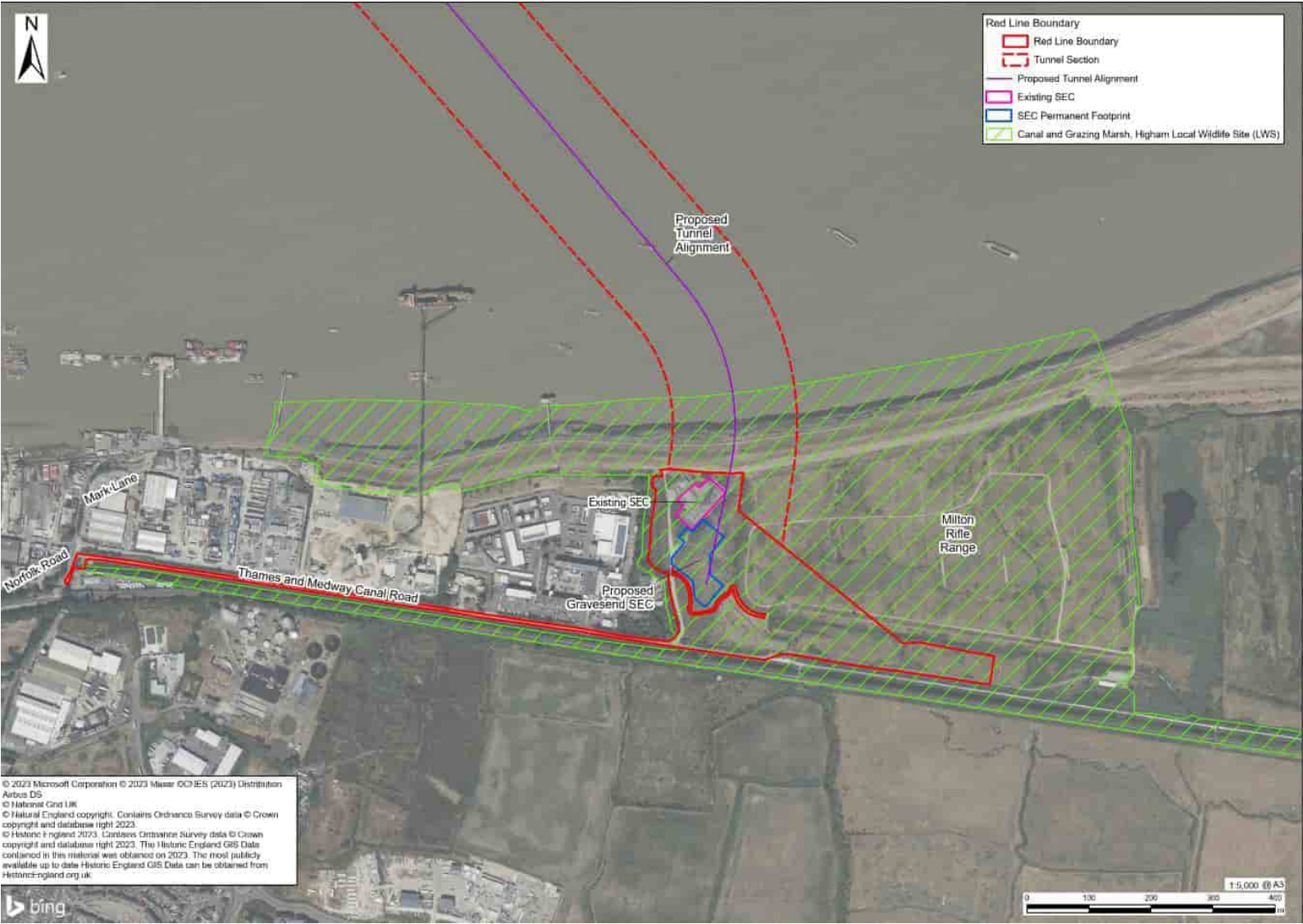
Foul Water Drainage Design

- 3.3.42 The Gravesend SEC will not be permanently manned and as such the preference will be to discharge foul water to the existing sewer. However, the Ground Penetrating Radar (GPR) survey results suggest there are no public foul sewers available for either site, therefore a 9,000 litre underground cess pit will be installed at the proposed Gravesend SEC. More information can be found in the Drainage Management Plan (Document Reference 30003364-BHK-XX-XX-RP-C-02060).

Operational Access to the Gravesend SEC

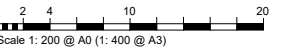
- 3.3.43 The proposed Gravesend SEC will be accessible from an existing private road belonging to National Grid. This connects to another private road, the Thames and Medway Canal Road owned by Network Rail, which runs alongside the Thames and Medway Canal. The Thames and Medway Canal Road connects to Mark Lane, then Norfolk Road, which then connects to Prospect Grove, then the A226 Milton Road and the wider SRN.
- 3.3.44 No new permanent access roads will be required for operational access in to the proposed Gravesend SEC.
- 3.3.45 Temporary access changes are required to facilitate the construction of the cable tunnel and Gravesend SEC and these are described in Section 3.7.

Plate 3-5: Gravesend Proposed Sealing End Compound Location Plan





- REFERENCE DRAWINGS**
- PDD-100116-LAY-102 - CSE Layout with cable termination arrangement (Gravesend site) (A784/A785)
- PDD-100116-LAY-123 – GRAVESEND SHAFT GENERAL ARRANGEMENT
- PDD-100116-LAY-037 - GRAVESEND COMPOUND LEVELS



nationalgrid

Document Title:

Gravesend Headhouse - Planning - Site Plan

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30003364-BHK-XX-XX-DR-A-01400

3.3.46 A summary of the key characteristics of the Gravesend SEC is outlined in Table 3-3.

Table 3-3: Tunnel Headhouses and SECs – Summary of Key Characteristics

Factor	Tunnel Headhouses	Sealing End Compound
Permanent footprint	230m ² / 0.023ha	6,328m ² / 0.6328ha
Temporary working area	37,000m ² / 3.71 ha	
Max. heights	Approximately 8m	Approximately 13m (overhead line gantries)
Technology	• Ventilation dampers; and • Tunnel shaft including stairwell and access hatches, electrical 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; • 6 Earth switch; and • 1 water tank for fire fighting purposes
Exterior lighting	External lighting will be within the compound area for ease of access and maintenance at night. The lighting system will include sensors based on motion and day light availability and will be LED with a downward spill. Given the very low frequency of maintenance visits (6-12 visits per year), the use of external lighting is considered minimal.	
Access	The proposed Gravesend SEC is accessible from an existing private road belonging to National Grid, which connects to a private road, the Thames and Medway Canal Road owned by Network Rail, which runs alongside the Thames and Medway Canal. The Thames and Medway Canal Road connects first to Mark Lane, then Norfolk Road, which then connects to Prospect Grove, then the A226 Milton Road and the wider SRN.	
Fencing	The Gravesend 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.	
Headhouse Roof	Biodiverse roof	

Overhead Line Diversions

- 3.3.47 The new SECs require connection in to the wider TKRE 400 kV OHL.
- 3.3.48 It should be noted that modifications to the existing overhead lines are consented via Section 37 of the Electricity Act 1989 and, although described in this Environmental Statement, do not form part of the Town and Country Planning Act planning application.
- 3.3.49 A description of these connection works are provided below:

Tilbury

- 3.3.50 At Tilbury, terminal pylon 4VG045A will be replaced with a new terminal pylon, which will be erected adjacent to its existing location, to the north of the proposed Tilbury SEC. This will form the new commencement of the 400kV OHL. The existing terminal pylon 4VG045B inside the Tilbury Substation will be refurbished.
- 3.3.51 Approximately 600m (3 spans of OHL conductor and OHL pylons 4VG45A, 4VG44 and 4VG43) of the existing 400kV OHL will be removed.
- 3.3.52 Approximately 200m of new double span overhead line will be installed from the existing terminal pylon (4VG45B) within the Tilbury Substation, to the new pylon 4VG045A. This is illustrated on Plate 3-6.

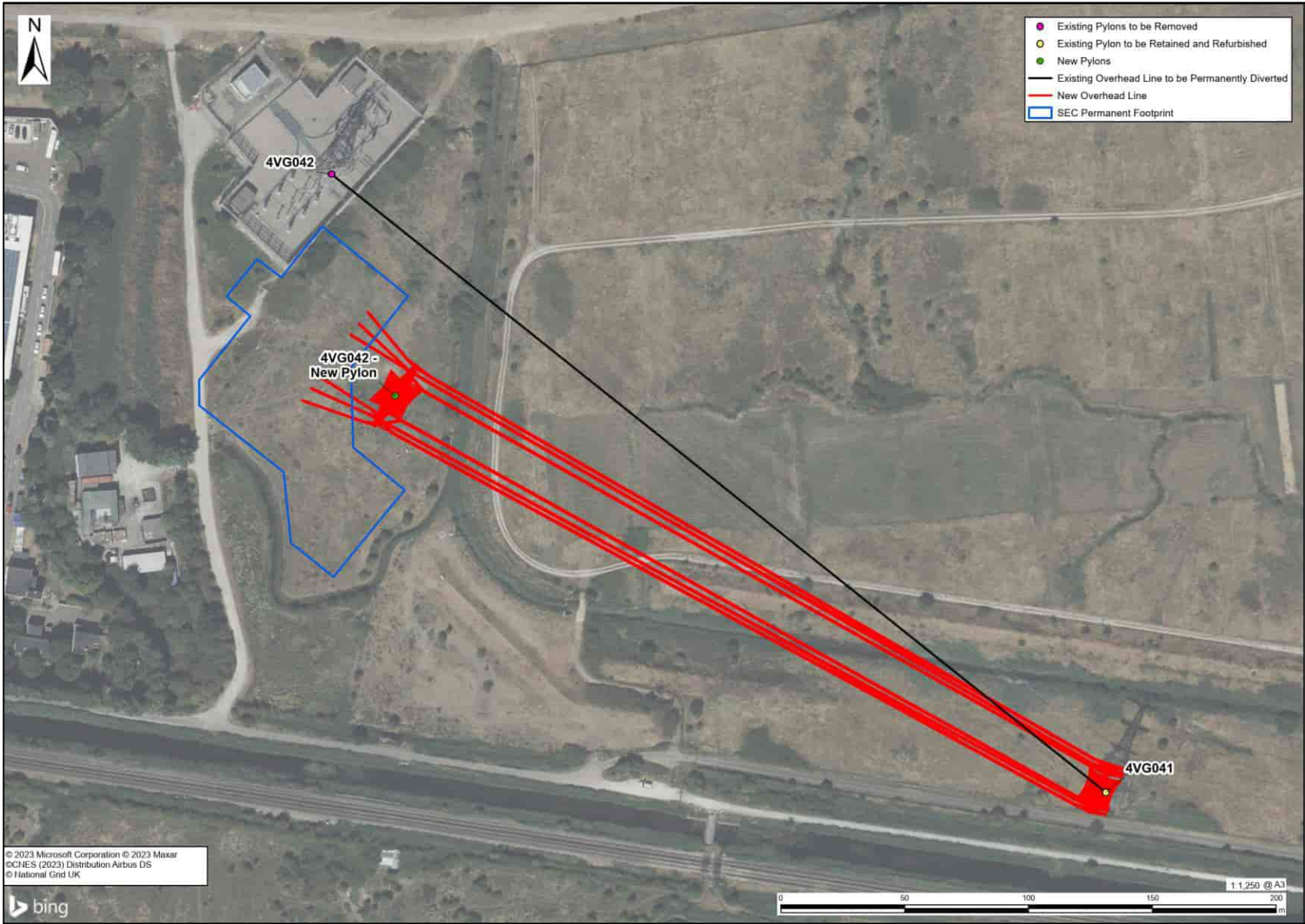
Gravesend

- 3.3.53 At Gravesend, approximately 400m of single span overhead line will be permanently removed and approximately 330m new double span overhead line will be installed between pylons 4VG041 and new pylon 4VG042. The existing pylon 4VG042 will be removed. Pylon 4VG042 will be replaced by a new terminal pylon which will be erected near the new SEC. The existing Pylon 4VG041 will be refurbished. This is illustrated on Plate 3-7.
- 3.3.54 The permanent and temporary working areas of the Proposed Development are shown on Figure 3-5 and Figure 3-6.

Plate 3-6: Tilbury - OHL Diversions



Plate 3-7: Gravesend – OHL diversions



3.4 Construction Phase – Cable Tunnel and Shafts

Tilbury

Drive Shaft Site at Tilbury

- 3.4.1 The tunnel will be constructed using a Tunnel Boring Machine (TBM). Tunnel construction will commence from the Tilbury side and drive south underneath the River Thames with all tunnel arisings being removed from the Tilbury side. A main works construction compound will be required at Tilbury to facilitate the construction of the drive shaft for the TBM (see Section 3.8).

Drive Shaft Construction at Tilbury

- 3.4.2 The depth of the drive tunnel shaft is expected to be approximately 42.5m. A total working area of approximately 35,260 m² is required for the construction of the drive shaft. This is made up of:
- the finished internal diameter;
 - the diameter of the working area for the shaft, including required construction plant and material delivery; and
 - storage of segments and spoil.
- 3.4.3 The construction of the drive shaft is expected to take approximately eight months.

Tunnel Construction at Tilbury

- 3.4.4 Once the drive shaft construction is complete, the tunnelling phase will commence. Staff numbers will increase for this phase and tunnelling will continue 24 hours a day until complete. The tunnelling programme would last for approximately 8 months. Storage of the tunnel segments will require an area of 1500m².
- 3.4.5 The tunnel will be constructed using a TBM to bore through the ground. The tunnel will then be lined with precast concrete segments, which are installed behind the TBM.
- 3.4.6 The type of TBM will be determined and fully specified by the contractor, once onboarded. For the spoil handling, the required area is based on the type of TBM selected. For example, for an Earth Pressure Balance (EPB) tunnelling machine, 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 acceptance requirements of the disposal location for the spoil, before it leaves site.
- 3.4.7 If a slurry TBM is used, a separation plant is required to separate the arisings from the bentonite (a lubricant). The processed material is stored in the same way as the EPB machine prior to removal from site. If this method is used, the separation plant will be required with a footprint of 4000m². A slurry TBM has been assumed for the basis of design, to ensure the required separation plant has been accounted for during the construction phase and space allocated. This is illustrated on the indicative construction compound layout (Figure 3-5).
- 3.4.8 Depending on the type of TBM used and the specific method of building the tunnel shaft (i.e. grouting), dewatering may not be required during excavation. If dewatering is required, a suitable discharge point will be selected in discussion with the Environment Agency.
- 3.4.9 During the tunnelling operations, cranes will be required to sit adjacent to the tunnel shaft to lift / lower plant and materials. This may be a crawler crane or a gantry crane with legs sitting either side of the shaft. An area of approximately 100m² is required to facilitate the crane which is depicted on Figure 3-5.
- 3.4.10 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. A provisional construction compound layout is provided in Figure 3-5.

Tunnel and Shaft Spoil

- 3.4.11 The excavated material from construction of the tunnel will be approximately 72,700m³. The excavated material from the construction of the Tilbury shaft will be approximately 13,000m³. This results in a total of approximately 85,700m³ of spoil which will need to be removed from the Tilbury site. The composition of the spoil from the tunnel will be chalk. The composition of the shaft spoil will be a mix of chalk, made ground, alluvium and river terrace deposits.
- 3.4.12 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 have been explored for the reuse of the spoil materials to meet National Grid's commitment to avoid landfill. Currently, National Grid are exploring opportunities to transport the spoil to habitat enhancement projects in the local vicinity such as the RSPB site at Cliffe Pools which would provide benefits to aquatic invertebrates and wading birds. Whichever site is chosen, the removal of the tunnel and shaft spoil at Tilbury will be via the River Thames, to reduce the number of HGV required on the local and strategic road network.
- 3.4.13 National Grid will seek to utilise either:
- the existing and working jetty to the south-east of the proposed Tilbury SEC, delivering the tunnel and Tilbury shaft spoil to the jetty via HGV and transferring to barge. There is an existing road extending to the jetty, however some upgrading of the existing road will be required. This route is depicted in the Planning Application – Red Line Boundary on Figure 1.1 (ES Volume II Chapter 1) and Plate 3-3.
 - Berth 5 at the Port of Tilbury, delivering the tunnel spoil to the berth via HGV and transferring to barge. No road upgrading will be required for this option. This route is depicted in the Planning Application – Red Line Boundary on Figure 1.1 (ES Volume II Chapter 1) and Plate 3-3.
- 3.4.14 There will be no requirement to use the jetty or berth during weekend or night-time hours, as spoil from the 24 hour tunnelling will be stored in the muck away areas (see Figure 3-5) overnight and during the weekend. It will only be transported to the jetty or berth during daytime working hours (see Section 3.11) and so the jetty will not require additional lighting during night-time hours.

Tilbury Utility Diversions

- 3.4.15 At Tilbury, a number of pre-existing utilities are present in the area highlighted below in Plate 3-8 including electricity cables, water mains and fibre optic cables. There is an existing 11kV cable between the existing Tilbury Substation and existing SEC which serves the existing tunnel and SEC. This will need to be temporarily diverted whilst the construction phase is underway, as it is needed to maintain a power supply to the current tunnel, until the new tunnel and headhouse are energised.
- 3.4.16 Due to the number of services in this area, it will not be technically feasible for trenchless crossings and so diversions will need to be undertaken via an open-cut method. Section A (demarcated in Plate 3-8) is approximately 10m wide. For the utility diversions, approximately 3-4m of the verge will be open cut to facilitate the diversion of the 11kV cable, leaving approximately 5-6m of the vegetated verge intact. In Section B (demarcated in Plate 3-8), the full extent of the verge will be lost to facilitate the diversion of the 11kV cable, as well as the main construction works.

Plate 3-8: Utility Diversions at Tilbury



Tilbury Utility Provision

Powering the TBM

- 3.4.17 It is National Grid's preference that the TBM will be powered through a grid connection (directly connected to the electrical grid that powers the local community), however, at this stage of design, it is not possible to confirm if this is a viable option. Consequently, as a worst case scenario, the TBM will need to be powered by onsite generators. In this event, two to three diesel generators would be required, depending on the type of TBM chosen, sited in the Main Works Compound at Tilbury at Tilbury (approximate locations are identified on Figure 3-5).
- 3.4.18 For the purposes of the environmental assessment, the construction program currently assumes that the tunnelling phase will last for a period of 34 weeks. Within that period, tunnelling will be undertaken for 25 weeks, with the remaining 9 weeks programmed for intervention. Over the 34-week program, the power demand required of the tunnelling work will vary. For example, the generators will only be required to operate at full load for around 12.5 weeks, 37% of the 34-week programme. At other times, the generators will operate at a reduced load, depending on the activities being undertaken at the time. This is also dependent on whether an Earth Pressure Balance (EPB) TBM or slurry TBM is selected (see Section 3.4.6 and 3.4.7).
- 3.4.19 As is identified in the Tilbury air quality assessment (ES Volume III Chapter 12), there is a requirement for emission stacks to be secured to the generators. The actual height of these would be stipulated by the final selection of the TBM as well as the manufacturer of the generator.
- 3.4.20 Modelled scenarios suggest a worst-case stack height of 50m which would be required for up to three generators, and a best-case height of <5m for two generators. Selective Catalytic Reduction (SCR) technology will be required to reduce NO_x impacts. The generators with their stacks would be positioned in the construction compound for up to 25 weeks during the tunnelling construction.

Gravesend

Reception Shaft Site at Gravesend

- 3.4.21 The reception shaft for the tunnel will be located on the Gravesend side and a similar area for spoil storage (a muck bay of approximately 18mx12m (216m²)) from the shaft construction will be needed to that of the Tilbury side. The reception shaft will be the same diameter as the drive shaft.

Reception Shaft Construction at Gravesend

- 3.4.22 The depth of the reception shaft is expected to be approximately 40m. A total of 37,000 m² working area is required for the construction of the reception shaft. This is made up of:
- the finished internal diameter;
 - the diameter of the working area for the shaft, including required construction plant and material delivery; and
 - storage of segments and spoil.
- 3.4.23 The construction of the reception shaft is expected to take approximately eight months.

Tunnel Construction Activity at Gravesend

- 3.4.24 The reception shaft is only required for the removal of the TBM, once the tunnel 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.

- 3.4.25 Due to the weight of the TBM, it is possible that foundations or potential ground improvements are required to support the crane track.

Shaft Spoil at Gravesend

- 3.4.26 The excavated material from construction of the shaft at Gravesend will be approximately 12,850m³. As with Tilbury, the composition of the shaft spoil at Gravesend will be a mix of chalk, made ground, alluvium and river terrace deposits.
- 3.4.27 As there is no suitable jetty on this side of the river, the shaft spoil will be removed via HGV. However, National Grid will direct this to a suitable reuse destination in line with the spoil from the Tilbury side, refer to Section 3.4.12 for more information.

3.5 Construction Phase - SECs

- 3.5.1 Once the shafts and tunnelling construction is complete, construction work will commence on the headhouses, followed by the OHL gantries and the full layout of the SECs. The new SECs are likely to require piled foundations, the length of the piles will depend on a number of factors, such as shear strength and internal friction angle. It is likely these could vary between approximately 8-15m deep, with an approximate diameter of 450mm. Pile-caps would sit on top of the piles, at approximately 1m deep.
- 3.5.2 The headhouses will take approximately 10 months to build and commission. The installation of the steelwork for the OHL gantries would take approximately two months.
- 3.5.3 The Main Works Compound and Reception Shaft Works Compound described in Section 3.8 will remain in place to support the construction of the SECs.

Cable Pulling and Jointing

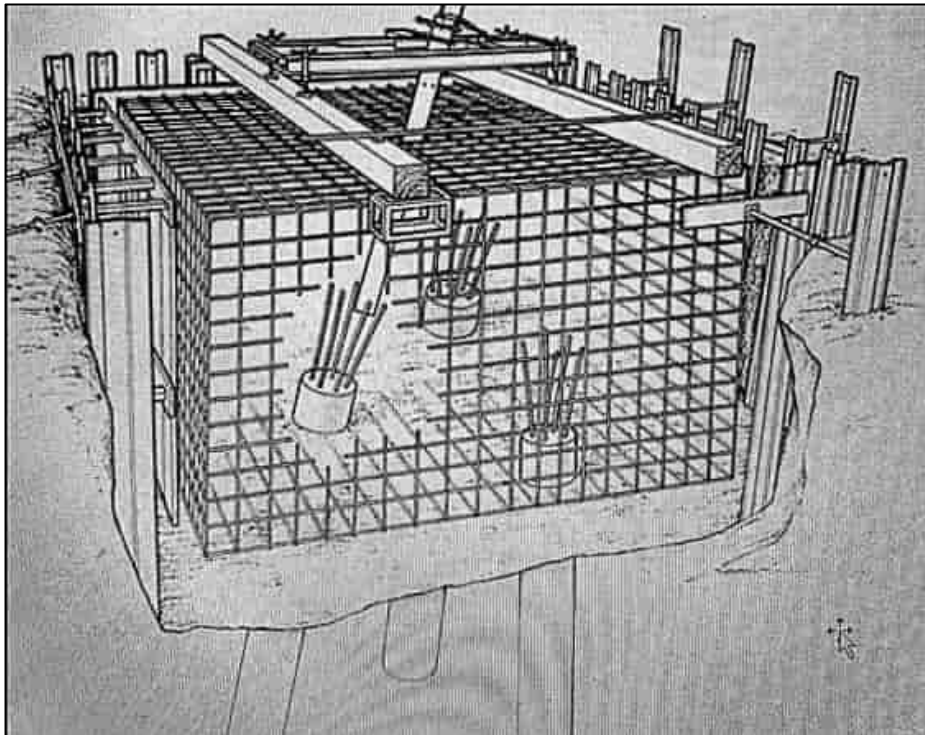
- 3.5.4 Once the tunnel shafts, tunnel, headhouses and SEC are constructed, the XLPE cables will be pulled through the tunnel.
- 3.5.5 The XLPE cables require joints at certain intervals along the tunnel. This is because the cable is supplied in fixed lengths dictated by the cable drum diameter, the diameter of the cable itself and the maximum weight that can be transported. The jointing will take place within the tunnel after the cables have been pulled in their continuous sections (two adjoining cable sections can then be jointed together).
- 3.5.6 Joints will be approximately every 800m–900m. In tunnels, this spacing of joints need to be consistent so to comply with National Grid safe working practices and meet the required limits of induced voltage. XLPE joints are prefabricated off site and assembled on site within the temporary jointing compounds and/or jointing tents, depending on the location of the joint.

3.6 Construction Phase - OHL Diversions

Installation of new terminal towers

- 3.6.1 Two new terminal pylons will be required, one either side of the River Thames; this forms the commencement of the 400kV OHL. At Tilbury, the new terminal pylon is at approximate grid reference XY 566324, 176030, and at Gravesend approximately XY 567454, 174130. Refer to Plate 3-7 and Plate 3-8 for locations.
- 3.6.2 Pylon foundation installation would take place first, before any circuit outages on the existing overhead line. Temporary working areas around the proposed new tower locations would be prepared prior to foundation excavation. Each working area would be taped off to delineate the working area to ensure impacts on sensitive habitats are kept to a minimum. Consideration would be given to varying the shape of the working area at each pylon to avoid constraints identified prior to construction.
- 3.6.3 To install the terminal pylon foundations, an area of approximately 6m by 6m (four excavation areas will be needed for each pylon leg) will be required to be excavated. Piled foundations will be required to a depth of between 14-20m as illustrated in Plate 3-9. The first 4m in depth will be concrete filled.

Plate 3-9: Indicative Pylon Foundation using Piles



- 3.6.4 The steelwork required for the new terminal pylons will either be erected by 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 3-10: Pylon Erection at Base Level



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

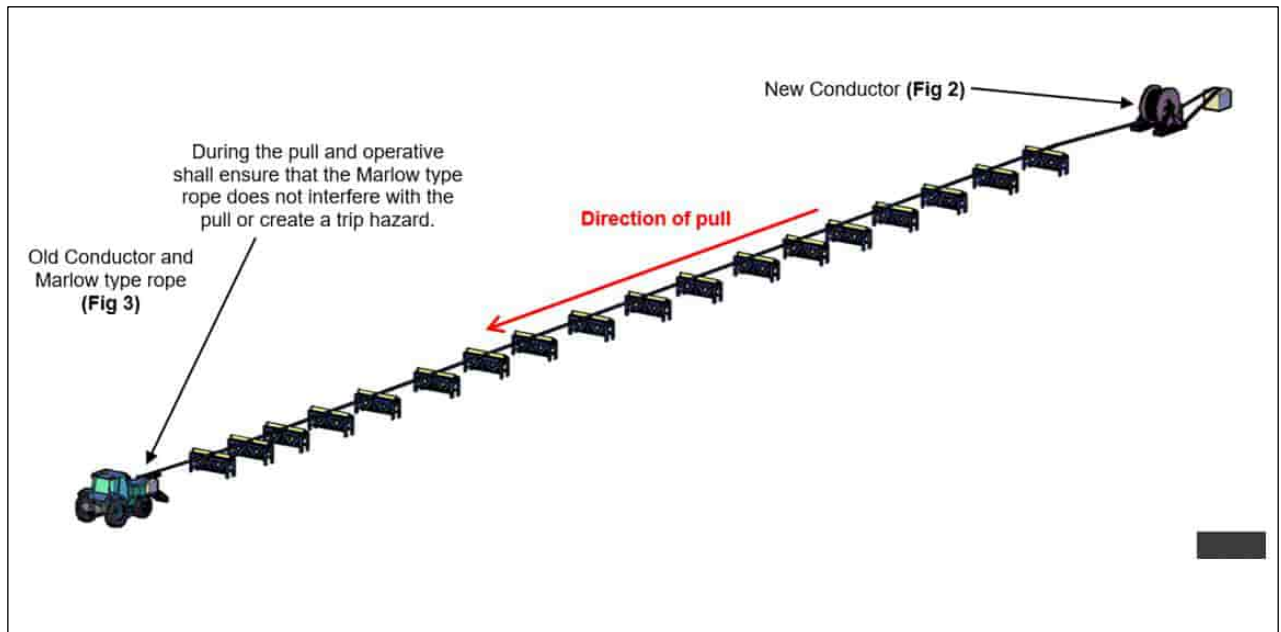
Plate 3-11: Pylon Erection at Upper Levels



Stringing of the New Overhead Cables

- 3.6.6 Once the pylons are built, the new conductors are hung. This is known as 'stringing'. Stringing is the method of positioning and pulling the new conductors between two pylons. There are two different ways to carry out this operation.
- 3.6.7 The first is **none tension pulling**. This involves pulling the new conductor from the required point A to B via a tractor winch at ground level. The new conductor can be pulled over trestle tables, rather than the ground, so to protect the new conductor as well as the underlying habitats.
- 3.6.8 Once the conductor is pulled to its required position, it is raised via a winch to its respective landing points on the pylon arms.
- 3.6.9 Once the conductor is secure, a working platform can be raised to the working height point. This ensures operatives work at height safely. The conductor is then 'sagged' (tensioned to ensure mechanical and electrical correctness) via a winch. Once completed, the conductor is then attached to its landing point on the pylon via its fittings, insulators and jumpers. This process is then repeated for each conductor.

Plate 3-12: Cable roll out on trestle style tables

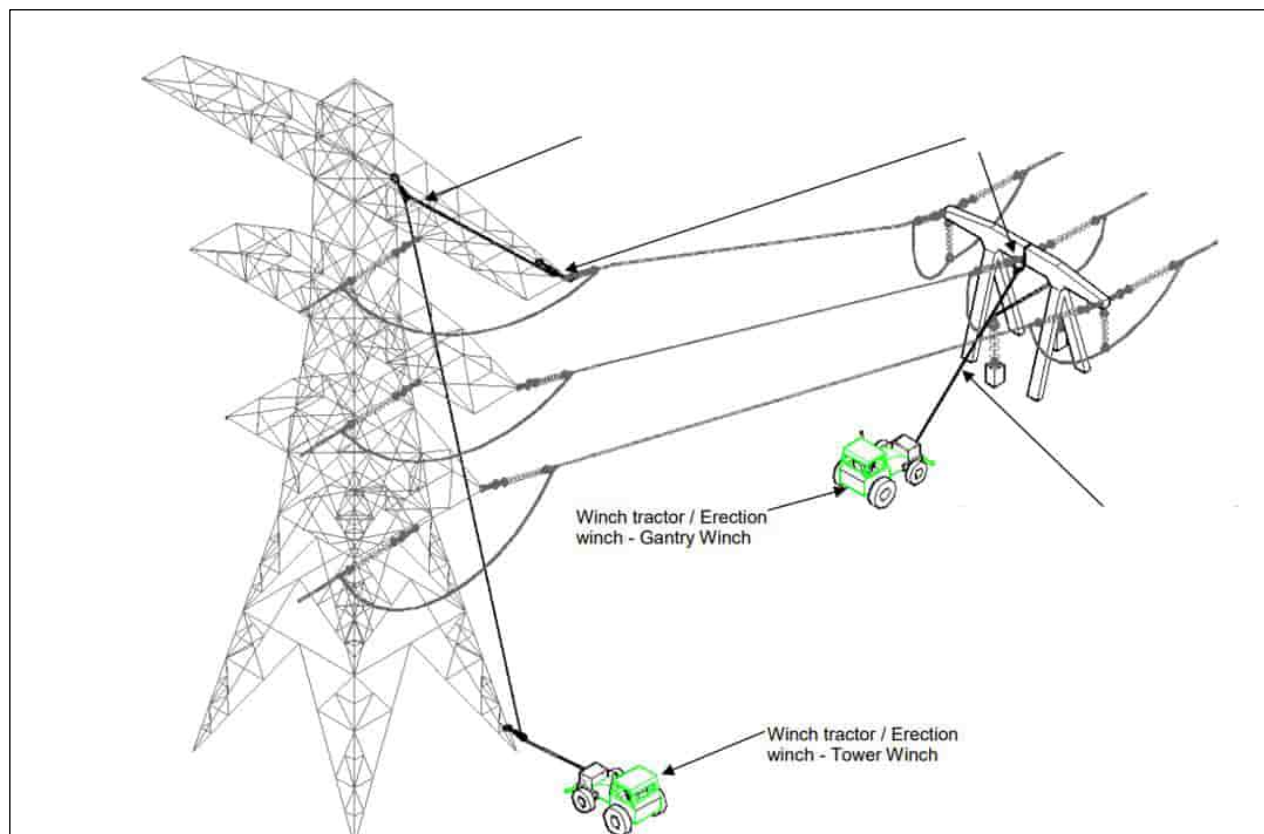


- 3.6.10 The second stringing method is called **tension stringing**. This method keeps the conductor off the ground entirely. Working platforms are raised at each pylon and a running wheel attached to the arms of each pylon.
- 3.6.11 Two hydraulic puller/tension machines are set up at each pylon, one acting to pull the conductor and one acting to tension (pull back) the conductor. This enables the operatives to control the height and tension the conductor is pulled at, ensuring it is kept off the ground.
- 3.6.12 One puller tension machine is set at the base of the pylon, whilst the other is positioned behind the other pylon (set back by approximately 50m). If this method is used, their positions will be discussed with the ecological clerk of works as to the most appropriate positions for the tension machines, in relation to the existing habitats.
- 3.6.13 Lighter pilot rope is pulled through the puller tension machines and up to the running wheels. These will be pulled through the total span and this enables the conductor to be attached at the tension end, and the conductor to be pulled through the span without coming in to contact with the ground.
- 3.6.14 Once this is complete, the conductor is then sagged to the required tension, and secured with fittings, insulators and jumpers from the working platform.

Stringing of the Downloads (between the terminal tower and overhead line gantries in the SECs)

- 3.6.15 The conductor which runs from the new pylon to the gantry within the SECs is called a download. This is attached via an insulated connection. A download connects the live conductor to the final connection.
- 3.6.16 The downloads are installed via two tractor winches as shown in Plate 3-13. These will pull the conductor to its landing point. The downloads are laid out on the ground and cut to their appropriate length. They are then attached to the tractor winches.
- 3.6.17 Once pulled to position, a mobile elevated work platform (MEWP) would be raised to working height on the pylon. The download is then attached to its landing point on the pylon via its fittings, insulators and jumpers.

Plate 3-13: Stringing of Downleads between SEC gantry and pylon



Foundation Works Required at Existing Tower at Gravesend

- 3.6.18 There may be a requirement to reinforce the foundations of existing pylon 4GV041. This will require excavating a pit approximately 6m by 6m at each foot to expose the foundation.
- 3.6.19 Once exposed, a new concrete slab is bound to the existing foundation, therefore adding strength and integrity.
- 3.6.20 Once completed, the excavations will be back filled.

Plate 3-14: Diagram of a typical pylon foundation

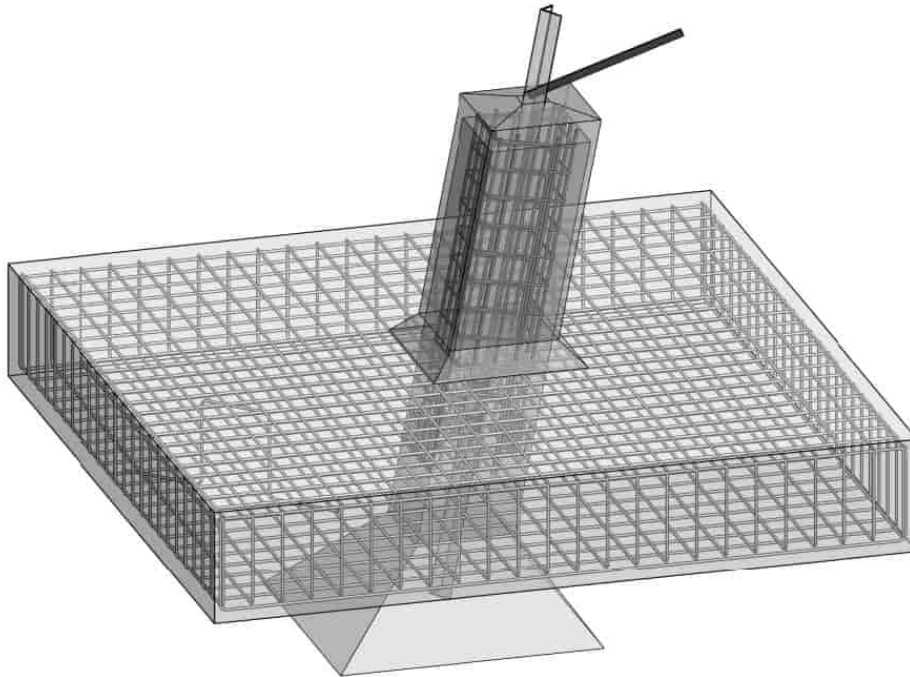


Plate 3-15: Typical Excavations for Upgrading of Pylon Footing Foundations



Removal of Existing Overhead Line Infrastructure

- 3.6.21 Existing pylons 4VG043, 4VG044 and 4VG045A at Tilbury, and pylon 4VG042 at Gravesend will require removal. These pylons are shown on Plate 3-6 and Plate 3-7.
- 3.6.22 The existing OHL conductors would be removed by lowering them on to trestles rollers or wooden batons which are placed in line underneath the conductor and rolled in (as shown in Plate 3-12).
- 3.6.23 Pylon dismantling and removal can be carried out using a variety of methods depending on the pylon type, location and accessibility. Due to the location of these existing pylons, their surrounding land uses and habitats, it is likely the pylons will be dismantled via cranes.
- 3.6.24 Before the pylon structures can be removed, the conductor and fittings are removed first. For safety reasons it may be necessary to 'backstay' the pylons. This would involve approximately three 1.2 tonne concrete blocks (2m by 1m), called 'backstays' being placed onto a sledge (via tractor) at strategic locations. The concrete blocks act as a safety device, typically placed approximately 35m back from the new pylon and connected by wire rope,
- 3.6.25 The localised placement of the backstay (concrete block) positions will be discussed with the ecological clerk of works as to their most appropriate positions in relation to the existing habitats.
- 3.6.26 Once all backstays are in position, working platforms will be raised to working height at the pylons, and insulators and fittings will be lowered to the ground via tractor and winch. Once this is completed, the conductor can then be lowered to the ground where it will rest on trestles tables, or if more suitable, tarpaulin. This process will be repeated for each conductor.
- 3.6.27 Once the conductor is lower on to the trestle tables or tarpaulin, operatives, on foot, with handheld hydraulic cutters, cut the conductor into manageable pieces. These pieces will be rolled up and carried back to a central location for pick up.
- 3.6.28 The pylons are then dismantled. A large mobile hydraulic crane will be positioned on a crane pad at the pylon location. The crane pad will be approximately 20m x 10m 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.
- 3.6.29 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.
- 3.6.30 Foundations are generally removed to a minimum depth of 1m below ground level, with excavation usually no more than 0.5m by 0.5m. This work is undertaken using a tracked excavator which would dig around the concrete 'muff' to a depth of approximately 1m. The excavator would then be used to break the concrete around the steel 'raker' bar within the concrete before all concrete is then removed from the excavation and the remaining steel 'raker' bar cut to a depth of approximately 1m. This action would then be repeated for the remaining pylon legs and the land reinstated.

Plate 3-16: Hydraulic Shearer Mounted on an Excavator Boom



- 3.6.31 The OHL diversions, from foundations, pylon build, and stringing will be completed as the final phase of the Proposed Development in 2028 and be completed in under one year. The removal of the existing pylons at Tilbury will be completed only once the new equipment is energised, and removal is expected to take approximately three months.

3.7 Construction Traffic Movements and Access

Tunnel and Shaft Excavation Traffic Movements

- 3.7.1 The peak construction activity in terms of traffic generation is expected to relate to the excavation of aggregate during tunnelling. As described in section 3.4.12, National Grid are seeking to remove the shaft and tunnel spoil from Tilbury via the River Thames. However, as a worst case scenario for the purposes of assessment, traffic movements have been forecast as if using the local highway network.
- 3.7.2 If the local highway network were to be used for Tilbury shaft and tunnel spoil, initial forecasts indicate that there will be in the order of 2,548 HGV movements for the shaft spoil across the 8 months period for shaft construction, and 10,218 two-way HGV movements required in total across the eight-month tunnel construction period. This equates to a daily average of 15 two-way trips at Tilbury during the shaft construction, and 75 two-way trips at Tilbury during the tunnel construction.
- 3.7.3 The total number of HGV movements based on both the estimated volumes of excavated material and tunnel lining segments is included below in Table 3-4 for Tilbury and Table 3-6 for Gravesend. The tables present the estimated two-way movements of HGVs. One two-way movement is defined as a vehicle arriving at and then leaving the site.
- 3.7.4 As it is National Grid's preference to remove shaft and tunnel spoil via barge at Tilbury, the two-way HGV movements to either the jetty or Port of Tilbury Berth are included in Table 3-5
- 3.7.5 More information on traffic movements can be found in the Outline Construction Traffic Management Plan in Appendix 10.1 (ES Volume VI).

SEC Construction Traffic Movements

- 3.7.6 The peak number of two-way HGV movements during the construction of the SECs will be approximately 10 per day, per site (Tilbury and Gravesend) for 26 weeks.

Headhouse Construction Traffic Movements

- 3.7.7 The average number of two-way HGV movements during the construction of the headhouses will be approximately 6 two way movements, per day, per site (Tilbury and Gravesend) for 12 months.

Overhead Line Diversions Construction Traffic Movements

- 3.7.8 The peak number of two-way HGV movements during the construction phase the Overhead Line diversions will be approximately 20 per day in Tilbury and 15 per day in Gravesend for 32 weeks.

Table 3-4: Tilbury - Provisional Construction HGV Movements

Construction Phase	Total HGV Movements (in and out of site)	Average Two-way movements per day	Peak Two-way movements per day	Approximate Programme
Shaft Construction	2,548	15	30	24 weeks
Tunnel Construction	10,218	75	150	24 weeks
Tunnel lining segments delivery	4,410	40	80	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	128	6	Not Applicable	52 weeks
Sealing End compound construction	780 (390 x 2)	3	10	26 weeks
400kv overhead line diversions	1300 (650x2)	8	20	32 weeks

Table 3-5: Tilbury - Provisional Construction HGV Movements (with Shaft/Tunnel spoil movements to Jetty/Berth)

Construction Phase Activity	Total HGV Movements (in and out of site)	Average Two-way movements per day	Peak Two-way movements per day	Approximate Programme
Shaft Construction	814	5	10	24 weeks
Tunnel Construction	512	4	8	24 weeks
Tunnel lining segments delivery	4,410	40	80	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	128	6	Not Applicable	52 weeks
Sealing End compound construction	780 (390 x 2)	3	10	26 weeks
400kv overhead line diversions	1,300 (650 x 2)	8	20	32 weeks

3.7.9 By utilising the River Thames to remove the shaft and tunnel spoil from Tilbury, approximately 11,440 HGV movements would be removed from the local and strategic highway network. This equates to approximately 42% of total HGV movements for the Proposed Development at Tilbury.

Table 3-6: Gravesend - Provisional Construction HGV Movements

Construction Phase	Total HGV Movements (in and out of site)	Average Two-way movements per day	Peak Two-way movements per day	Approximate Programme
Shaft Construction	2,462	15	30	24 weeks
Shaft lining segments delivery	208	1	3	24 weeks
Abnormal Indivisible Loads (AILs) TBM	10	2	6	1 week
Shaft fit out and head house construction	128	6	Not Applicable	52 weeks
Sealing End compound construction	780 (390 x 2)	3	10	26 weeks
400kv overhead line diversions	1,100 (550x2)	7	15	32 weeks

Tilbury - Access for TBM and Cable Drums

3.7.10 To facilitate access for the TBM and cable drums to the Tilbury location (which will be delivered as Abnormal Indivisible Loads (AIL)), there are three key areas of the Tilbury approach route which will require alterations to the existing road layout. These are:

- Rail level crossing height restriction:** the existing rail level crossing at grid reference TQ 65959 76076 provides access from the Port of Tilbury to a storage compound located to the north of the proposed access route. Any proposed vehicle movements to facilitate construction will require access across the existing rail track. Prior to the proposed access track, there is a height restriction, limiting the height of vehicles in this location to 5m. Due to the height of the TBM and cable drum delivery low loader, this will require the height restriction posts to be removed temporarily to facilitate access. Following delivery of the TBM, the height restriction can be reinstalled. The height restriction goal posts can be unbolted to facilitate temporary removal therefore will not require new height restriction posts to be installed in this location. Further assessment will be required to confirm whether protection is required to the existing tracks to avoid any damage during the construction phase;

Plate 3-17: Rail Crossing Height Restriction at TQ 65959 76076



- **S Bend:** Following the aforementioned rail level crossing, there is a 90-degree right hand turn (grid reference TQ 66054 76077) followed immediately by a left-hand turn (grid reference TQ 66066 76045). Due to the close proximity of the horizontal curves within the road layout, alterations to the existing highway will be required to facilitate the critical delivery vehicle manoeuvres in this location. Investigations have shown that the vehicles required will overrun the existing kerbs within the adjacent verge. A large section of this existing verge will need to be cleared of vegetation and temporary hardstanding installed to facilitate any critical vehicle manoeuvre, to be removed after construction. Kerbing along the southern edge of the carriageway in this location may need to be temporarily removed to provide finished levels on the hardstanding of the carriageways level. An entrance into the hardstanding area to be used as the Tilbury construction compound, will also be created to enable a new road construction access route and access to the proposed construction compound. There are currently two options considered for this entrance point as shown in red in Plate 3-19.

Plate 3-18: S-Bend Verge Vegetation Clearance



Plate 3-19: Options of entrance into the hardstanding area (construction compound)



- **Right hand bend with central reservation:** It has been identified that the low loader vehicles required during construction will over run the central reservation within this right-hand bend (grid reference TQ 66271 76037). It is proposed that this central reservation is removed temporarily. Following completion of the works, this may be reinstated subject to the requirements of Port of Tilbury.

Plate 3-20: Right hand bend with central reservation



Gravesend - Access for TBM Removal

3.7.11 To facilitate construction traffic access to the Gravesend site, minor alterations will be required in two key areas. These are:

- **Mark Lane Junction onto Norfolk Road:** Alterations will be required to the junction (grid reference TQ 66406 74134) between Norfolk Road and Mark Lane. This is to accommodate the removal of the TBM and the requirement for the access road to accommodate a low loader exiting the site. Alterations to the existing junction onto Norfolk Road will be required to facilitate left hand turns from the low loader towards the wider highway network. The grass verge to the south of Mark Lane junction, in which temporary hardstanding area will need to be installed to facilitate any overrun;

Plate 3-21: Grass Verge to South of Mark Lane – Norfolk Road Junction



- **Mark Lane to the access road:** Following a swept path analysis, it has been confirmed that alterations will be required to the existing road to facilitate any low loader used to remove the TBM from site. The track off the Thames and Medway Canal Road is an informal gravel track, which will require updating to facilitate the volume of vehicle movement anticipated. A formalised surfacing and construction make-up will be required to facilitate vehicle loadings in this location. The current surfacing on this road is currently not adequate to facilitate the construction vehicles. Additional paved areas will be required to facilitate any manoeuvre from the low loader into / leaving site.

Plate 3-22: Access Road to the Gravesend site from the Thames and Medway Canal Road



3.8 Construction Compounds

- 3.8.1 Indicative Construction Site Layouts are provided as Figure 3-5 and Figure 3-6 below, depicting likely layouts of working areas, and the access and egress, associated with the construction of the Proposed Development. The construction compounds will have 24 hour security.
- 3.8.2 The construction compounds at both Tilbury and Gravesend will first be configured to support the shaft construction phase, which once completed, will be reconfigured to support the tunnelling phase, then again to support the building of the headhouse and SEC. These reconfigurations will be within the extent of the temporary working area shown on Figure 3-5 and Figure 3-6.

Tilbury - Main Works Construction Compound

- 3.8.3 The Main Works Compound at Tilbury will require an area of approximately 47,200m² and will utilise the existing hardstanding areas from the former Tilbury Power Station. The indicative layout of the Main Works Compound at Tilbury (as shown in Figure 3-5) is likely to include:
- temporary access roads;
 - temporary storage areas;
 - temporary generators;
 - offices, welfare facilities, security huts, canteens, parking facilities;
 - topsoil / subsoil storage bunds;
 - security huts;
 - wheel washes;
 - grout mixing plant;
 - slurry treatment plant area;
 - muck handling;
 - tunnel segment storage area;
 - crane temporary storage area; and
 - access route from existing private road.
- 3.8.4 An additional area of approximately 42,988m² comprising of the remaining hardstanding area in the vicinity has been included in the Red Line Boundary, for flexibility in configuration of working areas.

Gravesend – Satellite Construction Compound

- 3.8.5 At Gravesend, the Satellite Construction Compound will require an area of approximately 37,000m² / 3.7 ha. The indicative layout of the Satellite Construction Compound at Gravesend (as shown in Figure 3-6) is likely to include:
- offices, welfare facilities, security huts, canteens, parking facilities;
 - temporary generators;
 - topsoil bund;
 - filters yard;
 - wheel wash;
 - crane and temporary caisson storage area; and
 - muck bay and muck handling area.
- 3.8.6 There is a veteran tree at the Gravesend site “T139” (as identified in the Arboriculture Impact Assessment, Appendix D Tree Protection Plan, sheet 11). In accordance with the National Planning

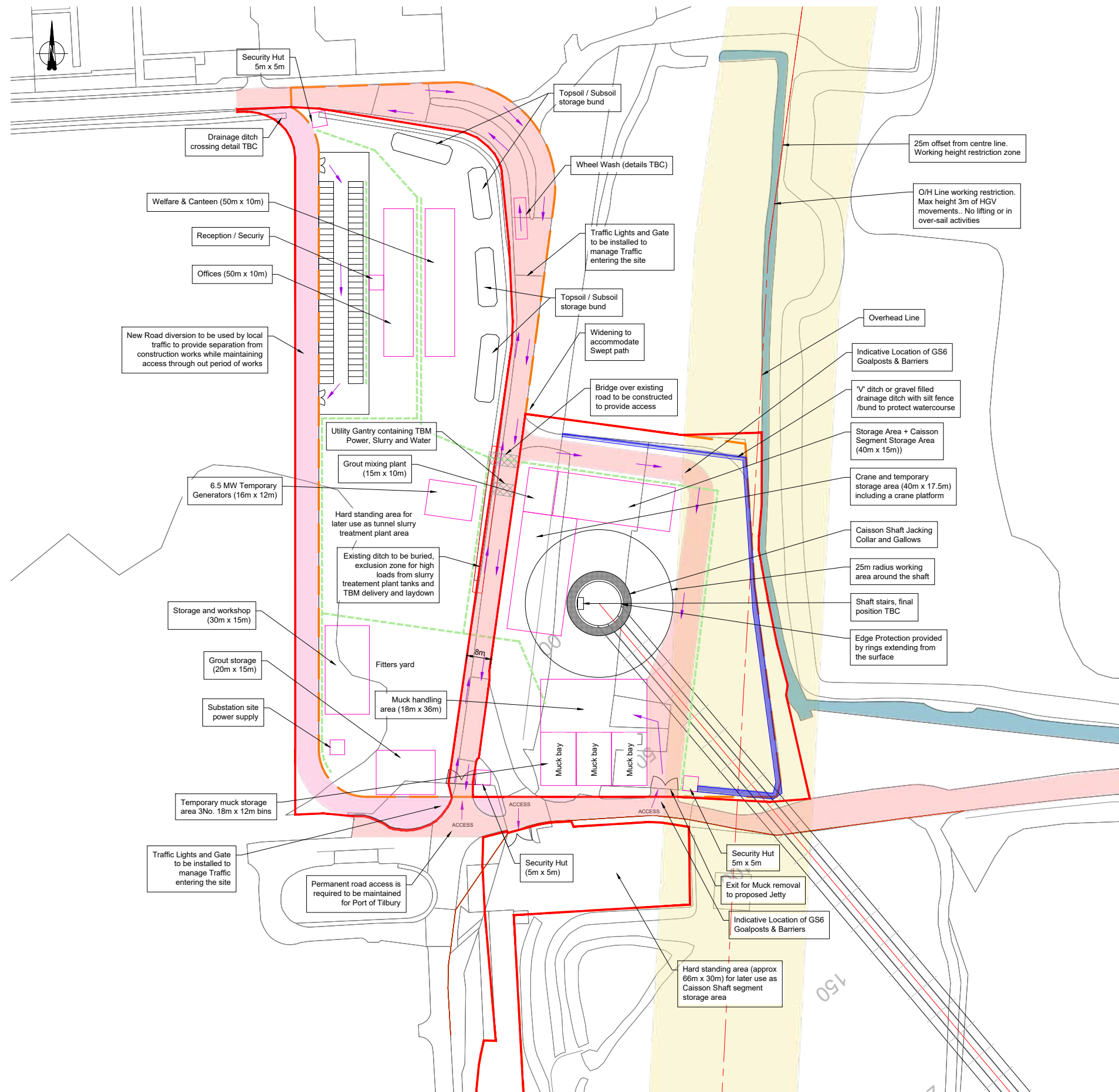
Policy Framework (NPPF)³, veteran trees are an irreplaceable habitat that can only be removed in wholly exceptional circumstances in addition to having a suitable compensation strategy.

- 3.8.7 This is currently shown as being lost to temporary parking in the indicative construction compound layout in Figure 3-6. It should be noted these layouts are indicative only and will be subject to further design refinement to ensure the veteran tree is fully retained and protected during the construction of the Proposed Development. This veteran tree will be protected from adverse impacts during this time in accordance with the tree protection measures presented in Appendix E of the Arboriculture Impact Assessment.

OHL Diversions – Temporary Working Areas

- 3.8.8 During the OHL diversion phase, as described in section 3.6, temporary working areas and plant areas are required to allow for their refurbishment, removal or erection, as well as pylon restringing.
- 3.8.9 Figure 3-7 and Figure 3-8 shows the extent of the working areas required for the pylon installation, refurbishment and removal at Tilbury. Figure 3-9 shows the extent of the working areas required for the pylon removal and refurbishment at Gravesend.

³ https://assets.publishing.service.gov.uk/media/64f991c99ee0f2000fb7c001/NPPF_Sept_23.pdf



Location Plan
Scale 1:750

Notes:

- To be read in conjunction with drawings:
 - NG: PDD-100116-LAY-125 / 30003364-MSE-XX-XX-DR-Y-10037
Tilbury Tunnel Construction Site Layout
 - NG: PDD-100116-LAY-128 / 30003364-MSE-XX-XX-DR-Y-10041
Gravesend Shaft Construction Site Layout
- Supporting Narrative provided in the Works Area Strategy report 30003364-MSE-XX-XX-RP-Y-10082
- Tilbury Shaft Location at SOP point E: 566288.082 N: 175840.645
- Locations are indicative of proposed construction phase arrangement.
- All Dimensions in mm unless stated otherwise.
- Works within the Working Height Restriction Zone to be conducted according to GS6.
- All Construction areas shown will need to be stoned, or temporary hard-standing laid.

KEY

- 15m Internal Diameter Shaft
- 25m offset from centre line. Working Height Restriction Zone
- Existing Road Access
- New Road Access
- Proposed Tunnel Alignment
- Gravel Drainage / V Ditch
- Land Take Boundary
- Pedestrian Access
- Overhead Line
- Temporary Working Area
- Water Course
- Bridge Crossing Structure

P03	Incorporating changes in CDM area	KD	TD	PT	11-10-2023
P02	Client Comments Incorporated	KD	TD	PT	12-09-2023
P01	First Issue	KD	TD	PT	27-07-2023
Rev	Description	Cre'd	Chk'd	App'd	Date

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Master Scheme No:	Sub-Scheme No:	Site:
100116	-	NEW TILBURY CSEC

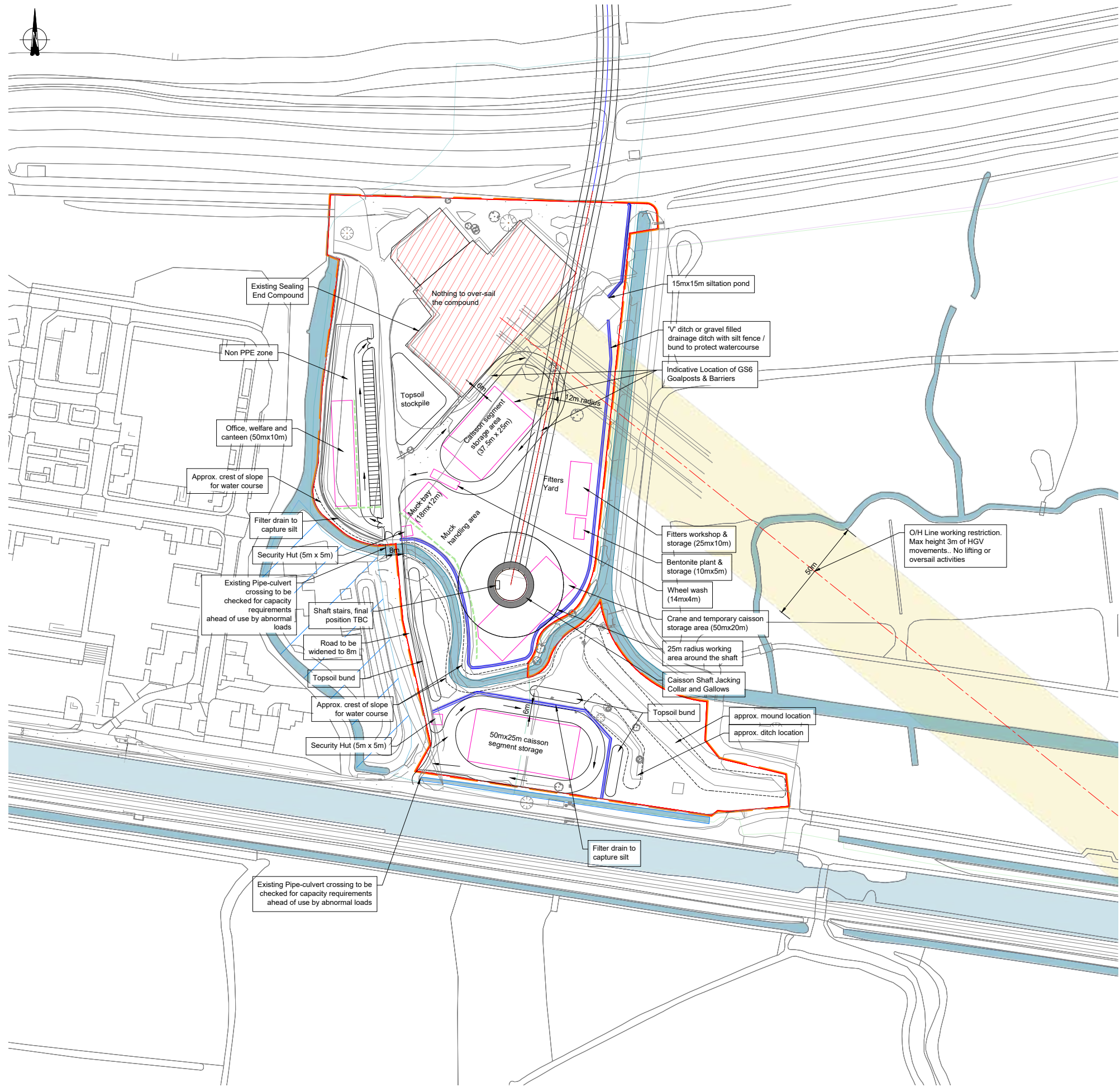
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TKRE GRAIN-TILBURY AND KINGSNORTH-TILBURY
400kV UPRATING

Document Title:
**Tilbury Shaft Construction
Site Layout**

Created by:	Date:	Checked by:	Date:	Approved by:	Date:
KD	11-10-2023	TD	11-10-2023	PT	11-10-2023
Development Eng:	Document Type:	Scale:	Format:	Sheet(s):	Rev:
BT	DRAWING	1:750	A1	1 of 1	P03

National Grid Document Number:
PDD-100116-LAY-127

FEED Document Number:
30003364-MSE-XX-XX-DR-Y-10040



Plan View
Scale 1:1000

Notes

- To be read in conjunction with drawings:
 - 1.1. NG: PDD-100116-LAY-125 / 30003364-MSE-XX-XX-DR-Y-10037
Tilbury Tunnel Construction Site Layout
 - 1.2. NG: PDD-100116-LAY-127 / 30003364-MSE-XX-XX-DR-Y-10040
Tilbury Shaft Construction Site Layout
- Supporting Narrative provided in the Works Area Strategy report 30003364-MSE-XX-XX-RP-Y-10082
- Gravesend Shaft Location at SOP point E: 567427.62 N: 174094.99
- Locations are indicative of proposed construction phase arrangement.
- All Dimensions in mm unless stated otherwise.
- Works within the Working Height Restriction Zone to be conducted according to GS6.
- All Construction areas shown will need to be stoned, or temporary hard-standing laid.

KEY

- 15m Internal Diameter Shaft
- 25m offset from centre line. Working Height Restriction Zone
- Proposed Tunnel Alignment
- Gravel Drainage / V Ditch
- Land Take Boundary
- Pedestrian Access
- Overhead Line
- Temporary Working Area
- Existing Sealing End Compound
- Water Course

P03	Changes to OHL Exclusion Zone	KD	TD	PT	11-10-2023
P02	Client Comments Incorporated	KD	TD	PT	18-09-2023
P01	First Issue	KD	TD	AM	03-07-23
Rev	Description	Cre'd	Chk'd	App'd	Date

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Master Scheme No:	Sub-Scheme No:	Site:
100116	-	NEW GRAVESEND CSEC

Scheme Name:
TKRE GRAIN-TILBURY AND KINGSNORTH-TILBURY
400kV UPRATING

Document Title:

Gravesend Shaft Construction
Site Layout

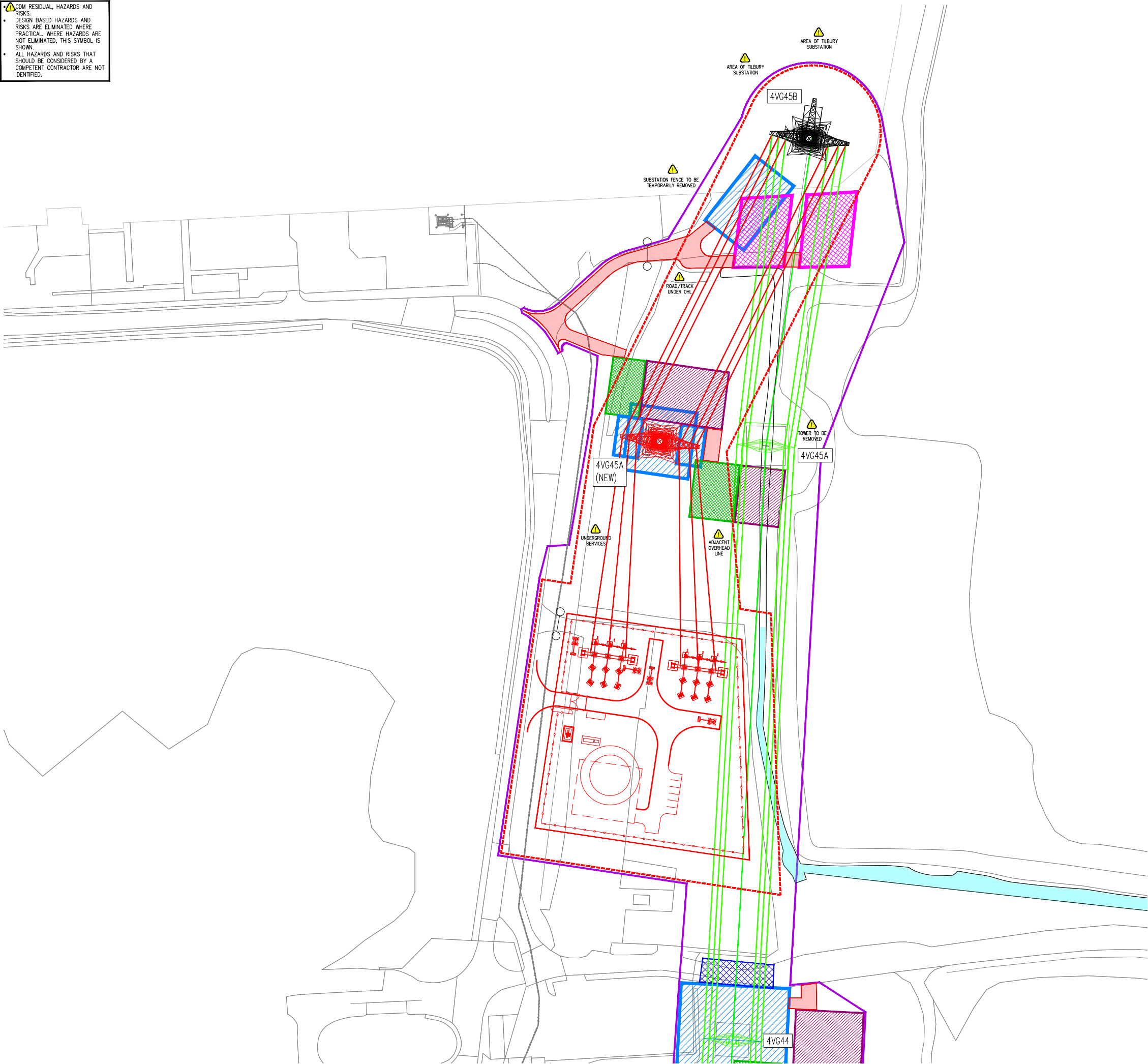
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REFERENCES:

108567_30_01 - GRAVESEND
108748_03_00 - NATIONAL GRID TILBURY

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GENERAL NOTES:

KEY

THE FOLLOWING ITEMS ARE DENOTED THUS:

- NEW STRUCTURE & OHL CONDUCTORS.
- EXISTING STRUCTURE
- CABLE CORRIDOR
- EASEMENT (25m EITHER SIDE OF C/L)
- EXISTING OHL TO BE REMOVED
- EXISTING OHL TO BE RETAINED
- CDM AREA
- WORKING AREA
- SCAFFOLD AREA
- EPZ AREA
- ACCESS TRACKWAY (APPROXIMATE WIDTH 4m)
- TOWER LAYDOWN AREA
- CRANE PAD AREA
- TOWER
- GOAL POST
- GATE

Utility Legend

Air Line	SWD Sewer
Alarm Cable	Survey Extents
BT Cable	Heating Pipe
CATV Cable	HV Electric Cable
Chamber Extent	Kingston Comms
Comms Cable	Oil Pipe
CWD Sewer	Rising Main
Earth Wire/Tape	Traffic Control
Electric Cable	Unknown Utility
Fibre Optic Cable	Vent Pipe
Fuel Line	Water
FWD Sewer	GPR Detection
Gas Pipe	Assumed Route
Band of Cables	Records Route
Empty Service Duct	Drainage
	Backdrop
	Cable Riser

Utility Abbreviations

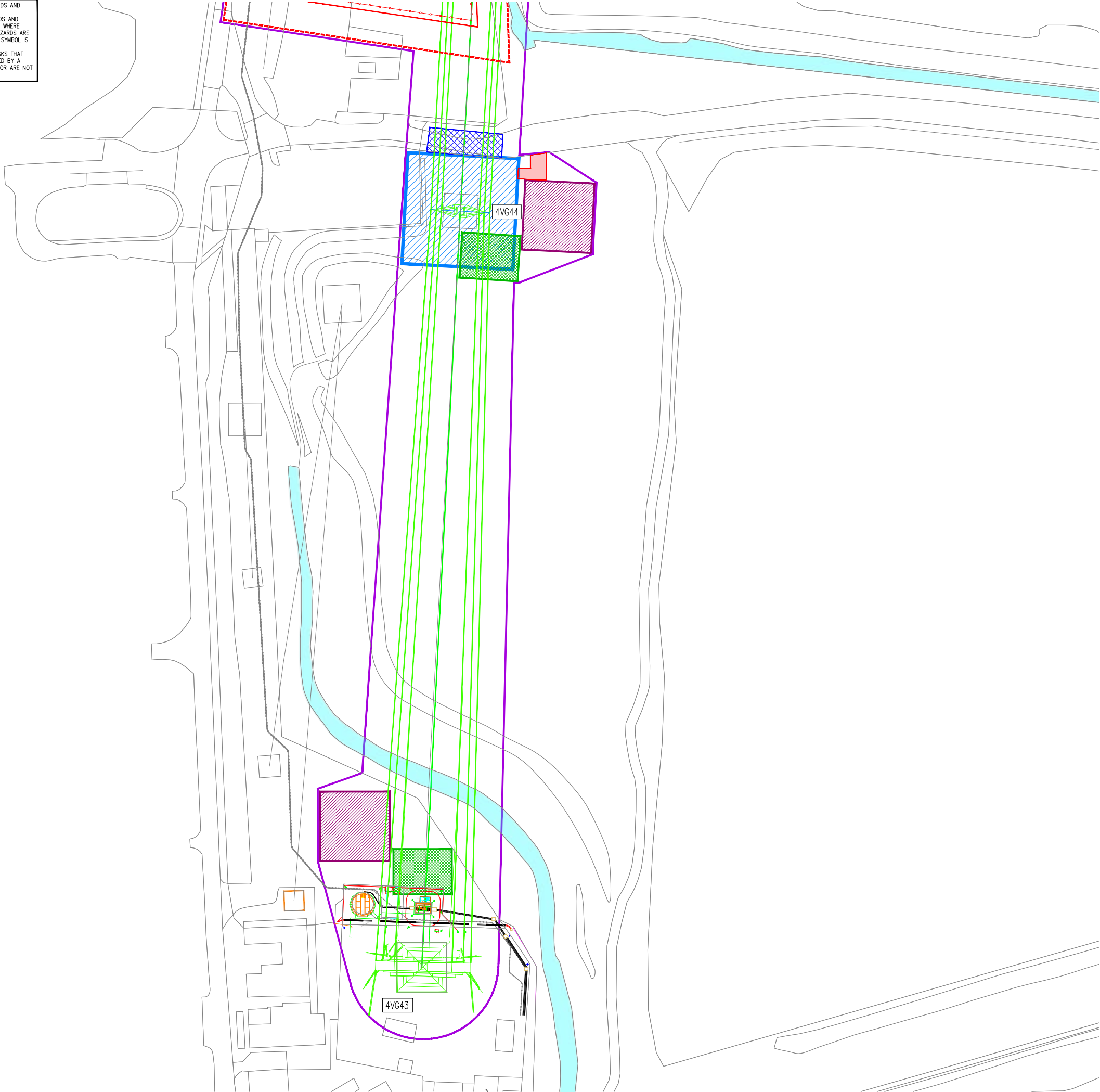
CP	Cathodic Protection	LoS	Loss of Signal
CU	Disconnected Utility	MDPE	Middle Density PE
DI	Ductile Iron	SI	Spun Iron
DoB	Depth of Bottom	TLC	Traffic Light Control
DoC	Depth of Cover	UDI	Unreliable Depth Info
ED	Empty Duct	uPVC	Unplasticised
EO	End of Trase	PPVC	Polyvinyl Chloride
PE	Polyethylene	UTR	Unable to Raise
HDPE	High Density PE	UTT	Unable to Trace
	VC	Vitrified Clay	

P02	FOR ACCEPTANCE	RCM	KR	AR	18/08/2023
4VG45A WORKING AREA REVISED					
P01	FOR ACCEPTANCE	NDN	KR	LGW	22/08/2023
Rev	Description	Drawn	Checked	Agreed	Date

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100116	-	TILBURY
Scheme Name: TKRE GRAIN-TILBURY AND KINGSNORTH-TILBURY 400KV UP RATING		
Document Title: CDM WORKING AREA SHEET 01 OF 03		
Created by: NDN	Date: 22/08/2023	Checked by: KR
Development Eng BT	Document Type: DRAWING	Scale: 1:500
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REFERENCES:

108567_30_01 - GRAVESEND
108748_03_00 - NATIONAL GRID TILBURY

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GENERAL NOTES:

KEY

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- NEW STRUCTURE & OHL CONDUCTORS.
- EXISTING STRUCTURE
- CABLE CORRIDOR
- EASEMENT (25m EITHER SIDE OF C/L)
- EXISTING OHL TO BE REMOVED
- EXISTING OHL TO BE RETAINED
- CDM AREA
- WORKING AREA
- SCAFFOLD AREA
- EPZ AREA
- ACCESS TRACKWAY (APPROXIMATE WIDTH 4m)
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- CRANE PAD AREA
- TOWER
- GOAL POST
- GATE

Utility Legend

Air Line	SWD Sewer
Alarm Cable	Survey Extents
BT Cable	Heating Pipe
CATV Cable	HV Electric Cable
Chamber Extent	Kingston Comms
Comms Cable	Oil Pipe
CWD Sewer	Rising Main
Earth Wire/Tape	Traffic Control
Electric Cable	Unknown Utility
Fibre Optic Cable	Vent Pipe
Fuel Line	Water
FWD Sewer	GPR Detection
Gas Pipe	Assumed Route
Band of Cables	Records Route
Empty Service Duct	Drainage
	Backdrop
	Cable Riser

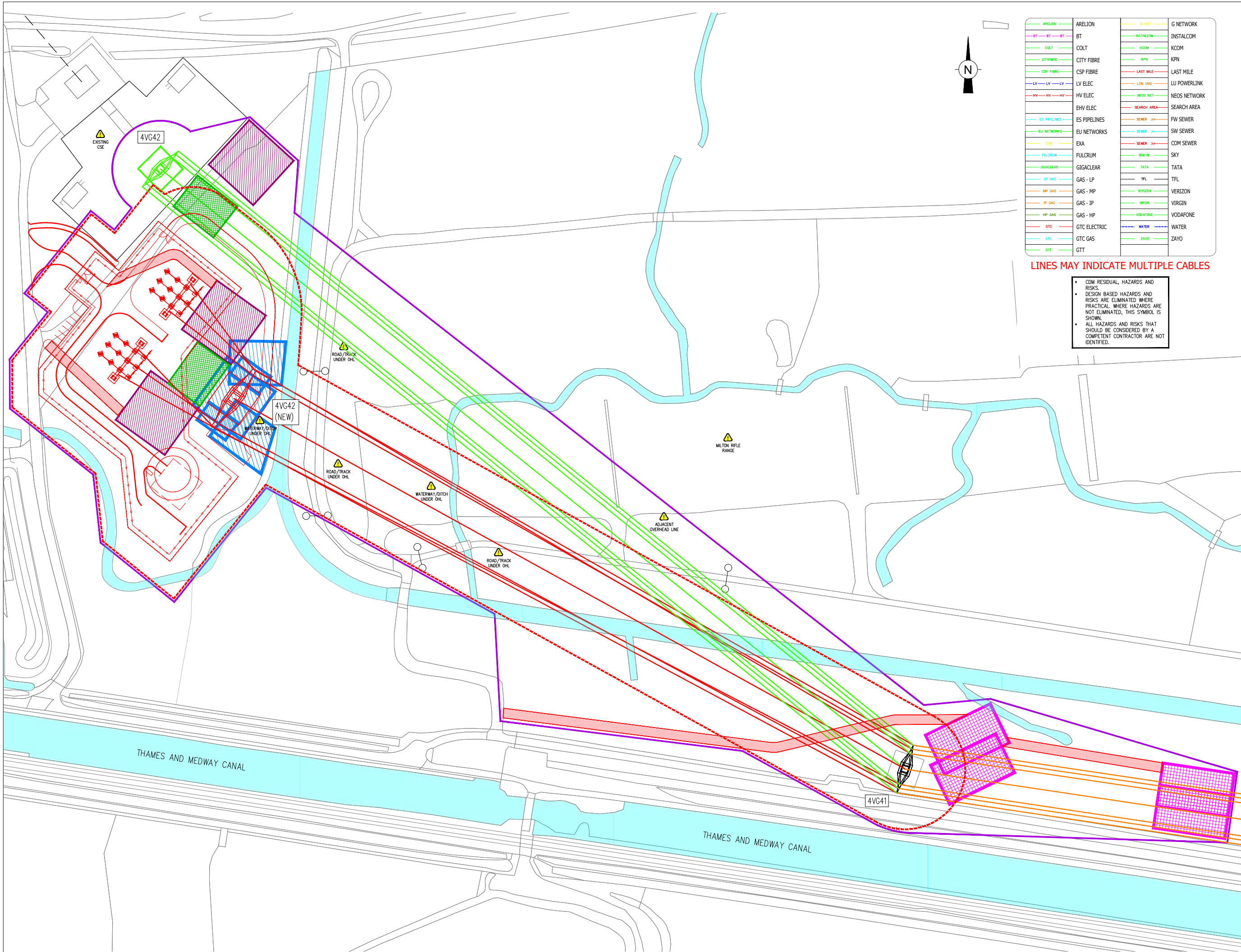
Utility Abbreviations

CP	Cathodic Protection	LoS	Loss of Signal
Cut	Disconnected Utility	MDPE	Middle Density PE
DI	Ductile Iron	SI	Spun Iron
DuB	Depth of Bottom	TLC	Traffic Light Control
DoC	Depth of Cover	UDI	Unreliable Depth Info
ED	Empty Duct	uPVC	Unplasticised
EOt	End of Trace	PVC	Polyvinyl Chloride
PE	Polyethylene	UTR	Unable to Raise
HDPE	High Density PE	UTT	Unable to Trace
	VC	Vitrified Clay	

P02	FOR ACCEPTANCE	RCM	KR	AR	18/09/2023
	4VG43 ACCESS REMOVED				
P01	FOR ACCEPTANCE	NDN	KR	LGW	22/08/2023
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Master Scheme No:	Sub-Scheme No:	Site:
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COLT	COLT	KCOM	KPM
CITY FIBRE	CITY FIBRE	KPM	LAST MILE
CSP FIBRE	CSP FIBRE	LAST MILE	LU POWERLINK
LV	LV	LV	NEOS NET
HV	HV	HV	SEARCH AREA
EHV ELEC	EHV ELEC	SEARCH AREA	FW SEWER
ES PIPELINES	ES PIPELINES	SEWER >>	SW SEWER
EU NETWORKS	EU NETWORKS	SEWER >>	COM SEWER
EXA	EXA	SEWER >>	SKY
FULCRUM	FULCRUM	SKY	TATA
GIGACLEAR	GIGACLEAR	TATA	TFL
GAS - LP	GAS - LP	TFL	VERIZON
MP GAS	GAS - MP	VERIZON	VIRGIN
IP GAS	GAS - IP	VIRGIN	VODAFONE
HP GAS	GAS - HP	VODAFONE	WATER
GTC	GTC ELECTRIC	WATER	ZAYO
GTC	GTC GAS	ZAYO	
GTT	GTT		

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	EXISTING OHL TO BE REMOVED
	EXISTING OHL TO BE RETAINED
	CDM AREA (10m OFFSET FROM OUTER CONDUCTOR)
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	SCAFFOLD AREA
	EPZ AREA
	ACCESS TRACKWAY (APPROXIMATE WIDTH 4m)
	TOWER LAYDOWN AREA
	CRANE PAD AREA
	TOWER
	GOAL POST
	GATE

FOR ACCEPTANCE	FOR ACCEPTANCE	FOR ACCEPTANCE	FOR ACCEPTANCE	FOR ACCEPTANCE	FOR ACCEPTANCE
Rev	Description	Rev	Description	Rev	Description

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Master Scheme No:	Sub-Scheme No:	Site:
100116	-	GRAVESEND

Scheme Name:
TKRE GRAIN-TILBURY AND KINGSNORTH-TILBURY
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Document Title:
CDM WORKING AREA
SHEET 03 OF 03

Created by:	Date:	Checked by:	Date:	Approved by:	Date:
NDN	22/08/2023	KR	22/08/2023	LGW	22/08/2023
Development Eng	Document Type:	Scale:	Format:	Sheet(s)	Rev
BT	DRAWING	1:500	A0	03 OF 03	P02

National Grid Document Number:
PDD-100116-OHL-015_03

FEED Document Number:
30003364-BHK-XX-XX-DR-OHL-06033

3.9 Public Rights of Way

Tilbury

- 3.9.1 There are no Public Rights of Way (PRoW) across the proposed Tilbury SEC. The nearest PRoW (Footpath 146) is located approximately 380 m 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. There will be no required temporary diversion to Footpath 146 during the construction of the Proposed Development.

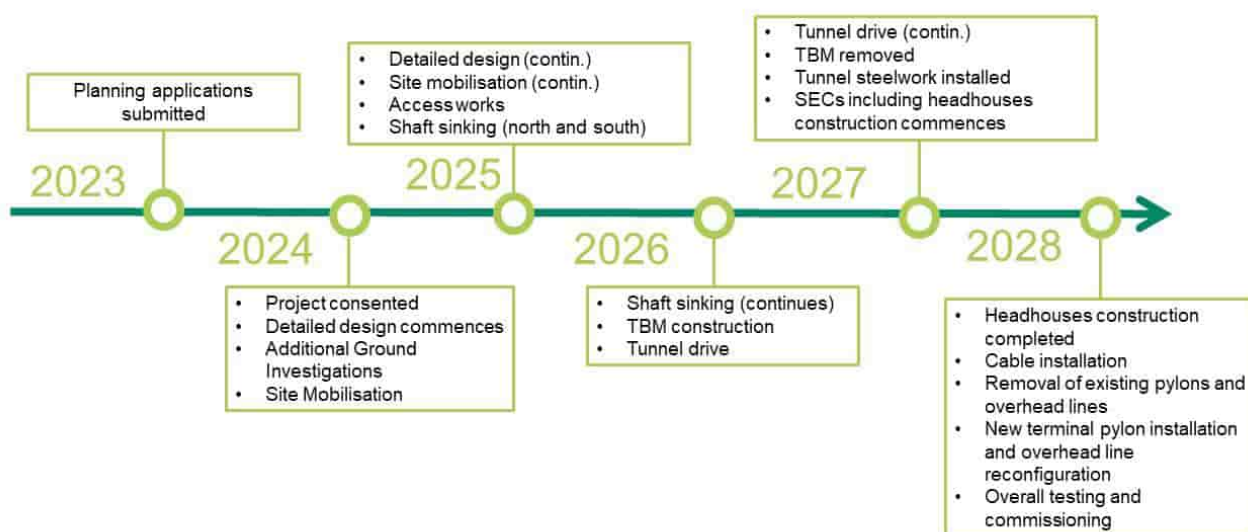
Gravesend

- 3.9.2 There are no PRoWs across the proposed Gravesend SEC. The nearest PRoW NG1 (Footpath) is located approximately 80 m to the north of the proposed Gravesend SEC and comprises part of the England Coast Path and Saxon Shore Way promoted recreational routes. An additional public footpath that runs alongside the Thames and Medway Canal (PRoW NG2 (Footpath)) is located approximately 150 m to the south of the site and also forms part of National Cycle Network (NCN) Route 1 from Dover to the Highlands of Scotland.
- 3.9.3 PRoW NG1 (Footpath) will not require any temporary diversion during the construction of the Proposed Development.
- 3.9.4 PRoW NG2 (Footpath) along the northern side of the Thames and Medway Canal (immediately to the south of the site) will be temporarily closed to ensure pedestrian safety. Pedestrians will be diverted to PRoW NG1 (Footpath)/ England Coast Path/ Saxon Shore Way, which runs along the southern side of the River Thames. The diversion route will be signed for the duration of the closure and will result in an additional 1.2km walking distance.
- 3.9.5 NCN Route 1 along the Thames and Medway Canal (immediately to the south of the site) will be temporarily closed to ensure cyclist safety. Going from west to east, cyclists will be diverted onto Chequers Street (in Lower Higham), Chalk Road, Lower Road, Lower Higham Road, A226 Rochester Road, Raphael Road, Prospect Grove (via a subway) and Norfolk Road. The diversion route will be signed for the duration of the closure and will result in an additional 1.5km cycling distance.

3.10 Construction Programme

3.10.1 Construction at the site will take place from 2024, when early mobilisation and further ground investigations take place. The main construction work will commence in 2025 and run until approximately 2028, when the Proposed Development is to be energised. The indicative construction programme is shown in Plate 3-23.

Plate 3-23: Indicative Construction Programme



3.11 Working Hours

- 3.11.1 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.
- 3.11.2 The core working hours for the rest of the construction activities will be between 8:00 – 18:00 (Monday to Sunday). 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 create significant disturbance to neighbouring residents/businesses but may include movement to place of work, maintenance and general preparation works.
- 3.11.3 No works are to be undertaken out of hours (subject to TBM delivery), on Bank Holidays without prior consultation and agreement with the relevant Local Highway Authorities.

3.12 Construction Environmental Management

- 3.12.1 An important measure to avoid significant environmental effects is effective management during design and construction, details of which will 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.
- 3.12.2 An Outline CEMP is provided in Appendix 3.1 (ES Volume VI) which will be finalised by the Contractor during detailed design, prior to the start of construction.

3.13 Reinstatement and Landscaping

- 3.13.1 Land used temporarily to support the construction of the Proposed Development will be reinstated to its former, or better than former, condition.
- 3.13.2 An Outline Landscape and Ecological Mitigation Plan (oLEMP) has been provided with the Planning Applications. This sets out the strategy for the establishment and future management of the proposed landscaping and ecological works associated with the Proposed Development. It sets out the short and longer-term measures and practices that will be implemented to establish, monitor and manage the areas of new planting.
- 3.13.3 The oLEMP includes a landscape plan for both the Tilbury and Gravesend SECs, depicting the proposed landscaping and planting schedules.
- 3.13.4 A detailed version of the LEMP which follows these principals will be prepared once a contractor is appointed.

3.14 Operational Phase

Operational Visits

- 3.14.1 Once the Proposed Development is commissioned and in operation, it is expected that operational activity will mirror that of the existing SECs. The facilities will be unmanned in normal operation. Operational activity of the Proposed Development may include:
 - Bi-monthly visits (Tilbury) / monthly visits (Gravesend) with a light van or car for e.g., safety checks on such equipment as fire alarms; 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.
- 3.14.2 The overall design life of the new tunnel, sealing end compounds including the headhouses is approximately 120 years.

Management of Surface Water

- 3.14.3 Surface water runoff from both sites will comprise headhouse roof runoff and water pumped from the tunnel. When the sites are operational, the surface water runoff rates are expected to be relatively low. The majority of surfacing will comprise free draining stone material with a Type 3 sub-base, meaning surface water will soak away naturally.
- 3.14.4 The surface water drainage design strategy for both Gravesend and Tilbury is to remove the road surface water via filtration trenches, which will collect and convey the water to a traditional pipe drainage system. This pipe system will also pick up roof water from the headhouse and any tunnel water seepage, before entering the existing ditches which are to the east of the Proposed Development via a new headwall at Tilbury, and via a new headwall into the existing ditch running around the East/South/West perimeter of the Proposed Development at Gravesend.
- 3.14.5 The new headhouses will be fitted with rainwater pipes. The addition of a biodiverse roof on the headhouses will also retain and slow water runoff.
- 3.14.6 The proposed systems will be restricted to greenfield run-off rates for each site - calculated to be 0.4 litre per second (l/s).
- 3.14.7 More information on the drainage management of the sites is presented in the Drainage Management Plan (Document Reference 30003364-BHK-XX-XX-RP-C-02060).

3.15 Electric and Magnetic Fields

- 3.15.1 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.

3.16 Decommissioning

Decommissioning of existing assets

- 3.16.1 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.
- 3.16.2 The cable terminations and steel structures within the existing headhouses and SEC's will be recycled, or reconditioned for reuse, or repurposed.

Decommissioning of proposed assets

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

3.17 Abbreviations

Abbreviation	Definition
AC	Alternating Current
AILs	Abnormal Indivisible Loads
aOD	above Ordnance Datum
CEMP	Construction Environmental Management Plan
DC	Direct Current
EMF	Electric and Magnetic Fields
EPB	Earth Pressure Balance
ES	Environmental Statement
GPR	Ground Penetrating Radar
ICNIRP	International Commission on Non-Ionizing Radiation Protection
kV	kiloVolt
l/s	litre per second
LV	Low Voltage
LWS	Local Wildlife Site
MCC	Motor Control Centre
MEWP	mobile elevated work platform
MPSTC	Metropolitan Police Specialist Training Centre
MVA	megavolt amperes
NCN	National Cycle Network
NPPF	National Planning Policy Framework
OHL	Overhead line
oLEMP	Outline Landscape and Ecological Mitigation Plan
PRoW	Public Rights of Way
RSPB	Royal Society for the Protection of Birds
SEC	Sealing End Compound
SF ₆	sulphur hexafluoride
SRN	Strategic Road Network
TBM	Tunnel Boring Machine
TKRE	Tilbury to Grain and Tilbury to Kingsnorth
WC	Water Closet
XLPE	Cross Linked Polyethylene

