CampbellReith
consulting engineers

Twyford Pumping Station
Queenborough & Rushenden

Environmental Report

For

Homes England

Project Number:

11465

April 2021

Campbell Reith Hill LLP
Raven House
29 Linkfield Lane
Surrey
RH1 1SS

T: +44(0)1737 784500
E: surrey@campbellreith.com
W: www.campbellreith.com

Document History and Status

Revision	Date	Purpose/Status	Author	Check	Review
0	11/01/21	Draft	Marian Cameron	Grant Plain	Alan Poulton
1	30/03/21	Final	Marian Cameron	Grant Plain	Alan Poulton

Document Details

Last saved	11/01/2021 08:40
Path	11465 Twyford PS Env Report 300321
Author	Marian Cameron
Project Partner	Alan Poulton
Project Number	11465
Project Name	Twyford Pumping Station, Queenborough & Rushenden

Contents

Appendices

Figures

1.0 INTRODUCTION

1.1. Background

1.1.1. This Environmental Report has been prepared on behalf of Homes England (the 'Applicant') to accompany a full planning application for a new surface water pumping station (henceforth referred to as the 'Twyford Pumping Station') which will replace the existing failing surface water pumping station within the Twyford Site. The Twyford Pumping Station is designed to increase the efficiency and capacity of discharging surface water run-off from Queenborough and Rushenden into the Swale to help facilitate future development within Queenborough and Rushenden. The existing surface water pumping station will be decommissioned and along with the drainage channels will be left in-situ[1].

1.1.2. The location and boundaries of the Site (hereafter referred to as the 'Site') are shown on **Figure 1.1**. The Site is approximately 0.94 hectares (ha) and is situated on previously developed land between Queenborough and Rushenden on the Isle of Sheppey.

1.1.3. The Twyford Pumping Station will be located west of Rushenden Road and north of First Avenue and Nelsons Vue between Queenborough and Rushenden on the Isle of Sheppey as shown in **Figure 1.1**. The National Ordnance Survey (OS) Grid Reference for the approximate centre of the Site at 590715, 171645. The main area of the Site will be located within the south-west corner of the wider Twyford Site. The wider Twyford Site along with the Klondyke Site directly to the north was subject to planning permission (SW/13/1550) (henceforth referred to as the 'Approved Scheme' which was granted in March 2014 for:

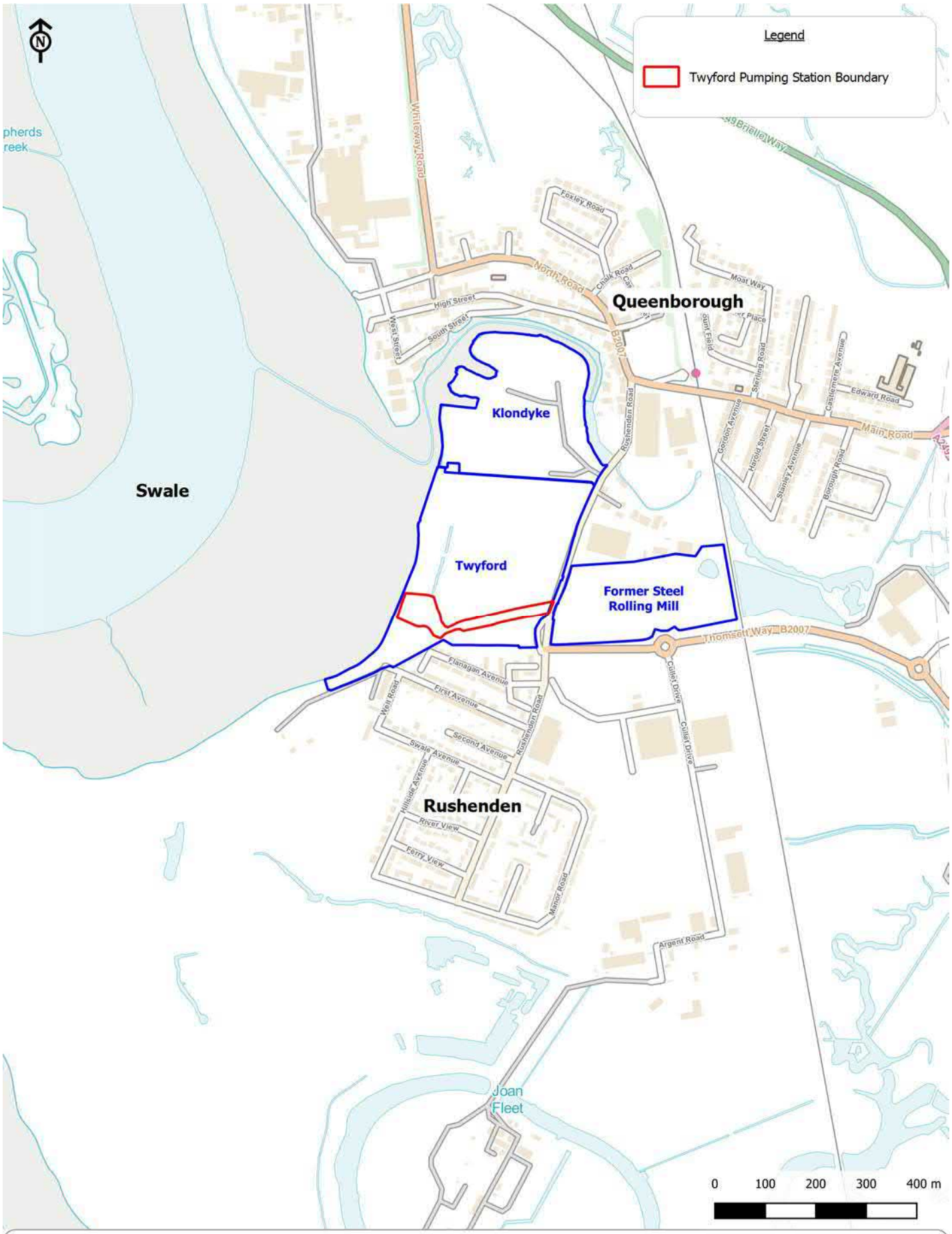
'Site clearance, demolition of existing buildings, remediation, enhancement of the existing flood defences and land raising to form a development platform above a minimum height of 4.9m and below a maximum height of 5.4m above Ordnance Datum (AOD) on the Twyford and Klondyke Sites'.

1.2. Planning History

1.2.1. The Site benefits from planning permission that was granted in March 2014 as discussed in Paragraph 1.1.3. The planning application was accompanied by a series of environmental reports which included:

- Campbell Reith Hill LLP (December 2013) Queenborough and Rushenden Phase 2, Twyford and Klondyke Sites, Ecology and Nature Conservation Report;
- Lloyd Bore (December 2013) Queenborough and Rushenden Phase 2, Twyford and Klondyke Sites, Landscape and Visual Amenity Appraisal;
- Accon UK (December 2013) Queenborough and Rushenden Phase 2, Twyford and Klondyke Sites, Noise Report;
- Accon UK (December 2013) Queenborough and Rushenden Phase 1, Twyford and Klondyke Sites, Air Quality Assessment Report;
- CampbellReith (December 2013) Queenborough and Rushenden Phase 2, Twyford and Klondyke Sites, Cultural Heritage; and

[1] The removal of the existing Pumping Station and infilling of the ditches to it will form part of a separate planning application and are therefore not considered further within this report.



Queenborough and Rushenden

Client: Homes England

Figure 1.1:
The Twyford Pumping Station Site

Scale:	1:10000@A4
CampbellReith OS Copyright:	© Crown copyright. All rights reserved. Licence number 100020027
Contains Ordnance Survey data	© Crown copyright and database right 2021.
Job Number:	11465
Drawn by - Checked by:	RP - MC
Drg No - Status/Revision:	GIS246 - B
File location:	N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\Environmental Report (pdf in Outputs)
Date (Revision History):	23/03/2021 (A, First Issue, 25/02/21, RP; B, Boundary Update, 23/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

- Campbell Reith Hill LLP (March 2014) Queenborough and Rushenden Phase 2, Twyford and Klondyke Sites, Outline Construction Environmental Management Plan.

1.2.2. During the intervening seven to eight years since these reports were produced in 2013 or 2014, land raising activities have commenced on the Twyford and Klondyke Sites, buildings have been removed and the site has undergone site clearance and ground remediation on the Former Steel Rolling Mill Site on the opposite side of Rushenden Road and the dwellings at the new housing development known as Nelsons Vue to the south of the Site have been constructed which has changed the baseline conditions in the Site and surrounding area.

1.3. Purpose of the Proposed Development

1.3.1. The existing Lower Medway Internal Drainage Board (LMIDB) surface water pumping station is beyond its working life and is now required to be decommissioned and demolished. The pumping station currently drains Southern Water's surface water sewer network that includes parts of Queenborough and Rushenden including land being developed by the Applicant on the Twyford, Klondyke and Former Steel Rolling Mill Sites. In addition to forming a fundamental part of the existing surface water sewer network, the replacement Twyford Pumping Station will also facilitate future mixed-use development as part of the Queenborough and Rushenden Masterplan[2] as well as freeing up an additional developable area within the wider Twyford Site in the location of the existing pumping station and drains for future residential development.

Queenborough and Rushenden Regeneration Project

1.3.2. The Queenborough and Rushenden Masterplan, was adopted as a Supplementary Planning Document as part of the Swale Local Development Framework in November 2010[3] with subsequent revisions in 2015[4]. It is also addressed through The Swale Borough Local Plan – Bearing Fruits 2031, adopted on the 26 July 2017[5].

1.3.3. Queenborough and Rushenden have suffered over the years from under investment, declining historic employment and restricted access. The Queenborough and Rushenden Regeneration Project is important for the Isle of Sheppey, as it aims to connect Queenborough and Rushenden together by producing a third, new, integrated community so that all three gain socio-economic advantages in the process. The proposals also aim to improve environmental standards throughout the Queenborough and Rushenden area and enhance the valuable Medway Estuary and Marshes Ramsar, Special Protection Area (SPA) and Site of Scientific Interest (SSSI) status of the land. The proposed development in the Masterplan area is a mix of:

- Residential and commercial development;
- Employment space;
- Community facilities and services;
- Open spaces; and
- A primary school.

[2] The future mixed-use development on the Twyford and Klondyke Sites will form the focus of separate planning applications and is not considered to form part of this Proposed Development.
[3] Swale Borough Council (November 2010) The Queenborough and Rushenden Masterplan Supplementary Planning Document (SPD)
[4] Swale Borough Council (2015) Indicative Revised Land Use Plan: Addendum to 2010 Adopted Masterplan
[5] Swale Borough Council (July 2017) Bearing Fruits 2031: The Swale Borough Local Plan.

1.4. Scope of the Assessment

1.4.1. This report considers and appraises the key environmental effects that could potentially arise from the construction and/or operation of the Twyford Pumping Station on its own or cumulatively with the Twyford, Klondyke and Former Steel Rolling Mill Sites. The following topics are included in this report:

- Biodiversity;
- Historic environment;
- Landscape effects; and
- Water environment.

Scoped Out Topics

1.4.2. The assessment excludes the following topics as it is considered unlikely that the Twyford Pumping Station will result in significant effects:

- Noise and vibration have been scoped out of the assessment as the effects would only occur during construction and would be minimised through the implementation of the CEMP (**Appendix 1**). Furthermore, low noise/vibration piling techniques (which is the main source of potential vibration) would be used to avoid noise and vibration effects. During operation, there would be minimal effects as the majority of the equipment and plant would be located underground and be regularly maintained;
- Air quality has been scoped out of the assessment as the effects would only occur during construction and would be minimised through the implementation of the Dust Control Plan which forms an integral part of the CEMP (**Appendix 1**). Furthermore, the works would not require any demolition which is a key source of dust during construction;
- Geology and soils have been scoped out of the assessment as remediation has already been carried out within the Site in 2015 as part of the wider Twyford Site construction works and therefore there would be no likely effects as a result of contamination on geology and soils beyond those arising directly from construction activities which are addressed in Chapter 7 Water Environment;
- Transportation has been scoped out of the assessment due to the small scale of the works which will require only a small number of vehicles during construction and only occasional vehicle visits during operation. During neither construction or operation would the number of vehicles on the road network significantly affect other road users or pedestrians;
- Waste has been scoped out of the assessment due to the small scale of the works. The temporary store of topsoil currently on the Site would be removed in advance of the construction works, while the excavated material would be reused within either the land raising at the Klondyke Site or Former Steel Rolling Mill Site to minimise the amount of waste removed from the Site. Any waste removed from the Site during construction would be deposed of in a legal and responsible way through the implementation of the CEMP. No waste is likely to be generated during the operational activities that cannot be removed and disposed of appropriately during the occasional maintenance or management operations;

- Socio economics has been scoped out due to the small scale of the works which would have no likely effects on population, jobs, community facilities or recreation and tourism during construction or operation;
- Lighting and night time has been scoped out as lighting during construction would be controlled through the implementation of the CEMP resulting in neutral effects. There would be no lighting during operation;
- Effects on climate change have been incorporated into the chapters on Biodiversity and Water Environment and will not be considered separately;
- Human health effects have been scoped out as the Twyford Pumping Station is of the type and scale not anticipated to cause any likely effects on health with the effective implementation of the CEMP and the health and safety documentation to ensure worker safety and public and environmental amenity are compliant with legislation and regulations;
- Effects on daylight, sunlight and overshadowing have been scoped out of the assessment as the structures are not considered to be of a height or density that would cause likely effects to other existing or proposed properties; and
- Material assets have been incorporated into Landscape Effects and Historic Environment and would not be considered separately.

2.0 THE SITE OF THE TWYFORD PUMPING STATION

2.1. Introduction

2.1.1. This chapter describes the Site's location and provides an overview of the surrounding area to place it in the context of the surrounding environment.

2.2. Site Context

2.2.1. The Site is located within Queenborough and Rushenden on the Isle of Sheppey in Swale Borough. The Site is centred at approximate National Grid Reference 590916, 171881. **Figure 2.1** provides a site context plan.

2.2.2. Notable features within the vicinity of the Site include: Queenborough; Rushenden; Medway Estuary and Marshes Ramsar, SPA and SSSI; Queenborough Conservation Area; various Listed Buildings within Queenborough; Queenborough Castle Scheduled Monument; Public Rights of Way (PROW); Rushenden Road; and Thomsett Way.

2.3. Site Description

2.3.1. The Site is 0.94 ha and is located within the wider Twyford Site which is located between Queenborough and Rushenden on the Isle of Sheppey in Swale Borough.

2.3.2. The main area of the Site is located within the south-west corner of the wider Twyford Site. The Site is bound by the raised development platform to the east; the disused railway line to the south; the flood defences with The Swale beyond to the west and a ditch and raised development platform to the north.

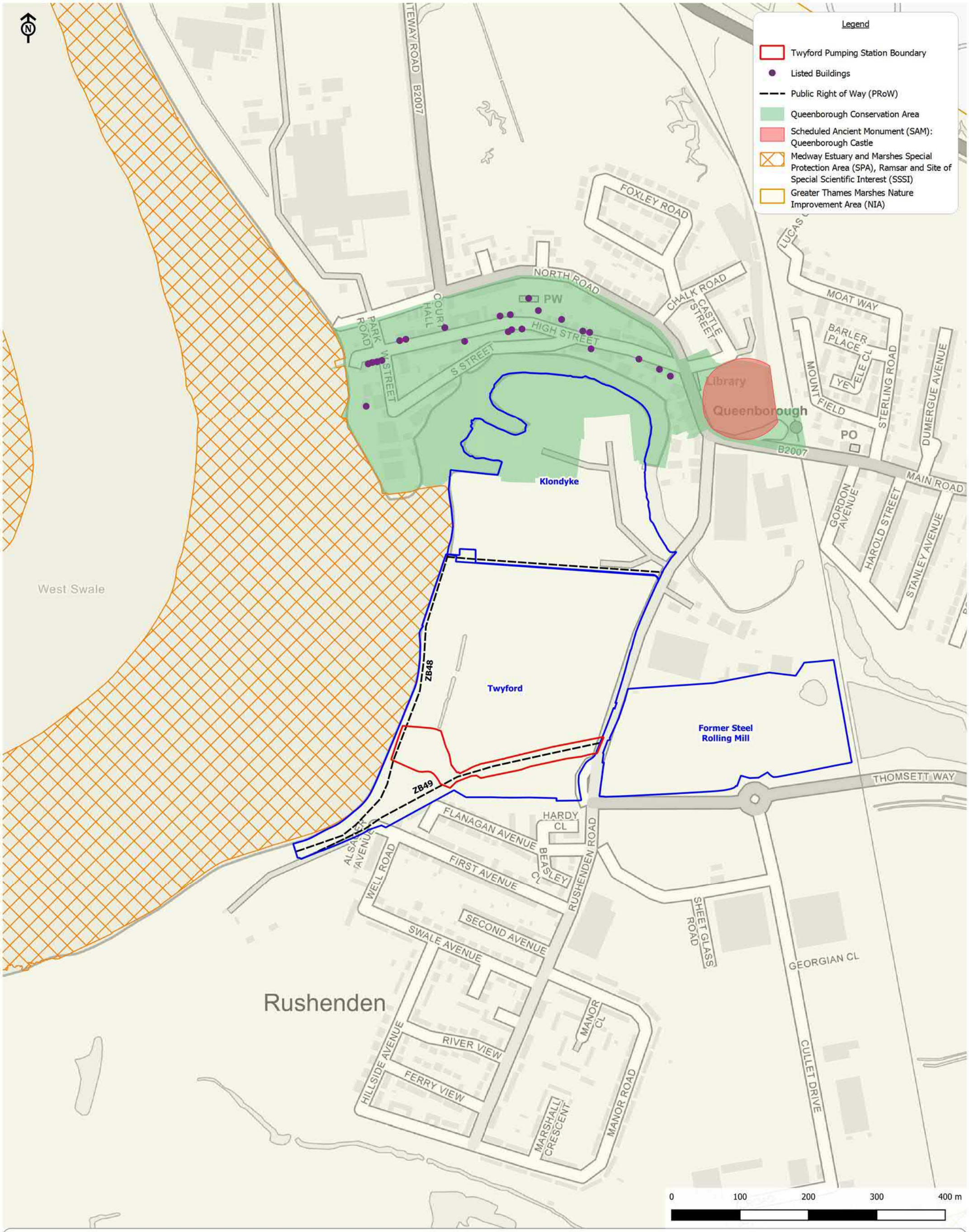
2.3.3. The Site at its original ground level was between 2.20m AOD and 2.87m AOD, but it is currently being used as a temporary store of approximately 8,000 sqm of topsoil associated with the former surcharge materials from the Nelson Vue, Keepmoat development to the south-east of Site. There is a ditch passing through the Site.

Twyford Site

2.3.4. The wider Twyford Site is a 11.2 ha brownfield site, which was previously used for manufacturing and is currently being land raised in preparation for future development. Prior to the land raising, to the north of the disused railway it was characterised by a large expanse of cleared hardstanding with occasional mounds of spoil and construction material that were being temporarily stored on it. It was bound by a tall green protec mesh fence with an entrance gate onto Rushenden Road.

2.3.5. Along the western boundary of the area there is a ditch with grass banks and beyond a grassed earth bund which forms the flood defences along the Swale. At the southern end of this area of the Twyford Site the drainage ditch is culverted as it passes beneath the disused railway line and the Site. The ditch has been left undisturbed during the works in the wider Twyford Site.

2.3.6. To the south of the disused railway, there is a triangular shaped area of land formed by Rushenden Road to the east, the disused railway to the north and a drainage ditch to the south. This area of the Site, before construction commenced, encompassed the Gateway Community Centre and one other disused warehouse to the east adjacent to Rushenden Road and an area of hardstanding with scrub colonising the cracks in the ground slabs further to the west.



Queenborough and Rushenden

Client: Homes England

Figure 2.1:
Site Context Plan

Scale: 1:5000@A3

Job Number: 11465
Drawn by - Checked by: RP - MC
Drg No - Status/Revision: GIS249 - B
File location: N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\Environmental Report (pdf in Outputs)
Date (Revision History): 23/03/2021 (A, First Issue, 10/03/21, RP; B, Boundary Update, 23/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

2.3.7. Since the wider Twyford Site was granted planning permission (SW/13/1550) in March 2014, site clearance, demolition of the Gateway Community Centre and the disused warehouse, remediation has been completed and land raising is currently underway. The characteristics of the wider Twyford Site have changed and is currently characterised by large flat topped mounds of material (between 4.9 and 5.4m AOD) separated by access routes through the site. The disused railway has been removed but its footprint has not been subjected to land raising. The grass covered flood defence along the eastern boundary has been left in situ, although there is a green protec mesh fence along the top of it to stop people entering into the construction site. The ditch at the toe of the flood defences is also still present and surrounded by grass.

2.4. Access to the Site

2.4.1. Located close to the A249, the Site is well connected to the national highways network. The A249 is accessed from the Site via the wider Twyford Site, Rushenden Road and Thomsett Way. The nearest railway station is within Queenborough approximately 735m to the north-east while the nearest bus stops are along Rushenden Road outside of the wider Twyford Site.

Pedestrian Links

2.4.2. Public Right of Way (PRoW) ZB49 passes through the Site and the wider Twyford Site as it follows the disused railway line connecting Rushenden Road with a small number of properties on the western side of Rushenden Hill overlooking the Swale as illustrated in **Figure 2.1**.

2.4.3. PRoW ZB48 passes through the Site and wider Twyford Site as illustrated in **Figure 2.1**. It starts at the junction between Chalk Wharf Road and Rushenden Road. It follows Chalk Wharf Road between the Twyford Site and Klondyke Site to the western extent of the road and the flood defences where it turns to the south-west to follow along the top of the flood defences to then follow the banks of the Swale around to Coal Washer's Wharf, which is west of Rushenden. Officially the definitive route of Public Footpath ZB48 is around the Klondyke Industrial Estate rather than along Chalk Wharf Road, however the official route has not been accessible for many years leading to the permissive route along Chalk Wharf Road.

3.0 THE TWYFORD PUMPING STATION AND CONSTRUCTION PROGRAMME

3.1. Introduction

3.1.1. This chapter presents a description of the physical characteristics of the Twyford Pumping Station (including the land use requirements during the construction and operational phases). The Twyford Pumping Station will replace the previously proposed works within the Site to open up the culverted section of the watercourse that flows through the Twyford Site and its surrounding raised land that was originally proposed within planning application (SW/13/1550). This chapter also provides a description of the construction activities and intended construction programme.

3.2. Description of the Twyford Pumping Station

3.2.1. The Twyford Pumping Station is shown on **Figure 3.1**. The outline design of the pumping station complex and associated drainage ditches were produced by CampbellReith in 2018. The design was subsequently agreed with the Lower Medway Internal Drainage Board (LMIDB) on 12th June 2019[6]. In summary the new pumping station will comprise:

- Pumping station complex with associated rising and gravity main discharging through an existing Environment Agency earth flood embankment to the Swale Estuary;
- New electrical connection to nearby below ground high-voltage cabling (11 kV) that will cross the proposed rising main;
- New drainage ditch/pond;
- Removal of existing 975mm culvert connecting the existing drainage ditches that are below the disused railway corridor and replacement with two offset 1,200 mm pipes with headwall and safety rail;
- Landscaping of sloping drainage ditches/pond;
- Provision of 8m access strip around the pumping station and drainage ditch/pond to facilitate future maintenance, or which 4m will be grassed and 4m will be of granular surface; and
- Security/maintenance gates and fencing to prevent unauthorised access to pumping station and potentially security gates at the site boundary.

3.2.2. The Twyford Pumping Station will discharge into the Swale at a rate of 400 l/s.

3.2.3. In the short to medium term the LMIDB will be responsible for the pumping station, however, in the longer term the pumping station is proposed to be adopted by Southern Water as more residential development comes forward as part of the Queenborough and Rushenden regeneration.

Access

3.2.4. Vehicular access to the Twyford Pumping Station during operation will only be required for occasional site inspections. Therefore, access to the Site will be from A249 via Thomsett and

[6] Letter ref: L8 MW Cons

CONTROL KIOSK
ACCESS GATE
PROPOSED MANHOLE
PROPOSED GRAVITY OUTFALL (1:40 - 450ø)
PROPOSED HEADWALL WITH FLAP AND VALVE
PROPOSED RISING MAIN (300ø)
ACCESS GATE
PROPOSED PUMPING STATION WET WELL AND VALVE CHAMBER
INLET PIPE & SLOPED GRILLE SET IN SHEET PILE WALL ACROSS WIDTH OF DITCH
HEADWALL WITH SAFETY RAIL
PROPOSED 2 No. 1.2mø OFFSET PIPES
PROPOSED MAINTENANCE GATES 6M WIDE

PHASE 1B LAND RAISE

HOMES ENGLAND'S RIGHT OF ACCESS

PHASE 1 DEVELOPMENT (NELSON VUE BY KEEPMOAT)

Legend

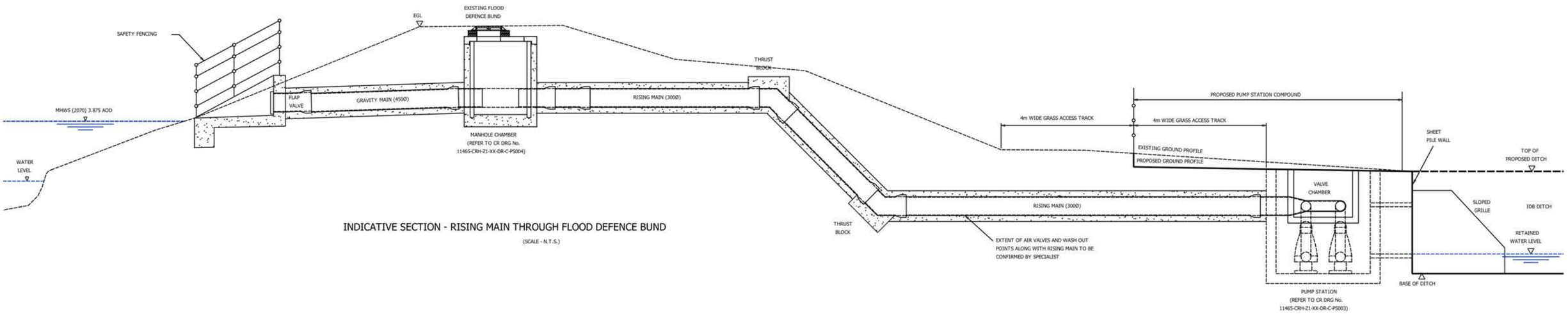
- Twyford Pumping Station Boundary
- Base of Surface Water Ditch
- Graded Slope / Bank (Geogrid Reinforcement required for 1:1 Grade Embankment)
- Type 6F1 Granular Surface (4m Width)
- Grass Surface (4m Width)
- Highways England's Right of Access
- Proposed Rising Main
- Proposed Gate and Fencing
- Existing HV Electrical Cable

Landscaping Notes
Slopes to surface water ditch are to be at a 1 in 2 grade. Suitable material to be used in areas where slopes are above existing ground level. Where slope grades within existing ground cannot be achieved, suitable slope reinforcement to be used

Slopes to surface water ditch are to be seeded. Seed mixes and percentage of mix to comprise of:

Dactylus Glomerata - 25%
Lolium Perenne - 20%
Holcus Lanatus - 5%
Phelum Pratense - 25%
Argrostis Stoloniferous - 5%
Alopecurus Geniculatus - 3%
POA Trivalis - 3%
POA Pratensis - 12%
Anthoxanthum Odoratum - 2%

0 10 20 30 40 m



INDICATIVE SECTION - RISING MAIN THROUGH FLOOD DEFENCE BUND

(SCALE - N.T.S.)

Queenborough and Rushenden

Client: Homes England

Figure 3.1:
Twyford Pumping Station

Scale: 1:1000@A3

11465-CRH-Z1-XX-DR-C-PS001_S4_P1 (May 2019)
Job Number: 11465
Drawn by - Checked by: RP - MC
Drg No - Status/Revision: GIS250 - B
File location: N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\Environmental Report (pdf in Outputs)
Date (Revision History): 23/03/2021 (A, First Issue, 01/03/21, RP; B, Boundary Update, 23/03/21)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

Way and Rushenden Road and the wider Twyford Site. Space to park vehicles will be provided on the Site to allow for vehicles used during inspections and other authorised activities.

3.2.5. The sections of Public Footpaths ZB49 and ZB48 that currently traverse the Site will be fully re-opened post-construction.

Landscaping

3.2.6. The landscaping works and ongoing maintenance associated with the Twyford Pumping Station will be carried out in accordance with the Ecology and Landscape Management Plan (**Appendix 2**). The slopes to the surface water ditch will be seeded with a grass mix which includes:

- Cock's-foot *Dactylus glomerata* (25%);
- Perennial ryegrass *Lolium perenne* (20%);
- Yorkshire fog *Holcus lanatus* (5%);
- Timothy-grass *Phelum pratense* (25%);
- Creeping bent grass *Agrostis stoloniferous* (5%);
- Marsh foxtail *Alopecurus geniculatus* (3%);
- Rough blue grass *Poa trivalis* (3%);
- Blue grass *Poa pratensis* (12%); and
- Sweet vernal grass *Anthoxanthum odoratum* (2%).

Sustainable Drainage Measures

3.2.7. Sustainable Drainage Systems (SuDS) will be used to reduce flood risk, improve water quality, assist groundwater recharge whilst also providing amenity and wildlife benefits. The existing culvert that runs beneath the Site will be replaced by a new culvert and pond (**Figure 3.1**). In addition, to the main works described above within the Site, the drainage ditch along the southern and western edges of the wider Twyford Site will be retained and maintained in its current state until the wider Twyford Site is developed.

Lighting

3.2.8. The Twyford Pumping Station will not be lit at night during operation, and therefore lighting has not been described or discussed further in this report.

Waste Management

3.2.9. During operation, no significant levels of waste will be produced within the Site as there will only be occasional access required for site inspections and other authorised activities and any waste produced during the visits will be removed at the time. Therefore, during operational waste has not been described or discussed further in this report.

3.3. Construction Methodology and Programme

Anticipated Programme

3.3.1. Construction of the Twyford Pumping Station is programmed to commence in summer 2021 and take approximately 6 months to complete.

Anticipated Construction Methodology

Construction Machinery

3.3.2. Consideration has been given to the types of plant that are likely to be used during the construction works. The plant and equipment likely to be used includes:

- Tracked/wheeled 360 degree excavators;
- Low noise/vibration piling equipment;
- Dumpers;
- Eight-wheeler trucks;
- Air compressors;
- Hand held tools including breakers (pneumatic and hydraulic);
- Power tools including percussion drills, cutting disks, pipe-threaders;
- Hand/power tools;
- Wheel washing plant;
- Delivery trucks; and
- Skips and skip trucks.

Outline Construction Methodology

3.3.3. The construction activities will be carried out in accordance with the Construction Environmental Management Plan (CEMP) presented in **Appendix 1**.

Enabling Works and Site Preparation

3.3.4. Enabling works and site preparation will involve:

- Construction of a temporary construction compound which will contain temporary offices and welfare facilities for management and construction work;
- Construction of temporary access points for construction vehicles;
- Erection of site hoarding around the Site which will be a minimum height of 1.8m;
- Translocation of reptiles from the Site to Harty Marshes Reptile Receptor Site Extension (see **Appendix 3**); and
- Installation of temporary surface water management measures for construction.

3.3.5. The following environmental advance and enabling works will also be undertaken during this phase:

- An application for an Environmental Permit will be submitted to the Environment Agency prior to any works affecting the watercourse or the Swale flood defences;
- An application for temporary closure of the sections of public footpaths ZB48 and ZB49 where they pass through the Site under the Road Traffic Act;
- General vegetation clearance within the Site; and

- Removal of the topsoil which is being temporarily stored on the Site and re-profiling of the land to create the new ground levels associated with the pond and the surrounding access track.

Earthworks and Construction of the Pumping Station, Pond and Access Track

3.3.6. The construction of the pumping station, pond and access track will involve the following general sequence:

- Excavation of the flood bund to facilitate the construction of the rising main and gravity outfall and associated headwall with flap valve and access chamber on the crest of the flood bund. The flood bund will be reinstated in accordance with conditions of the Environmental Permit. This work should be completed during the summer months to minimise flood risk;
- Construction of the new pumping station compound with associated pumps, wet well, control kiosk and security fencing;
- Connection of the new pond (in part), pumping station with rising main/ gravity outfall and install the two new 1,200 mm diameter offset pipes and outfall headwall whilst still maintaining flow to the existing culvert, drainage ditch and pumping station. At this point the new pumping station will be live during the construction process such that if required it can pump water into the Swale Estuary;
- Excavation of the remaining pond area including the removal and blocking up of the ends of the existing pipe culvert. This work will be undertaken during the summer months when surface water levels in the drainage ditches are at their lowest to mitigate any potential surface water flood risk. Emergency pumps (size of which will need to be agreed with the Regulators including the Environment Agency) will be on standby in a heavy rainfall even such that water can be pumped into the Swale if required. A flood emergency plan will be required; and
- Completion of landscaping, construction of access/ maintenance track/ loop with security gates and fencing.

Landscaping

3.3.7. The main planting and landscaping works will occur during the first main planting season after construction of the pumping station, pond and access track.

Hours of Work

3.3.8. It is anticipated that the working hours for construction activities audible at the Site boundary will be:

- 08:00-18:00 Monday to Friday; and
- 08:00-13:00 Saturday.

3.3.9. These hours will be agreed with Swale Borough Council (SBC) prior to construction commencing. All work outside these hours will be subject to prior agreement, and/or reasonable notice by SBC, who may impose certain restrictions and will have regard to planning conditions attached to any grant of permission. It is not envisaged that any work will be required during night time or bank holidays.

Material and Resource Use

3.3.10. The pumping station will be constructed in part from concrete, while the access track will be 4m wide and made from compacted type 6F1 granular surface. The track edges will be blended into the surrounding ground by haunching surplus spoil.

3.3.11. Where practicable, materials and resources used during the construction of the Twyford Pumping Station will be sourced from the local area. In terms of material selection, 'A' rated materials from the Building Research Establishment's Green Guide to Specification[7] will be preferred.

3.3.12. Any excess material from the Site will be removed and used locally as part of the land raise on the surrounding Twyford, Klondyke or Former Steel Rolling Mill Sites.

Management of Sub-Contractors

3.3.13. Individual contracts (for waste removal) will incorporate relevant requirements in respect of environmental control, based largely on the standard of 'good working practice' as well as statutory requirements. Sub-contractors will be required to demonstrate how they will achieve best practice, how targets will be met and how potential effects will be minimised.

Management of Construction Works

3.3.14. There will be a designated liaison officer employed by the Applicant who will deal with the public as well as other complaints and enquiries. The nominated individual will be named at the site entrance, with a contact number and will be identified to SBC and community groups, prior to the start of site activities, and whenever a change in responsibility occurs.

Prior Notice

3.3.15. In the event of unusual activities or events that can be anticipated, SBC and the relevant property owners, occupies and neighbours will be notified whenever possible, in advance of the activity.

Construction Phase Vehicle Movements and Access

3.3.16. There will be on average 10-20 vehicle movements a day, including HGVs, travelling to and from the Site over the six month long construction programme.

3.3.17. The main access to the Site by road will be from the A249 via Thomsett Way and Rushenden Road through the wider Twyford Site. No unauthorised vehicles associated with the construction of the Twyford Pumping Station will travel through the centre of Queenborough to access the Site.

3.3.18. Whilst no long-term road closures are envisaged, short term closures may be required to establish and remove large items of plant. If abnormal or oversized loads are required to deliver materials or plant to the Site, notice will be given to SBC, Kent County Council (KCC), the Police, the Fire Brigade and other emergency services, sufficiently in advance of the required closure or diversion dates.

3.3.19. To minimise the numbers of construction vehicles using the public highway, the following factors will be considered:

- Re-use and recycling of construction materials;

[7] Building Research Establishment (2002) Green Guide to Specification

- Control of wastage;
- Description of permitted routes for transit of materials, avoiding sensitive areas;
- Shared materials delivery opportunities;
- On-demand ordering;
- Phased delivery times throughout the working day;
- Car sharing for operatives;
- All construction traffic entering or leaving the Site will be closely controlled and will travel via designated routes which will have previously been agreed with SBC, KCC and other relevant authorities and bodies prior to construction commencing;
- Site operatives will be encouraged to car share if transport is not provided by the employer. Car parking arrangements for site operatives within or adjacent to the Site will be enforced to avoid uncontrolled parking on public highways; and
- Controls to Protect the Environment.

3.4. Embedded Mitigation

3.4.1. The following section provides a summary of the mitigation measures that will be embedded into the construction and/or operation of the Twyford Pumping Station. These are in addition to the integral design measures of the Twyford Pumping Station described earlier in the chapter.

3.4.2. Some of the embedded mitigation measures described below are standard best practice which will be routinely incorporated into the Twyford Pumping Station or any similar construction projects in the UK.

3.4.3. The embedded mitigation will be in place from the outset, as it is mitigation without which the Twyford Pumping Station is unlikely to be granted consent or allowed to commence. Therefore, all these measures have been assumed to be fully and effectively implemented in the assessment of likely effects in each of the technical chapters in this report.

Construction

Construction Environmental Management Plan

3.4.4. During construction of the Proposed Development, a Construction Environmental Management Plan (CEMP) will be implemented. The outline CEMP provided in **Appendix 1** sets out the methods of managing environmental issues for all involved with construction works, including supply chain management. The document is designed to be adopted and completed by the Contractor once appointed. The completed document will include a Construction Traffic Management Plan.

Protection of Construction and Maintenance Workers

3.4.5. Health and safety documentation will be prepared and measures will be taken to ensure worker safety and public and environmental amenity are fully compliant with the Health and Safety at Work etc. Act[8], Construction (Design and Management) Regulations[9], Environmental Protection

[8] The Health and Safety at Work etc Act 1974
[9] Construction (Design and Management) Regulations 2015

Act and Control of Hazardous Substances Regulations[10]. The design for working protocols will be in general accordance with HSE publication HS(G) 66[11] and CIRIA Report 132[12], and include measures to prevent off-site nuisances (such as dust) occurring. Health and safety policy and method statements will be submitted to the Local Planning Authority for approval prior to the commencement of works, including coverage of the following matters:

- Activities involving a health and safety risk as a result of on-site contamination (e.g. removal of asbestos);
- Programme, method statements and risk assessments;
- Site rules and health and welfare arrangements;
- Personal protective equipment (PPE) and first aid provisions, emergency procedures and emergency telephone numbers; and
- Training.

Drainage Strategy

3.4.6. Surface water drainage during construction will be controlled and discharge arrangements will be agreed with the Environment Agency and KCC or in the case of discharge to sewers, Southern Water. In addition, any risk will be reduced by adopting good management practices.

3.4.7. All liquids and solids of a potentially hazardous nature (for example diesel fuel, oils and solvents) will be stored on surfaced areas, with bunding, to the satisfaction of the Environment Agency.

Operation

Storage of Hazardous Substances

3.4.8. Storage of hazardous substances during operation will be guided by industry best practice and relevant guidance which will include the use of Material Safety Data Sheets (MSDSs) and appropriate containers/storage methods.

[10] Control of Substances Hazardous to Health Regulations 2002
[11] Health and Safety Executive (September 1991) Protection of Workers and the General Public During Development of Contaminated Land
[12] Construction Industry Research and Information Association (January 1996) CIRIA Report 132 – A Guide for Safe Working on Contaminated Sites

4.0 BIODIVERSITY

4.1. Introduction

4.1.1. This chapter assesses the likely significant effects of the Twyford Pumping Station in terms of biodiversity. It is supported by **Appendices 4 and 5**.

4.1.2. The chapter describes: the assessment methodology; the baseline conditions at the Site and in the surrounding area; the likely significant environmental effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; the likely residual effects after these measures have been employed.

4.2. Legislation and Planning Policy

Legislation

4.2.1. A range of habitats and species are afforded legal protection under international and national legislation. The main legislation affording protection to flora and fauna relevant to this assessment are:

- Ramsar Convention[13] which covers all aspects of wetland conservation and wise use. The Convention has three main 'pillars' of activity: the designation of wetlands of international importance as Ramsar Sites; the promotion of the wise use of all wetlands in each country; and international co-operation with other countries to further the wise use of wetlands and their resources;
- The Conservation of Habitats and Species Regulations 2017 (as amended)[14] transpose the European Community Directive 92/43/EEC on the 'conservation of natural habitats and of wild fauna and flora' (The Habitats Directive)[15] into English and Welsh law[16]. Sites that have been designated under The Conservation of Habitats and Species or Directive 2009/147/EEC (The Birds Directive) encompass Special Areas of Conservation (SAC) and Special Protection Areas (SPAs). Under UK planning policy, Ramsar Sites are treated in the same way as SACs and SPAs. Specific protections for animal and plant species in England and Wales which are considered to be of European Community Importance ('European Protected Species') are listed in Schedules 2 and 5 of The Conservation of Habitats and Species Regulations 2017 (as amended) respectively;
- Wildlife and Countryside Act 1981 (as amended)[17] which identified protected sites and species of flora and fauna including all bats, reptiles, all wild birds and some species of invertebrates;
- Countryside and Rights of Way Act 2000[18] which modifies some offences under the Wildlife and Countryside Act 1981 including prohibiting reckless acts that result in the killing or injuring of protected species; and

[13] www.ramsar.org
[14] The Conservation of Habitats and Species Regulations 2017 (as amended). SI 1012
[15] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.
[16] The EIA Regulations, being 'EU-derived domestic legislation' (i.e. originally made under section 2(2) European Communities Act 1972 ('ECA')), continue in force notwithstanding the repeal of European Communities Act 1972 by virtue of section 2 of the European Union (Withdrawal) Act 2018. In terms of the EIA Directive, section 3 of the European Union (Withdrawal) Act 2018 only incorporates 'direct EU legislation' into UK law as 'retained EU law', which excludes any directive.
[17] The Wildlife and Countryside Act 1981 (as amended)

- Natural Environment and Rural Communities (NERC) Act 2006 [19] which places an obligation on Local Planning Authorities for the material consideration of species of principal conservation importance, which are listed in Section 41 of the Act.

Planning Policy Context

The National Planning Policy Framework (NPPF)[20]

4.2.2. The Government published the NPPF in June 2018 which provides guidance to Local Planning Authorities when developing planning policies and when considering planning applications affecting protected habitats, sites and species.

4.2.3. In respect of the natural environment, Section 15, Paragraph 170 of the NPPF states that:

'Planning polices 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 impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures; …'

4.2.4. This is followed up in Paragraphs 174 and 175 which state 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 re-creation of priority habitats, ecological networks and the protection and recovery of priority species populations, linked to national and local targets, and identify suitable indicators for monitoring biodiversity in the plan; …'

'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

[18] Countryside and Rights of Way Act 2000
[19] Natural Environment and Rural Communities (NERC) Act 2006
[20] Ministry of Housing, Communities and Local Government (June 2019) National Planning Policy Framework

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; …

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

Planning Practice Guidance: Natural Environment[21]

4.2.5. The Planning Practice Guidance on the Natural Environment is divided into four parts: agricultural land, soil and brownfield land of environmental value; green infrastructure; biodiversity, geodiversity and ecosystems; and landscape. The sections of biodiversity, geodiversity and ecosystems and green infrastructure acknowledge that Section 40 of the NERC Act places a duty on all public authorities in England and Wales to have regard, in the exercise of their functions, to the purpose of conserving biodiversity. It also notes that the NPPF is clear that pursuing sustainable development includes moving from a net loss of biodiversity to achieving net gains for nature, and that a core principle for planning is that it should contribute to conserving and enhancing the natural environment and reducing pollution.

Local Planning Policy

Bearing Fruits 2031: The Swale Borough Local Plan 2017[22]

4.2.6. SBC adopted Bearing Fruits 2031: The Swale Borough Local Plan in 2017. It set out the vision and overall development strategy for the area and how it will be achieved for the period from 2014-2031. It identifies where development will take place and how the natural environment and built heritage of the Borough will be protected and enhanced. The policy relevant to this assessment is Policy CP 7 Conserving and enhancing the natural environment – providing for green infrastructure which states:

'The Council will work with partners and developers to ensure the protection, enhancement and delivery, as appropriate, of the Swale natural assets and green infrastructure network and its associated strategy. Development proposals will, as appropriate:

1. Recognise and value ecosystems for the wider services they provide, such as for food, water, flood mitigation, disease control, recreation, health and well-being;

2. Protect the integrity of the existing green infrastructure network as illustrated by the Natural Assets and Green Infrastructure Strategy Map, having regard to the status of those designated for their importance as set out by Policy DM24 and Policy DM28;

3. Where assessment indicates that it is necessary to enhance and extend the network (including when management, mitigation and/or compensatory actions are required to address adverse harm), be guided by the Green Infrastructure Network and Strategy Map, prioritising actions toward identified Biodiversity Opportunity Areas;

[21] Ministry of Housing, Communities and Local Government (July 2019) National Planning Practice Guidance: Natural Environment
[22] Swale Borough Council (July 2017) Bearing Fruits 2031: The Swale Borough Local Plan

4. *Ensure that there is no adverse effect on the integrity of a SAC, SPA or Ramsar site, alone or in combination with other plan and projects, as it would not be in accordance with the aims and objectives of this Local Plan;*
5. *Require the completion of project specific Habitats Regulations Assessment, in accordance with Policy DM28, to ensure there are no likely significant effects upon any European designated site. For residential sites within 6km of an access point to any of the North Kent Marshes, development must contribute to its Strategic Access Management and Monitoring Strategy;*
6. *Contribute to the objectives of the Nature Partnerships and Nature Improvement Areas in Kent;*
7. *Make the enhancement of biodiversity and landscape as their primary purpose;*
8. *Promote the expansion of Swale's natural assets and green infrastructure, including within new and existing developments, by:*
    a. *delivering a high standard of design quality to maximise the social, economic, health and environmental benefits of green infrastructure;*
    b. *providing a focus for social inclusion, community development and lifelong learning;*
    c. *taking into account the guidelines and recommendations of relevant management plans and guidance, Biodiversity Action Plans and Supplementary Planning Documents;*
    b. *contributing to the protection, conservation and management of historic landscapes, archaeological and built heritage assets;*
    a. *achieving, where possible, a net gain of biodiversity;*
    b. *providing new recreational facilities in accordance with Policy DM17, exploiting opportunities to link urban and countryside areas and to create new footpath and cycle links;*
    c. *taking account of and integrating with natural processes, such as flood risk and utilising sustainable urban drainage; and*
    d. *including proposals to 'green' existing and proposed developed areas by increasing opportunities for nature in domestic gardens, streets and buildings, including street trees and in and around formal open spaces and sports provision.'*

Swale Local Plan Review 2021[23]

4.2.7. Swale Borough Council is currently carrying out a Regulation 19 consultation between the 8th February and 30th April 2021. The consultation is in regards to a review which sets out the amount and location of new housing and employment and the planning policies to guide development in the borough for the period 2022 to 2038. Policy DM 24 Biodiversity and Geodiversity Conservation and Biodiversity net Gain states:

[23] Swale Borough Council (February 2021) Local Plan Review 2021. Pre-Submission Document (Regulation 19)

'Part A – For designated sites

Development proposals which have a direct or indirect effect on designated sites, as shown on the Proposals Map, will conserve and enhance them in a manner equal to the significance of their biodiversity and geodiversity status as follows:

1. *Within internationally designated sites (including candidate sites), the highest level of protection will apply. The Council will ensure that development proposals only proceed when in accordance with relevant Directives, Conventions and Regulations. Where the proposed development will have an adverse effect on the integrity of a European site, planning permission will only be granted in exceptional circumstances, where there are no less ecologically damaging alternatives, there are imperative reasons of overriding public interest and where the damage can be fully compensated.*
2. *Within nationally designated sites (including candidate sites) development will only be permitted where it is not likely to have adverse effect on the site or its interests unless the benefits clearly outweigh both the impacts it is likely to have on the features of the site and the wider environmental network of sites.*
3. *Within locally designated sites (including candidate sites) development likely to have an adverse effect will only be permitted where the damage can be avoided or adequately mitigated or when its need outweighs the ecological interest of the site. Compensation will be sought for loss or damage to locally designated sites.*

Part B – For all sites

Development proposals will:

1. *Apply national planning policy in respect of the conservation and enhancement of:*
    a) *the habitats, species and targets in UK and local Biodiversity Action Plans and Biodiversity Strategies;*
    b) *linear and continuous landscape features or those acting as stepping-stones for biodiversity; and The Swale Local Plan Review February 2021 175 Development management policies 7*
    c) *aged or veteran trees and irreplaceable habitat, including ancient woodland and traditional orchards.*
2. *Be informed by, and further the guidelines and biodiversity network potential of The Swale Landscape Character and Biodiversity Appraisal (2011), which can be accessed in two parts - Part 1 and Part 2;*
3. *Support, where appropriate, the vision and objectives of the relevant environmental and biodiversity management and action plans;*
4. *Be accompanied by appropriate surveys undertaken to clarify constraints or requirements that may apply to development, especially where it is known or likely that the development sites are used by species and/or contain habitats that are subject to UK or European law;*
5. *When significant harm cannot be avoided through consideration of alternative sites or adequate mitigated provided on-site or within the immediate locality, compensatory*

measures will be achieved within the relevant Biodiversity Opportunity Area, or other location as agreed by the Council;

6. *Unless exempt, provide a minimum 20% net gain in biodiversity against a pre-development baseline; and*

7. *Actively promote the expansion of biodiversity within the design of new development and with reference to the Green and Blue Infrastructure Strategy in Policy ST 10.'*

Agenda 21

4.2.8. Sustainable development is central to current and future UK and local government environmental policies (UK Government, 1994)[24]. Of particular relevance are Agenda 21 and the Convention on Biological Diversity (Biodiversity), both a result of the Rio Earth Summit, to which the UK government is a signatory.

4.2.9. Agenda 21 is the process of developing local policies for sustainable development and biodiversity, the maintenance and enhancement of ecosystems, habitats, plant and animal species, and is a key component in achieving this. Both Agenda 21 and Biodiversity are implemented through local plans (e.g. Biodiversity Action Plans) and policies.

Biodiversity Action Plans

4.2.10. The national Biodiversity Action Plan or UKBAP (UK Steering Group, 1995)[25] lists and prioritises habitats and species and sets national targets to be achieved. Species of principal importance for conservation of biological diversity in England are currently listed under Section 41 of the NERC Act. The intent of the Biodiversity Convention, however, is much broader than the protection and enhancement of less common species and habitats and is also meant to embrace the wider countryside.

4.2.11. Implementation of the national action plans is to be achieved at the regional and local level through Local Biodiversity Action Plans (LBAP). In addition to the UKBAP, consideration is therefore given to the potential effects of development on the conservation priorities and targets within the Northamptonshire Biodiversity Action Plan[26].

Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services[27]

4.2.12. Biodiversity 2020: A strategy for England's Wildlife and Ecosystem Services aims to guide the current conservation effects in England. The mission for the strategy is:

'To halt overall biodiversity loss, support healthy well-functioning ecosystems and establish coherent ecological networks, with more and better places for nature for the benefit of wildlife and people.'

4.2.13. The outcomes will be delivered through action in four areas:

- *'A more integrated large-scale approach to conservation on land and at sea;*
- *Putting people at the heart of biodiversity policy;*

[24] UK Government (1994) UK Action Plan on Biodiversity
[25] UK Steering Group (1995) Biodiversity: the UK Steering Group Report Volume 2: Action Plans (Tranche 1 Species and Habitat Action Plans)'
[26] http://www.northamptonshirebiodiversity.org/
[27] Department for Environment, Food and Rural Affairs (August 2011) Biodiversity 2020: A strategy for England's wildlife and ecosystem services

- *Reducing environmental pressures; and*
- *Improving our knowledge.'*

4.3. Assessment Methodology and Significance Criteria

4.3.1. The approach adopted for the EcIA broadly follows the Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Coastal and Marine published by the Chartered Institute of Ecological and Environmental Management (CIEEM) in September 2019[28].

Desk Study

4.3.2. A desk study was undertaken to identify any statutory and non-statutory protected sites and species between 1km and 5km of the Site depending on the species. A summary of the organisations and websites that were contacted or searched and the data obtained area provided in **Table 4.1.**

Table 4.1: Summary of Desk-Study Information

Organisation/website	Information obtained
Multi-Agency Geographic Information for the Countryside (MAGIC) website	Statutory designated sites of nature conservation importance.
Joint Nature Conservation Committee (JNCC) website	Citation sheets for international statutory designated sites
Natural England website	Citation sheets for national statutory designated sites.
Kent and Medway Biodiversity Records Centre	Non-statutory designated sites for nature conservation importance (obtained January 2021) Records of protected/notable species and Schedule 9 species.
British Trust for Ornithology (BTO)	Wetland bird survey data (WeBS) (obtained January 2021).

4.3.3. Information obtained during a desk study is dependent upon people and organisations having made and submitted records for the area of interest. As such, a lack of records for a particular species does not automatically mean that such species do not occur within the study area. Likewise, the presence of records for protected species does not automatically mean that these species still occur within the area of interest or are relevant in the context of the Twyford Pumping Station. However, a desk study helps characterise the baseline conditions, provides context, and can provide valuable background information that would not be gathered on a site visit alone.

Study Area

4.3.4. The study area is based on the likely extent of any impacts from the Twyford Pumping Station (considering both the nature/source of the impact and any pathways by which those impacts could affect ecological features), and the nature and mobility of the potential features themselves, which is often referred to as the zone of influence (CIEEM, 2019). The zone of influence is not a rigid limit, and different ecological features (i.e. species) have the potential to be affected at different distances from any particular impact. Consequently, a discretionary approach has been adopted for ecological features outside the general study area. Within the

[28] Chartered Institute of Ecology and Environmental Management (September 2019) Guidelines for Ecological Impact Assessment in the UK and Ireland, Terrestrial, Freshwater and Coastal. Version 1.1.

general study area (which includes the desk-based assessment area) are the desk-study and survey areas for habitats, bats, birds and reptiles within the Site.

Limitations and Assumptions

4.3.5. The limitations associated with the surveys have been discussed within the technical reports.

4.3.6. The following principal assumptions have been made during the EcIA:

- Unless otherwise specified, all distances within this report relate to the shortest distance between two described points. For example, the distance between the Site and a designated site is presented as the linear ('as the crow flies') distance between the two closest points on their boundaries; and
- All botanical nomenclature in this document follows that described in Stace's New Flora of the British Isles[29]. In general, for all species, scientific species names are provided at the first reference of that species within the chapter, together with its vernacular name. Thereafter, the species is referred to using only its common name.

Field Survey Methodology

4.3.7. The scope of the surveys undertaken to inform this assessment and the respective methodologies adopted are summarised in the paragraphs below.

Ecological Appraisal

4.3.8. An ecological appraisal of the Site and wider Twyford Site was carried in September and October 2013 to inform the Twyford and Klondyke Sites' planning application. The scope of the survey focused on the and within and immediately adjacent to the Twyford and Klondyke Sites boundaries. The presence of notable or invasive plant species was recorded where seasonal survey constraints allowed. The ecological appraisal was supplemented by the conclusions within Queenborough Extended Phase 1 Habitat Report (Keystone Environmental, March 2010)[30] which focuses on the Twyford Site.

4.3.9. A second preliminary ecological appraisal focused on the Site was carried out by Lloydbore on the 2nd March 2021 which recorded the habitats present on Site along with any potential fauna populations associated with the habitats[31] (**Appendix 4**).

Botanical Survey

4.3.10. A botanical survey was undertaken on 4th and 9th of September and 22nd October 2013 to record the habitat types and the presence and potential of particular species associated with the Medway Estuary and Marshes SSSI, SPA and Ramsar Site within the Twyford and Klondyke Sites (encompassing the Site). During the surveys each of the habitat types, including grassland, ditches, creek, tree-lines, disturbed ground and areas of damaged hardstanding were examined. A thorough search of the different habitat stands was undertaken to ascertain the species composition and determine the habitat type.

4.3.11. The Saltings in the north of the Klondyke Site was the most extensive area of vegetation identified and it encompassed brackish creek-side vegetation and dry grassland. The majority

[29] Stace (2010) Stace's New Flora of the British Isles
[30] Keystone Environmental (March 2010) Queenborough Extended Phase 1 Habitat Report
[31] Lloydbore (March 2021) Queenborough and Rushenden – Tywford Pumping Station, Ecological Impact Assessment

of survey effort concentrated on this area and the area of vegetation along the flood defences adjacent to the west of the Twyford Site.

4.3.12. The majority of the Twyford Site comprises hard standing of little botanical interest so this area was included in the walkover survey alone.

Bird Surveys

4.3.13. Bird surveys were carried out over a 12 month period between 2013 and 2014 and included an assessment of breeding, wintering and passage birds. The surveys focused on the Twyford and Klondyke Sites and their surrounding areas.

4.3.14. The zone of potential impact of the Twyford and Klondyke Sites on birds on the mudflats within the Swale has been identified as extending up to 500m from the western Site boundary. Therefore, the bird surveys were conducted from Public Footpath ZB48 on top of the flood defences along the western boundary of the Twyford Site and towards Coal Washer's Wharf which provides reasonably good views over the mudflats up to and beyond the 500m zone of potential impact. These vantage points provided the opportunity to look into the Twyford Site (including the Site) to check for use in this area by waders and wildfowl. The surveys also included a visit to the quayside on the north side of the Creek in Queenborough to record the record the presence of birds in this location.

4.3.15. The surveys were carried out for a mixture of high and low tides. The high tide visits were programmed for 1 hour before high tide until 2 hours after high tide while the low tide visits were for the period at low tide until 2 hours after low tide.

4.3.16. The counts concentrated on the visible areas to the east of the flood defences and north and east of Public Footpath ZB48 with observations also being made over the Long Reach, to the east of Coal Washer's Wharf.

4.3.17. The area was also surveyed for breeding birds by following a 'transect' route along Public Footpath ZB48 on the flood defences where there are elevated views into the Twyford Site. The route then followed the line of the disused railway across the Twyford Site (and the Site) until turning north at Rushenden Road to follow the eastern boundary of the Twyford Site. The route then followed the access road into the Klondyke Industrial Estate and then moved to the quayside on the north site of the Creek within Queenborough. Birds were noted along the route and evidence of nesting territorial behaviour was noted.

4.3.18. Wintering bird monitoring was also undertaken during the remediation works at the Twyford Site during the winter of 2014/15 by Keystone Ecology. The surveys were to determine the degree to which the remediation works affected wintering bird assemblage associated with the adjacent Medway Estuary and Marshes SPA/Ramsar Site, with a particular focus on the qualifying species[32].

4.3.19. A barn owl survey was carried out on 19th November 2018 within the Klondyke Industrial Estate buildings prior to the demolition of the buildings[33].

[32] Keystone Environmental Limited (February 2015) Twyford, Isle of Sheppey, Wintering Bird Noise Monitoring
[33] Native Ecology (November 2018) Letter titled Klondyke Industrial Estate, Queenborough and Rushenden, Isle of Sheppey, Kent: Internal Building inspections for the presence of barn owls

Bat Surveys

4.3.20. Bat surveys have not been carried out on the Twyford Site or the Site as from 2013 onwards the sites have offered poor foraging habitat for bats as there has been little vegetation to support terrestrial invertebrates across the open area of the sites. It also has been lacking in shelter such as tree lines and hedgerows which enable bats to fly across the landscape while sheltered from strong winds and protected from predators.

4.3.21. Two evening bat surveys were carried out on the Klondyke Site on the 27th August and 3rd September 2013 from 0.25 hours before sunset to up to 2 hours after sunset and a dawn survey was carried out on the 25th September 2013 from 2 hours before sunrise until sunrise.

Reptile Survey

4.3.22. Reptiles were surveyed between 19th September and 14th October 2013 to establish whether reptile species were present and to determine the distribution and relative abundance of the population of viviparous lizards *Zootoca vivipara* and slow worm *Anguis fragilis* within the Twyford and Klondyke Sites. The surveys concentrated on areas of suitable habitat within the Twyford and Klondyke Sites which included: The Saltings; small isolated areas of vegetation within Klondyke Site; and the rough maritime grassland and improved, managed grassland along the flood defences to the west of the Twyford Site (which lie within the Site).

4.3.23. The large area of hardstanding within the Twyford Site, including the main area of the Site, was not surveyed for reptiles as the reptiles present on this area had been translocated off-site during 2012. In addition, the land within and to the south of the disused railway (including the area within the Site) was not surveyed during 2013 as it did not form part of the planning application until after the survey season had finished. However, this area of the Twyford Site had been previously surveyed for reptiles in 2010 by Keystone Ecology.

4.3.24. Ecology Solutions carried out a reptile population survey on the Klondyke Site comprising seven survey visits in September and October 2020 to get an updated understanding of the current population on the Klondyke Site.

4.3.25. No further reptile surveys have been carried out on the Twyford Site as reptiles were translocated from the Twyford Site to Reptile Receptor Site 2 (south of Rushenden) and the Harty Marshes Reptile Receptor Site between March and July 2014[34]. Since then, the vegetation within the Twyford Site has been managed during the construction activities to minimise the risk of recolonisation of the Twyford Site by viviparous lizards and slow worm.

Terrestrial Invertebrate Survey

4.3.26. An initial site visit for terrestrial invertebrates was carried out on the 1st November 2013 to identify suitable sampling areas on the grassland, within The Saltings, in the northern area of the Klondyke Site. Following this site visit three groups of pitfall traps were set down across the area and then checked on the 13th November 2013. The flood defences and Twyford Site (including the Site) were not surveyed because the habitat present was considered unlikely to support a diverse or important assemblage of invertebrates.

[34] CampbellReith (November 2014) Queenborough and Rushenden Phase 2 – Klondyke and Twyford Sites, Summary of Reptile Translocation at the Twyford Site.

4.3.27. The survey information was supplemented by the Queenborough Preliminary Invertebrate Report (Keystone Environmental, September 2010)[35]. On 3rd September 2010 the Twyford Site was walked and terrestrial invertebrate habitats were examined in detail with a view to appraising their overall potential to support rare or notable invertebrates or assemblages of invertebrates. Since this survey was undertaken the hardstanding within the Twyford Site was cleared of vegetation during the reptile translocation work apart from the grass banks of the ditch and the flood defences along the western boundary of the Twyford Site.

4.3.28. The survey in 2010 excluded the land to the south of the railway line because it is almost entirely hard standing or existing buildings and was considered unlikely to support a diverse or important assemblage of invertebrates.

4.3.29. An invertebrate habitat assessment was undertaken by Lloydbore on 1st February 2019 to provide an update assessment of the suitability of on-site habitats for important invertebrates. The survey concentrated on the area of grassland north of the boat yard and south of the Creek in The Saltings[36].

Impact Assessment Significance Criteria

4.3.30. The following paragraphs describe the EcIA methodology, including evaluation of the nature conservation of ecological features, the impacts (either direct or indirect) and the likely significance of the environmental effects.

4.3.31. The approach to EcIA is as follows:

- Habitats and species that might be affected by the Proposed Development are considered and baseline conditions are defined through a combination of desk-based study and field survey work;
- The importance of each habitat and species (that is both present and could be affected by the Proposed Development) is evaluated to place their relative biodiversity/nature conservation value, social/community value and economic value into context in terms of their international, national, regional or local level. The ecology of the habitats and species present is also considered;
- The changes or perturbations predicted to result as a consequence of the Proposed Development (i.e. impacts), which could potentially affect habitats and species are identified and their nature described. Established best-practice, legislative requirements or other incorporated embedded mitigation measures to minimise or avoid impacts are described and are taken into account;
- The likely effects (beneficial or adverse) of these impacts on species and their habitats are then assessed, and where possible quantified in terms of their extent, magnitude, duration, reversibility, timing and frequency;
- Additional measures beyond those already considered to be embedded mitigation or enabling measures to avoid or reduce any significant effects, if possible, are then developed in conjunction with other elements of the design (including mitigation for other environmental disciplines). If necessary, measures to compensate for effects on features of nature conservation importance are also included;

[35] Keystone Environmental (September 2010) Queenborough Preliminary Invertebrate Report
[36] Lloydbore (March 2019) Invertebrate Habitat Assessment Report, Klondyke Site, Queenborough & Rushenden, Kent

- Scope for enhancement is considered where applicable; and
- Any residual effects of the Proposed Development are reported.

Evaluation of Ecological Features' Importance to Nature Conservation

4.3.32. The relative importance of potential ecological features to nature conservation has been evaluated in accordance with CIEEM's guidance.

Importance of Ecological Features

4.3.33. To determine the relative importance of an ecological feature, the following characteristics have been used:

- Naturalness;
- Animals or plant species, subspecies or varieties that are rare or uncommon, either internationally, nationally or more locally, including those that may be seasonally transient;
- Ecosystems and their component parts, which provide the habitats required by important species, populations and/or assemblages;
- Endemic species or locally distinct sub-populations of a species;
- Habitat diversity;
- Habitat connectivity and/or synergistic associations;
- Habitats and species in decline;
- Rich assemblages of plants and animals;
- Large populations of species or concentrations of species considered uncommon or threatened in a wider context;
- Plant communities (and their associated animals) that are considered to be typical of important natural/semi-natural vegetation types, including examples of naturally species-poor communities; and
- Species on the edge of their range, particularly where their distribution is changing as a result of global trends and climate change.

4.3.34. The Ratcliffe Criteria[37] have also been considered. They have been developed in the UK and in most instances, have been quantified for the selection of statutory sites of national importance for nature conservation, designated as Sites of Special Scientific Interest (SSSI). A similar approach is often taken to identify the most important non-statutory sites at a county or district level. The key criteria considered are:

- Size (area of extent);
- Rarity;
- Diversity;
- Fragility;

[37] Radcliffe (1977) The Ratcliffe Criteria

- Potential value;
- Position within an ecological/geographical unit;
- 'Typicalness';
- Recorded history;
- 'Naturalness'; and
- Intrinsic appeal.

4.3.35. These criteria include measures by which both relative importance can be attributed and indications of how likely it is that the ecological feature will be affected by a change connected to construction or operation of the Proposed Development. The assignment of relative importance (i.e. categorising within a defined geographical context) is necessary before the significance of predicted effects can be assessed. The assignment of importance to a specific ecological feature requires that the assessor makes use of the relevant published evaluation criteria (where available). Where published evaluation criteria do not exist (for example, guidance for assigning importance below the county level is rarely available) it has been necessary to apply judgement, supported by a carefully reasoned argument. The categories of species importance that have been adopted for this assessment are provided in **Table 4.2**.

Table 4.2: Scales of Biodiversity Importance

Scale of Importance	Criteria	Example
International and European	High importance and rarity, international scale and limited potential for substitution	• Internationally designed sites (e.g. SACs, SPAs and Ramsar Sites, Candidate SACs, potential SPAs, proposed Ramsar Sites and biosphere reserves); • Sustainable area of a habitat listed in Annex I of the Habitats Directive[38], or smaller areas of such habitat where they are essential to maintain the viability of a larger whole; or • Sustainable population of a species listed in Annex IV of the Habitats Directive and Annex I of the Birds Directive.
National	High importance and rarity, national scale, or regional scale with limited potential for substitution	• Nationally designated sites (e.g. SSSIs and National Nature Reserves, Marine Nature Reserves, NCR Grade I Sites); • Regionally important sites with limited substitution possibilities; • Sustainable area of a priority habitat identified in the UK BAP; or • Sustainable population of a species listed on Schedules 1, 5 and 8 of the Wildlife and Countryside Act 1981, or a priority species identified in the NERC Act, of a UK Red Data book species, or of a nationally rare species (15 or fewer 10 km squares in the UK).
Regional/County	High or medium importance and rarity, local or regional scale and limited potential for substitution	• Regionally important sites with potential for substitution; • Locally designated sites (e.g. SINCs, CWS, Ancient semi-natural woodland and LNRs); or • Sustainable area of a priority habitat identified in the local BAP, or as a nationally scarce species (16-100 10

[38] Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)

Scale of Importance	Criteria	Example
		km squares in the UK.
Local	Low or medium importance and rarity, local scale	• Undesignated sites that are good examples of a more widespread habitat, or species-poor examples of a habitat of note (as described above) or of each heritage interest; or • Population of a species that is of low importance/rarity but of some value locally.
Negligible	Not applicable	• Sites, habitats and species not meeting any of the above criteria with low grade and widespread habitats.

4.3.36. The geographic frames of reference used to assess the importance of nature conservation features are outlined in **Table 4.3**.

Table 4.3: Geographic Frames of Reference for Determining the Relative Nature Conservation Importance

Geographic Frames of Reference	Geographic Area
International	European Community and wider (up to global) area
National	England
Regional	South East of England
County	Kent
Local	Site and Survey Areas

4.3.37. Where the importance of the ecological feature is considered, and then subsequently not considered to be of importance at even a local level, this is clearly stated. Such features may or may not be considered further, depending on their extent and relationship with other features.

4.3.38. Whilst there are national criteria for appraising rarity and threats to populations for different groups of species, species may be widespread or common nationally, but of scarce occurrence in a county or district context. Conversely a species may be common in a county or district context but considered to be rare nationally or internationally. Consequently, when undertaking an evaluation of a site, consideration is also given to relevant local biodiversity guidance documents such as local BAPs and the species and habitat action plans that might be derived from these.

4.3.39. Whilst the level of legislative protection afforded to a particular ecological feature is noted as part of the evaluation process, this may not have a direct bearing on the evaluation of a feature in terms of its nature conservation importance.

4.3.40. In addition to the existing importance an ecological feature represents in terms of nature conservation, the potential importance of species and habitats has also been taken into consideration where it is feasible to restore a feature to a favourable nature conservation status.

4.3.41. Secondary or supporting features of importance are also considered in this study. These are features that might not have any significant relative nature conservation importance in themselves but provide some ecological function such as acting as a buffer against negative impacts or enabling the effective conservation of a more important feature.

Prediction of Impacts and Significance of Effects

4.3.42. All potential effects on each important ecological feature were identified, using professional judgement, in relation to activities during construction and operation of the Twyford Pumping Station. Tables defining magnitude and significance categories have not been used in this assessment in accordance with the CIEEM Guidance. Instead, the magnitude or significance of each potential effect has been described using the parameters present in **Table 4.4**.

Table 4.4: Environmental Parameters that Influence the Magnitude of a Potential Impact or Significance of the Resulting Effect

Environmental Parameter	Description
Beneficial or adverse	Where the effect benefits or detracts from the net biodiversity value of the feature.
Extent	The physical extent of an impact is the area over which the impact occurs i.e. numbers of individuals affected, or area of habitat lost. The magnitude and extent of an impact may be synonymous.
Magnitude	The 'size' or 'amount' of an impact is determined on a quantitative basis where possible
Duration	The duration of an impact is the measured time interval for the activity and likely duration of effect upon the ecological feature. The following categories have been used as appropriate: temporary (short-term, medium-term) long-term, permanent – in relation to ecological characteristics e.g. species lifecycles rather than human timeframes.
Timing and frequency	Some activities or changes may only cause an adverse effect if they coincide with critical life stages or seasons, therefore timing of the activity or change is important in assessing the impact. Such effects may be avoided through careful timing of works. The frequency of an activity (impact) may also influence the resulting effect.
Reversibility	Reversible (or temporary) impacts are those that do not have a persistent or permanent nature. Reversible or temporary effects are those from which a spontaneous recovery is possible, or for which effective mitigation is possible that will allow such a recovery. Irreversible (or permanent) impacts are those that endure within the context of a specific timescale, for example extending throughout the duration of the Proposed Development's post-construction phase and potentially beyond. Irreversible (or permanent) effects include those from which recovery is not possible within a reasonable timescale, or for which there is no reasonable change of action being taken to reverse it. The effects of permanent land-take may lead to irreversible fragmentation and decline of habitats. Some indirect effects may also be irreversible or of an unspecified duration.

4.3.43. The significance of the effect resulting from impacts on ecological features associated with the Proposed Development will depend on all these factors and can relate to the integrity of ecological functioning sites or systems. The definition of 'site integrity' (as developed for use in the Habitats Regulations Assessment) is: '*the coherence of its ecological structure and function, across its whole area, that enables it to sustain that habitat, complex of habitats and/or the levels of populations of the species for which it was classified'* (Office of Deputy Prime Minister (ODPM) and Department for Environment Food and Rural Affairs (DEFRA, 2005)).

4.3.44. It is important to attribute a level of confidence by which the predicted effect has been assessed, particularly in the case where only a qualitative assessment can be made. The

criteria for these definitions are set out in **Table 4.5**. Unless otherwise stated, confidence levels are certain/near certain.

Table 4.5: Confidence Levels

Confidence Level	Description
Certain/near-certain	Probability estimated at 95% chance or higher
Probable	Probability estimated to be at or above 50% but below 95%
Unlikely	Probability estimated to be at or above 5% but less than 50%
Extremely unlikely	Probability estimated at less than 5%

Screening of a Habitats Regulations Assessment

4.3.45. **Appendix 5** provides a report to inform the screening of a Habitats Regulation Assessment in compliance with the Conservation of Habitats and Species Regulations 2017. The purpose of the report is to identify whether the Twyford Pumping Station on its own or in combination with the development on the Twyford, Klondyke and Former Steel Rolling Mill Sites will have any likely significant effects on the integrity of the Medway Estuary and Marshes SPA and Ramsar. The effect on integrity of a designated site is judged in terms of the implications of a plan on a site's 'qualifying features.'

4.3.46. The report concludes that there will not be any likely significant effects on the integrity of the SPA and Ramsar providing the following conditions/embedded design measures are implemented:

- Construction Method Statements which include best practice methods and a Construction Environmental Management Plan (**Appendix 1**) during the construction phase; and
- Lighting during construction will be of a downwards directional type, fixed in a location and directed in a manner that avoids glare being directed towards the SPA and Ramsar to reduce impacts on birds (**Appendix 1).**

4.3.47. The implementation of these embedded design measures through the Proposed Development will result in:

- No reduction of areas of key habitats;
- No significant disturbance to key species using the Swale;
- No habitat or species fragmentation;
- No reduction in species density;
- No adverse changes in key indicators of conservation value (water quality etc.);
- No climate change impacts; and
- No changes in water levels in either of the lakes.

4.3.48. In conclusion, the Proposed Development will have no adverse effect on the integrity of the SPA and Ramsar.

4.4. Baseline Conditions

Statutory Designated Sites

4.4.1. Relevant designated sites are shown on **Figure 4.1**. The Site is adjacent to the Medway Estuary and Marshes Special Protection Area (SPA), Ramsar and Site of Special Scientific Interest (SSSI).

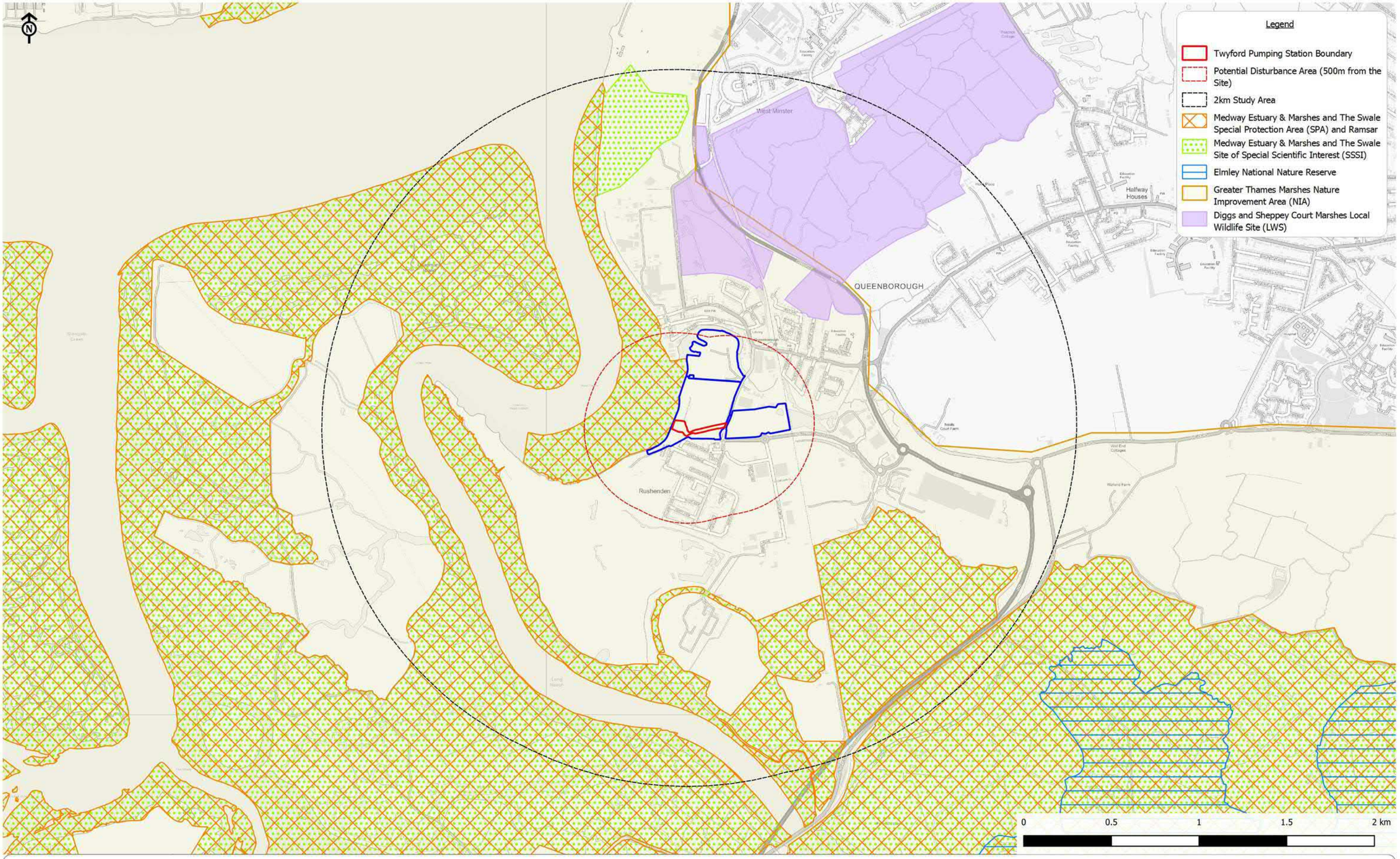
4.4.2. The Medway Estuary and Marshes lies on the south side of the outer Thames Estuary in Kent. It forms a single tidal system with the Swale and joins the Thames Estuary between the Isle of Grain and Sheerness. It has a complex arrangement of tidal channels, which drain around large islands of saltmarsh and peninsulas of grazing marsh. The mud-flats are rich in invertebrates and also support beds of *Enteromorpha* and some Eelgrass *Zostera spp*. Small shell beaches occur, particularly in the outer part of the estuary. Grazing marshes are present inside the sea walls around the estuary. Grazing marshes are present inside the sea walls around the estuary. The complex and diverse mixes of coastal habitats support internationally important numbers of waterbirds throughout the year. In summer, the estuary supports breeding waders and terns, whilst in winter it holds important numbers of geese, ducks, grebes and waders. The site is also of importance during spring and autumn migration periods, especially for waders.

4.4.3. The Medway Estuary and Marshes SPA and Ramsar are susceptible to effects resulting from:

- Water diversion for irrigation, domestic or industrial use,
- Drainage/reclamation for industry;
- Dredging;
- Erosion;
- Eutrophication;
- Recreational/tourism disturbance (unspecified); and
- Transport infrastructure development.

4.4.4. The Swale SPA, Ramsar and SSSI is designated for its extensive complex of mudflats, saltmarsh and freshwater grazing marsh, an estuarine channel, and areas of shingle, shell and sand beaches and mussel beds. The saltmarshes and mudflats support a high species diversity of plants and invertebrates, including several nationally rare species. The area is of national importance for various breeding, passage and wintering ducks and waders, and regularly supports internationally important numbers of numerous species of wintering waterbirds. It is susceptible to erosion and recreational/tourism disturbance.

4.4.5. The Thames Estuary and Marshes SPA and Ramsar and South Thames Estuary and Marshes SSSI lies 4.5km to the north-west and is separated from the Site by the Medway Estuary and Marshes SPA, Ramsar and SSSI. The Thames Estuary and Marshes SPA and Ramsar and South Thames Estuary and Marshes SSSI comprises a complex of brackish, floodplain grazing marsh ditches, saline lagoons and intertidal saltmarsh and mudflat along the River Thames between Gravesend and Sheerness in Essex and Kent. The habitats support internationally important numbers of wintering waterfowl, and the saltmarsh and grazing marsh are of international importance for their diverse assemblages of wetland plants and invertebrates. The site performs important hydrological functions, including shoreline stablization, sediment trapping, flood water



Queenborough and Rushenden

Client: Homes England

Figure 4.1:
Nature Conservation Designated Sites

Scale: 1:20000@A3

Job Number: 11465
Drawn by - Checked by: RP - MC
Drg No - Status/Revision: GIS251 - B
File location: N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\Environmental Report (pdf in Outputs)
Date (Revision History): 23/03/2021 (A, First Issue, 10/03/21, RP; B, Boundary Update, 23/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

storage and desynchronization of flood peaks, and maintenance of water quality by removal of nutrients[39].

4.4.6. The Thames Estuary and Marshes SPA qualifies under Article 4.1 of the EU Birds Directive as it supports internationally important populations of the regularly occurring Annex 1 species avocet *Recurvirostra avosetta* and hen harrier *Circus cyaneus*. This Site also qualifies as an SPA under Article 4.2 of the EU Birds Directive as it supports internationally important populations of regularly occurring migratory species including ringed plover *Charadrius hiaticula*, grey plover *Pluvialis squatarola*, dunlin *Calidris alpina*, knot *Calidris canutus*, black-tailed godwit *Limosa limosa* and redshank *Tringa tetanus*. This SPA site also supports an internationally important assemblage of waterfowl as stated in Section 4.2 of the Directive, which include gadwall *Anas strepera*, shoveler *Anas clypeata*, tufted duck *Aythya fuligula*, and pochard *Aythya fuligula*[40].

4.4.7. The Thames Estuary and Marshes Ramsar site qualifies under Criterion 2 as it supports one nationally rare and 14 nationally scarce plant species, as well as one endangered, 10 vulnerable and 12 rare invertebrate species. It also qualifies under Criterion 5 for its internationally important assemblage of waterfowl, and Criterion 6 for its internationally important numbers of over-wintering waterfowl.

4.4.8. The Thames Estuary and Marshes SPA, Ramsar and South Thames Estuary and Marshes SSSI are susceptible to effects resulting from[41]:

- Coastal squeeze and erosion of intertidal habitat within the site;
- The intertidal area is vulnerable to disturbance from water borne recreation;
- Terrestrial habitats depend on appropriate grazing and management of water; and
- Development pressure in terms of direct landtake and indirect disturbance and hydrological effects.

4.4.9. The Medway Estuary and Marshes SPA, Ramsar and SSSI have been scoped into the assessment, as it is adjacent to the Site with potential effects arising from the construction activities.

4.4.10. The Swale SPA, Ramsar and SSSI is located 1.8km from the Site and as such there will be no effects on erosion or recreational/tourism disturbance due to the nature of the Twyford Pumping Station. Furthermore, the Thames Estuary and Marshes SPA and Ramsar and South Thames Estuary and Marshes SSSI are located 4.5km to the north-west of the Site and separated from the Site by the Medway Estuary and Marshes SPA, Ramsar and SSSI and the Isle of Grain and as the Site is brownfield and will not introduce new residents the Twyford Pumping Station will not affect the designated site. Therefore, the Swale SPA, Ramsar and SSSI and Thames Estuary and Marshes SPA and Ramsar and South Thames Estuary and Marshes SSSI has been scoped out of this assessment although they are considered further in the Report to Inform the Habitats Regulations Assessment (**Appendix 5**) for completeness.

Non-Statutory Designated Sites

4.4.11. Diggs and Sheppey Court Marshes Local Wildlife Site (LWS) is located approximately 0.76 km north of the Site as shown on **Figure 4.1** and is designated for its wet grazing marsh. It

[39] Thames Estuary and Marshes | Ramsar Sites Information Service
[40] UK9012021.pdf (jncc.gov.uk)
[41] Thames Estuary and Marshes SPA - UK9012021A (naturalengland.org.uk)

comprises a large area of sheep and cattle-grazed pastures with an interconnecting dyke system and an old disused railway embankment raised above the level of the marsh. Due to the distance between the Site and Diggs and Sheppey Court Marshes and the presence of intervening features such as Queenborough and the Creek, no significant effects are anticipated as a result of Twyford Pumping Station as there are no direct impact pathways and therefore the LWS is not considered further in this assessment.

4.4.12. The Site is also within the Greater Thames Marshes Nature Improvement Area (NIA) as shown on **Figure 4.1**. The Greater Thames Marshes NIA covers nearly 50,000 ha of estuarine marshland in Southeast England, stretching from East London to Whitstable in Kent and Southend in Essex. It is one of the most important estuaries in Europe for some 300,000 wintering waterfowl and is home to endangered species such as water vole *Arvicola terrestris*, shrill carder bee *Bombus sylvarum* and unique invertebrates of the Thames Terrace soils and many farmland birds. The landscape is under pressure from habitat loss and disturbance through growth of developments, roads and other infrastructure; colonisation by invasive species; and climate change. The Greater Thames Marshes NIA seeks to protect existing flora and fauna.

4.4.13. Due to the scale and overlap of the Greater Thames Marshes NIA with the Medway Estuaries and Marshes SPA, SSSI And Ramsar, the effects on the Greater Thames Marshes NIA are not specifically referred to in this chapter. Instead, they are integral to the assessment of the effects on the habitats and designated sites.

Protected Species

4.4.14. Several species of principal importance as listed on Schedule 41 of the NERC Act, Wildlife and Countryside Act or in the Kent BAP were identified as present, or potentially present, within the study area as part of the desk study. Species that have been identified that would potentially be significantly affected by the Twyford Pump Station are discussed in the text below.

Habitats and Botany

Twyford and Klondyke Sites

4.4.15. Before the construction activities commenced on Twyford and Klondyke Sites, the sites comprised a complex of different areas and habitats types which included:

Mesotrophic Rough Grassland

4.4.16. Mesotrophic rough grassland was found in The Saltings in the Klondyke Site and along the top of the flood defences as well as along the adjacent ditch within the Twyford Site and the Site. The majority of the mesotrophic rough grassland has not been directly affected by the construction works carried out so far in the Klondyke Site as it is located outside of the working area. However, between the 2013 botanical survey and the 2020 invertebrate habitat assessment, bramble *Rubus fruticosus agg*. scrub has increased within the area of mesotrophic grassland. The mesotrophic rough grassland along the flood defences and the adjacent ditch within the Twyford Site has been regularly cut short since it was surveyed to minimise the recolonisation of reptiles but otherwise it has been left undisturbed.

4.4.17. The majority of the grassland was nutrient enriched and supported a relatively homogeneous stand dominated by grasses with a small number of dicotyledons. The grassland was mainly composed of sea couch *Elytrigia maritimus*, cock's-foot *Dactylus glomerata* and false oat-grass

Arrhenatherum elatius. The latter two species dominated the central area of the stand, especially to the west. Sweet vernal-grass *Anthoxanthum odoratum* is less frequent, as is creeping bent-grass, which is more abundant along the track edges. Dycotyledons are frequent, including creeping thistle *Cirsium arvense* in patches, travellers joy *Clematis vitalba*, curled dock *Rumex crispus*, bristly ox-tongue *Helminthotheca echioides*, creeping cinquefoil *Potentilla reptans* and red dead nettle *Lamium pupureum*. Common nettle *Urtica dioica* is present in large stands reflecting pockets of nutrient enrichment. There was also a large stand of rosebay willowherb *Chamerion angustifolium* to the north. The saltwater influence was apparent by the occasional clumps of sea beet *Beta vulgaris*.

Salt Marsh

4.4.18. The brackish water influenced the vegetative composition. Within the Klondyke Site, towards the Creek the grassland became dominated by sea couch with red fescue *Festuca rubra* also frequent in the area. On the damp Creek sides, which resemble salt-marsh habitat, sea purslane *Atriplex portulacoides* formed low shrubby masses. Annual sea blite *Suaeda maritima*, sea astor *Aster tripolium* and golden samphire *Inula crithmoides* were scattered throughout the area. Beaked tasselweed *Ruppia maritime* was present in the wettest areas on the water line, stretching onto the mudflats. On the mudflats close to the waterline, glassworts *Salicornia europaea agg*. were abundant. There were also patches of common cordgrass *Spartina anglica* on the eastern Creek edge.

4.4.19. The sea-ward side of the flood defences along the western boundaries of the Twyford and Klondykes Sites as well as the Site also supported species including sea couch, sea purslane and golden samphire.

Disturbed ground

4.4.20. Ruderal species were present where there was disturbed ground during the survey including: along the trackway in the boat yard; areas of the Klondyke Industrial Estate; and the damaged hard standing in the Twyford Site and the Site. The disturbed ground within the Klondyke Site is still present while the hard standing in the Twyford Site and the Site has been removed and replaced by the land raised material. The Twyford Site and the Site have not been subsequently surveyed but vegetation on the land raised material is regularly cut.

4.4.21. Species on the disturbed ground include fern grass *Catapodium rigidum,* Hawkweed *Hiercium agg.*, bristly ox-tongue, ribwort plantain *Plantago lanceolata*, hoary mustard *Hirschfeldia incana*, perennial wall-rock *Diplotaxis muralis*, Oxford ragwort *Senscio squalidus* and wild carrot *Daucus carota*.

4.4.22. A similar species composition was present along the flood defences on the western boundary of the Twyford Site and the Site, which was also regularly disturbed by walkers along Public Footpath ZB48. The habitat along the flood defences was unremarkable with species such as sea couch, cock's-foot grass, knotgrass *Polydonum aviculare* and sea beet also present.

Amenity grassland

4.4.23. Areas of amenity grassland were recorded throughout the Klondyke Industrial Estate, mainly close to the entrance and café during the survey. They are still present although less well managed since construction commenced and will shortly be removed as part of the on-going construction works on the Klondyke Site. Species associated with this habitat include perennial

rye-grass, common mallow *Malus sylvestris*, white clover *Trifolium repens*, yarrow *Achilla millefolium*, ribwort plantain, common nettle and pellitory of the wall *Pareietaria diffusa*.

Flowing Water

4.4.24. There is a drain flowing east-west along the southern boundary of the Twyford Site and the Site. When it was surveyed in 2010 it was largely inaccessible at the time of the survey. During the survey, viewed from the western end, the drain appeared to be approximately 6m wide and of an unknown depth, the water was turbid and slow-flowing with evidence of pollution (film on water). Small patches of reedbed were visible, dominated by common reed *Phragmites australis* and bulrush *Scirpoides holoschoschoenus*. The banks were steep and dominated by scrub on the southern bank and rough grassland on the northern bank which is managed by the LMIDB once or twice a year. The open section of the drainage ditch is approximately 150m long and is culverted to the east and west.

4.4.25. The culvert at the western end of this ditch reopens up further along to form the north-south ditch along the western boundary of the Twyford Site with patches of reedbed dominated by common reed and bulrush. The banks are also steep and dominated by rough unmanaged grassland interspersed with some scrub.

4.4.26. The bankside vegetation of the ditch was cut back in 2014 to remove all the scrub and has been kept short ever since to avoid recolonisation by reptiles.

Hardstanding

4.4.27. The majority of the Twyford Site north of the Site was characterised by a large area of hardstanding use to store construction materials during the survey. It has been subsequently been removed and replaced by the land raising material.

4.4.28. The areas of hardstanding within the Klondyke Site interspersed between the buildings that were recorded during the survey are still present along with the ground slab of the now demolished buildings within the Klondyke Industrial Estate. These areas are considered to be of little ecological value and is not considered further in this assessment.

The Site

4.4.29. A preliminary ecological appraisal was carried out on the Site with a site visit on the 2nd March 2021. The survey identified three habitat types using UK Habitat Classification descriptions[42].

Other Neutral Grassland (g3c)

4.4.30. To the south of the hardstanding road access track on the bank of the eastern extent of the east-west drainage ditch that separates the Site from Nelson's Vue housing estate, there is a small grassland area comprising tall tussocky grassland. A wooden post and rail fence borders the off-site drainage ditch and this small grassland area.

4.4.31. To the north of the artificial unvegetated unsealed surface and the hardstanding road access track there is a large expanse of short grassland with areas of bare ground and areas of ephemeral vegetation. Species present within this area include bristly oxtongue, groundsel *Senecio vulgaris*, white clover, black medick *Medicago luplina*, vetch *Vicia sp.*, ribwort plantain, speedwell *Veronica sp.* and hemlock *Conium maculatum*. The grassland, ruderal and ephemeral vegetation has established on recently disturbed ground. In the centre of this area

[42] ukhab – UK Habitat Classification

is a small areas of grassland with areas of bare ground, surrounded by Heras fencing. The grassland has established on recently disturbed ground. None of the grassland in this area includes any maritime grassland habitat.

4.4.32. On the eastern slope of the flood defence bund up to the green protec mesh fence, there is an area of taller grassland (c. 10-15cm in height) with occasional ephemeral vegetation. Species present within the grassland include shepherd's purse *Capsella bursa-pastoris* and cow parsley *Anthriscus sylvestris*.

4.4.33. On the top and western slope of the flood defence there is an area of grassland which also does not include any maritime grassland habitat.

Developed Land, sealed surface (u1b)

4.4.34. Within the centre of the artificial unvegetated unsealed surface with a hardstanding road access track along a broadly east-west alignment in the centre of the disused railway corridor. The track is used for PROW ZB48.

Artificial unvegetated unsealed surface (u1c)

4.4.35. Along the disused railway corridor surrounding the hardstanding road access track, there is a linear expanse of gravel and bare earth along a broadly east west alignment. The eastern boundary is delineated by a green protec mesh fence.

Evaluation

4.4.36. Of the habitats present within the Site and its surroundings, the upper and lower salt-marsh habitats bounding the Creek side are the most valuable (County value) with the rest, including within the Site being of zone of influence value to nature conservation

Wintering Birds and Passage Birds

4.4.37. West Point, the shoreline of Chetney Marshes and Deadman's Island has been and remains an important high tide roost site for waders and wildfowl. The roost locations are over 700m from the flood defences and lie outside of the zone of potential impact which is up to 500m from the flood defences along the western boundary of the Twyford Site, Klondyke Site and Site.

4.4.38. At high tide few birds remain on the Rushenden shoreline. During the 2013/2014 survey on the 15th November two curlew *Numenius arquata* and five black-headed gulls *Chroicocephalus ridibundus* were recorded remining on the tide line throughout high tide. In addition, birds including 115 common ringed plovers and two little egrets *Egretta garzetta* roosted on structures, pontoon and barge, close to Coal Washer's Wharf.

4.4.39. As the tide fell, birds move onto exposed mud along the Chetney Marshes shoreline, which is the first area uncovered as the tide falls. The mud along the flood defences is not exposed until a while after the tide turns due to the profile of the Rushenden shoreline. Birds then move on to the exposed mud, the first section being at the southern end of the flood defences. Once the mud is exposed, the tide recedes quite quickly so that the area of potential feeding for the waders to the front of the flood defences increases rapidly. At the lowest tide birds are widely distributed and a proportion of birds on the mud to the east of the flood defences were screened from view by the profile of the shore.

4.4.40. During the remediation works at the Twyford Site in advance of land raising activities within bird monitoring reports were carried out during January 2015 during which the following seven

qualifying species of the Medway Estuary and Marshes SPA/Ramsar were recorded during low tide: avocet, shelduck *Tandorna tandorna*, dunlin, grey plover, red knot, redshank and ringed plover.

4.4.41. In comparison with the 2014 baseline, the 2015 assemblage during low tide was more diverse with 19 species compared with 11 species. Of these, black-tailed godwit and little egret were not recorded using the estuary during the February 2015 surveys. By contrast, 10 of the 19 species recorded in 2015 were not recorded during surveys carried out in 2014. The most abundant species reported during February 2015 at low tide was black-headed gull (peak count of 31) and shelduck (peak count of 24).

4.4.42. During January and February 2015 at high tide a peak count of 86 birds was recorded within 500m of the Twyford Site at high tide which was less than the peak count in 2014. The counts of each species recorded on the survey occasions in February 2014 and February 2015 changed relatively little for the majority of species, with the counts of shelduck increasing as compared with the January surveys while black-headed gulls dominated the assemblage at high tide in both survey years. In addition, dunlin formed the highest proportion of the assemblage recorded.

4.4.43. Within the wider study area, a wintering bird survey was carried out at Former Steel Rolling Mill Site on the opposite side Rushenden Road from the Twyford Site in 2018[43]. During the survey no significant assemblages of wintering birds were recorded using either the site or the wetland area to the east. Low numbers of widespread species such as meadow pipit *Anthus pratensis* and black-headed gull utilised the available habitats such as wet grassland and the larger area of deeper water adjacent to Thomsett Way. No species associated with the Medway Estuary and Marshes SPA/Ramsar were recorded during the surveys. The area to the east of the railway comprised a waterbody and wetland and therefore supported predominantly wildfowl such as mallard *Anas platyrhnchos* and teal *Anas crecca*.

4.4.44. The survey data for wintering birds has been supplemented by the most recent KMBRC (January 2021) and WeBS data (2013-2018).

KMBRC Data

4.4.45. Within 1km of the Site there were 135 bird species recorded between November and March inclusive since 2000 according to KMBRC. Of these the following 23 red listed species were recorded: shag *Phalacrocorax aristotelis*; white-fronted goose *Anser albifrons*; pochard; velvet scoter *Melanitta fusca*; hen harrier; merlin *Falco columbarius*; lapwing *Vanellus vanellus*; black-tailed godwit; whimbrel *Numnius phaeopus*; curlew; herring gull *Larus argentatus*; skylark *Alauda arvensis*; grey wagtail *Motacilla cinerea*; fieldfare *Turdus pilaris*; song thrush *Turdus philomelos*; redwing *Turdus iliacus*; mistle thrush *Turdus viscivorus*; starling *Sturnus vulgaris*; house sparrow *Passer domesticus*; tree sparrow *Passer montanus*; linnet *Caruelis cannabina*; yellowhammer *Emberiza citronella* and corn bunting *Miliaria calandra*.

4.4.46. Also recorded by KMBRC were the following 49 amber listed species: black-throated diver *Gavia artica*; great northern diver *Gavia immer*; black necked grebe *Podicepts nigricollis*; spoonbill *Platalea leucorodia*; mute swan *Cygnus olor*; Bewick's swan *Cygnus columbianus*; whooper swan *Cygnus cygnus*; taiga bean goose spp *Anser fabalis*; pink-footed goose *Anser brachayrhynchus*; greylag goose *Anser anser*; barnacle goose *Branta bernicla*; shelduck; wigeon

[43] RSK ADAS Ltd (January 2018) Wintering Bird Survey Report: Queenborough, Isle of Sheppey

Anas penelope; gadwall; teal; mallard; pintail *Anas acuta*; shoveler; goldeneye *Bucephala clangula*; smew *Mergus albellus*; marsh harrier *Circus aeruginosus*; kestrel *Falco tinnunculus*; oystercatcher *Haematopus ostralegus*; grey plover; knot; dunlin; snipe *Gallingo gallingo*; bar-tailed godwit *Limosa lapponica*; spotted redshank *Tringa erythropus*; redshank; greenshank *Tringa nebularia*; green sandpiper *Tringa ochropus*; turnstone *Arenaria interpres*; Mediterranean gull *Larus melanocephalus*; black-headed gull; common gull *Larus canus*; great black-backed gull *Larus marinus*; Artic tern *Sterna paradisaea*; guillemot *Uria aalge*; razorbill *Alca torda*; stock dove *Columba oenas*; short-eared owl *Asio flammeus*; kingfisher *Alcedo atthis*; meadow pipit; water pipit *Anthus spinoletta*; dunnock *Prunella modularis*; Dartford warbler *Sylvia undata*; snow bunting *Plectorphenax nivalis*; and reed bunting *Emberiza schoeniclus.*

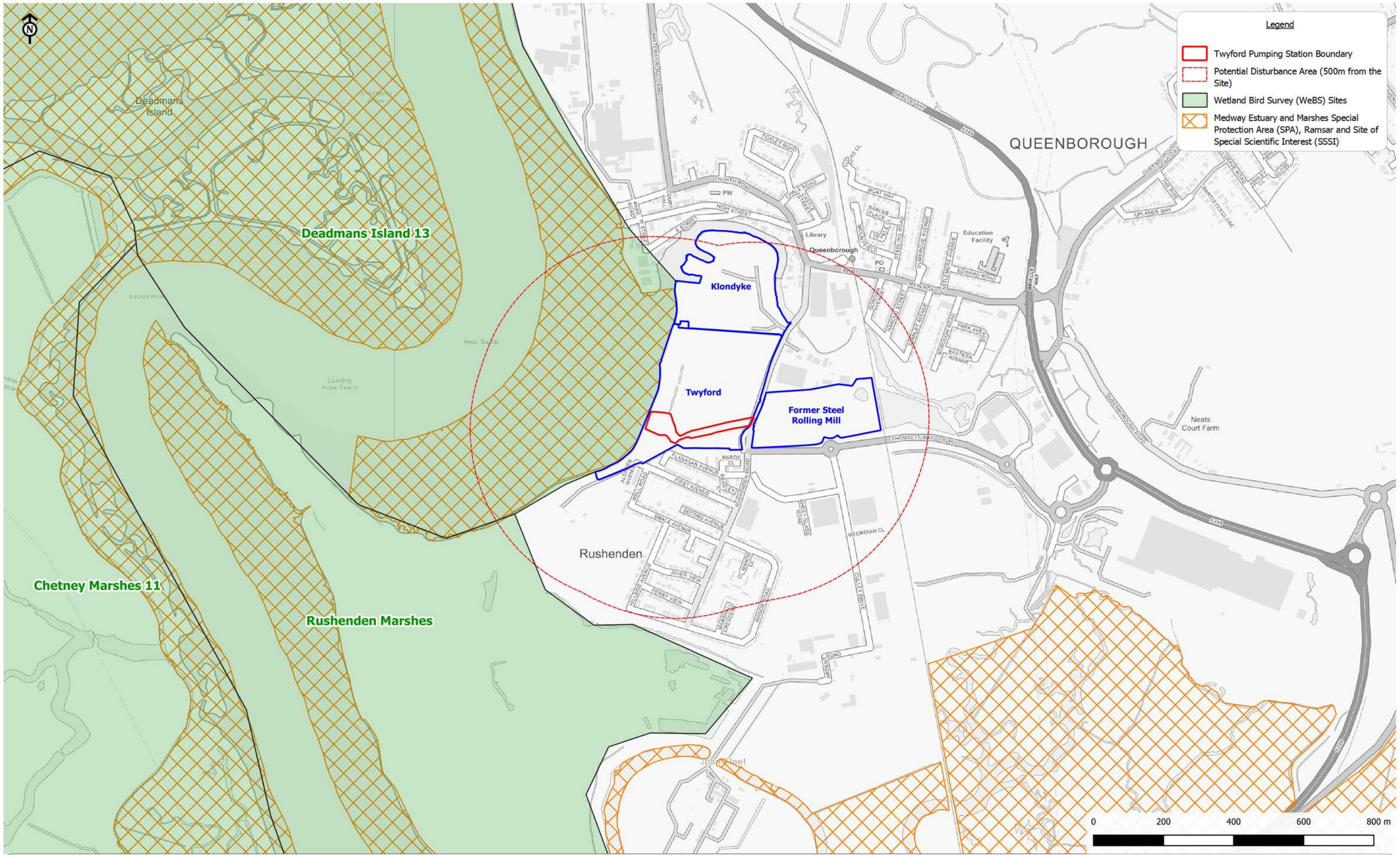
4.4.47. Of these the following 21 species are on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended): Artic tern; Bewick's swan; black-tailed godwit; black-throated diver; Dartford warbler; fieldfare; goldeneye; great northern diver; green sandpiper; hen harrier; kingfisher; marsh harrier; Mediterranean gull; merlin; pintail; redwing; snow bunting; spoonbill; velvet scooter; whimbrel; and whooper swan.

WeBS Data

4.4.48. The WeBS data for Chetney Marshes (11), Deadman's Island (13) and South Grain Offshore (15) sectors were provided by the BTO in February 2021. These are the closest sectors to the Site which have been monitored in the Medway Estuary and Marshes SPA, Ramsar and SSSI. The sectors are identified on **Figure 4.2.** The peak counts for species recorded in Chetney Marshes and Deadman's Island between November and February between 2014/15 and 2018/19 are presented in **Tables 4.6 and 4.7** respectively. South Grain Offshore is a new sector monitored for the first time starting in December 2018, with results for December, January, February and March 2018/19 presented in **Table 4.8**. Rushenden Marshes and Ferry Marshes sectors also identified on **Figure 4.2** are recent creations and as there is no data available yet, they have been excluded from the baseline.

Table 4.6: Chetney Marshes (11) – Five year peak monthly counts of each species 2014/15 to 2018/19

Species		Nov	Dec	Jan	Feb	Mar	Peak Count
Brent Goose (Black Brant)	*Branta bernicla nigricans*	0	1	1	0	0	1
Brent Goose (Dark-bellied)	*Branta bernicla bernicla*	170	850	2,500	650	176	2,500
Brent Goose (Svalbard light-bellied)	*Branta bernicla hrota*	0	1	0	0	0	1
Canada goose	*Branta canadensis*	400	500	400	300	278	500
Barnacle goose	*Brant leucopsis*	0	2	0	3	0	3
Greylag goose (British/Irish)	*Anser anser*	500	400	250	150	150	500
Domestic greylag goose	*Anser anser domesticus*	2	0	0	1	0	2
Hybrid goose	*Branta spp.*	1	0	0	0	0	1
Black swan	*Cygnus atratus*	1	1	0	0	0	1



Queenborough and Rushenden

Client: Homes England

Figure 4.2:
Location of Sectors within Medway Estuary and Marshes SPA, Ramsar and SSSI surveyed as part of the Wetlands Birds Survey (WeBS).

Scale: 1:10000@A3

Job Number: 11465
Drawn by - Checked by: RP - MC
Drg No - Status/Revision: GIS247 - B
File location: N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\Environmental Report (pdf in Outputs)
Date (Revision History): 23/03/2021 (A, First Issue, 01/03/21, RP; B, Boundary Update, 23/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

Species		Nov	Dec	Jan	Feb	Mar	Peak Count
Mute swan	*Cygnus olor*	28	26	10	28	11	28
Shelduck	*Tadorna tadorna*	250	500	500	500	336	500
Shoveler	*Anas clypeata*	0	32	3	11	16	32
Gadwall	*Anas strepera*	12	3	10	0	8	12
Wigeon	*Anas Penelope*	200	500	500	350	250	500
Mallard	*Anas platyrhynchos*	500	400	250	290	260	500
Pintail	*Anas acuta*	69	382	400	24	30	400
Teal	*Anas crecca*	500	300	470	500	208	500
Pochard	*Aythya ferina*	0	0	0	0	22	22
Tufted duck	*Aythya fuligula*	0	0	0	2	10	10
Little grebe	*Tachybaptus ruficollis*	6	0	6	3	7	7
Spoonbill	*Platalea leucordia*	0	1	0	0	1	1
Grey heron	*Ardea cinerea*	10	9	6	11	10	11
Little egret	*Egretta garzetta*	15	7	5	7	5	15
Cormorant	*Phalacrocorax carbo*	5	6	2	5	4	6
Water rail	*Rallus aquaticus*	0	1	0	0	0	1
Moorhen	*Callinula chloropus*	16	17	12	20	8	20
Coot	*Fulica atra*	1	1	17	165	61	165
Oystercatcher	*Haematopus ostralegus*	350	300	500	400	350	500
Avocet	*Recurvirostra avosetta*	105	130	100	9	345	345
Lapwing	*Vanellus vanellus*	1,500	3,000	3,000	4,000	400	4,000
Golden plover	*Pluvialis apricaria*	850	2,980	1,100	600	348	2,980
Grey plover	*Pluvialis squatarola*	8	1	6	5	1	8
Ringed plover	*Charadrius dubius*	12	50	22	1	23	50
Curlew	*Numenius arquata*	18	71	127	152	84	152
Black-tailed godwit	*Limosa limosa*	115	100	300	136	270	300
Turnstone	*Arenaria interpres*	0	0	0	1	3	3
Knot	*Calidris canutus*	0	0	0	40	0	40
Dunlin	*Calidris alpina*	2	5	20	15	0	20
Snipe	*Gallinago gallinago*	7	7	5	10	5	10
Green sandpiper	*Tringa ochropus*	7	3	3	2	5	7
Redshank	*Tringa totanus*	100	53	40	46	11	100
Spotted redshank	*Tringa erythropus*	1	0	0	0	0	1
Black-headed gull	*Chroicocephalus ridibundus*	2	2	2	2	8	8
Mediterranean gull	*Larus Melanocephalus*	0	0	0	0	6	6

Species		Nov	Dec	Jan	Feb	Mar	Peak Count
Common gull	*Larus canus*	0	1	1	0	1	1
Great black-backed gull	*Larus marinus*	2	1	4	5	0	5
Herring gull	*Larus argentatus*	12	5	5	10	4	12
Lesser black-backed gull	*Larus fuscus*	0	0	0	1	2	2
Kingfisher	*Alcedo atthis*	2	0	2	2	0	2

Table 4.7: Deadman's Island 13 – Five year peak monthly counts of each species 2014/15 to 2018/19

Species		Nov	Dec	Jan	Feb	Mar	Peak Count
Brent Goose (Dark-bellied)	*Branta bernicla bernicla*	245	94	4	664	397	664
Canada goose	*Branta canadensis*	118	1	0	22	43	118
Greylag goose (British/Irish)	*Anser anser*	150	0	0	0	32	150
Shelduck	*Tadorna tadorna*	160	450	378	87	117	450
Shoveler	*Anas clypeata*	0	0	0	80	25	80
Gadwall	*Anas strepera*	0	0	0	0	11	11
Wigeon	*Anas Penelope*	940	200	205	130	61	940
Mallard	*Anas platyrhynchos*	13	13	0	6	9	13
Pintail	*Anas acuta*	86	55	0	55	7	86
Teal	*Anas crecca*	669	650	140	389	164	669
Little grebe	*Tachybaptus ruficollis*	0	0	0	1	0	1
Great crested grebe	*Podiceps cristatus*	10	2	0	1	6	10
Grey heron	*Ardea cinerea*	3	2	1	0	0	3
Little egret	*Egretta garzetta*	6	0	0	0	0	6
Cormorant	*Phalacrocorax carbo*	4	1	0	4	4	4
Oystercatcher	*Haematopus ostralegus*	1,355	650	472	641	523	1,355
Avocet	*Recurvirostra avosetta*	139	45	0	262	350	350
Lapwing	*Vanellus vanellus*	170	15	2	2	1	170
Golden plover	*Pluvialis apricaria*	45	2	0	150	0	150
Grey plover	*Pluvialis squatarola*	149	89	0	134	41	149
Ringed plover	*Charadrius dubius*	4	0	140	101	18	140
Curlew	*Numenius arquata*	280	300	69	300	50	300
Bar-tailed godwit	*Limosa lapponica*	3	100	0	13	5	100
Black-tailed	*Limosa limosa*	27	25	0	61	15	61

Species		Nov	Dec	Jan	Feb	Mar	Peak Count
godwit							
Turnstone	*Arenaria interpres*	66	9	0	24	39	66
Knot	*Calidris canutus*	1,000	2,000	0	1,220	40	2,000
Dunlin	*Calidris alpina*	5,125	600	100	1,786	1,195	5,125
Redshank	*Tringa totanus*	107	16	0	54	12	107

Table 4.8: South Grain Offshore (15) – Peak monthly counts of each species 2018/19

Species		Dec	Jan	Feb	Mar	Peak Count
Brent Goose (Dark-bellied)	*Branta bernicla bernicla*	47	13	77	50	77
Shelduck	*Tadorna tadorna*	11	0	0	0	11
Little egret	*Egretta garzetta*	1	0	0	0	1
Cormorant	*Phalacrocorax carbo*	2	6	5	7	7
Oystercatcher	*Haematopus ostralegus*	146	1	7	66	146
Curlew	*Numenius arquata*	15	0	0	1	15
Turnstone	*Arenaria interpres*	0	12	0	0	12
Sanderling	*Calidris alba*	0	11	0	0	11
Redshank	*Tringa totanus*	30	24	11	2	30

4.4.49. The species mix and numbers recorded in these tables reflect the wintering '*important numbers of geese, ducks, grebes and waders'* of the Medway Estuary and Marshes Special Protection Area and Ramsar in which the three areas lie. **Table 4.9** compares the peak counts in the Ramsar Site Criterion 6 and the populations within the Medway Estuary and Marshes SPA with the combined peak counts within the three sectors closest to the Site.

Table 4.9: Comparison of the three sectors against the Medway Estuary and Marshes Ramsar Site Criterion 6 peak counts and the target counts in the Medway Estuary and Marshes SPA

Species	Peak Count / Target (individuals)	Peak Count across Chetney Marshes (11), Deadman's Island (13) and South Grain Offshore (15) WeBS Sectors (individuals)	Percentage of total individuals found within the three sectors compared to the designated sites
Medway Estuary and Marshes Ramsar Site[44]			
Dark Bellied brent goose	2,575 (peak count 1998/99 – 2002/03)	3,241	125%
Shelduck	2,627 (peak count 1998/99 – 2002/03)	961	36%
Pintail	1,118 (peak count 1998/99 – 2002/03)	86	43%
Ringed plover	540 (peak count 1998/99	190	35%

[44] untitled (jncc.gov.uk)

Species	Peak Count / Target (individuals)	Peak Count across Chetney Marshes (11), Deadman's Island (13) and South Grain Offshore (15) WeBS Sectors (individuals)	Percentage of total individuals found within the three sectors compared to the designated sites
	– 2002/03)		
Knot	3,021 (peak count 1998/99 – 2002/03)	2,040	68%
Dunlin	8,263 (peak count 1998/99 – 2002/03)	5,145	62%
Medway Estuary and Marshes SPA[45]			
Dark-bellied brent goose	Above 4,130 (target)	3,241	78%
Shelduck	Above 5,900 (target)	961	16%
Pintail	Above 980 (target)	86	9%
Avocet	Above 70 (target)	695	992%
Ringed plover	Above 740 (target)	190	26%
Grey plover	Above 4,810 (target)	157	33%
Knot	Above 3,690 (target)	2,040	55%
Dunlin	Above 22,900 (target)	5,145	22%
Redshank	Above 4,180 (target)	237	6%

4.4.50. **Table 4.9** shows that a significant proportion of the wintering bird population within the Medway Estuary and Marshes Ramsar and SPA reside within the three sectors closest to the Site. However, it should be noted as shown on **Figure 4.2** that only parts of Deadman's Island and Rushenden Marshes lie within 500m of the Site which defines the potential zone of disturbance from activities occurring on the Site. The key roosting sites at West Point, Chetney Marshes and Deadman's Island are at a much greater distance away from the Site.

Evaluation

4.4.51. Although West Point, the shoreline of Chetney Marshes and Deadman's Island are beyond the 500m zone of potential impact has been and remains and important high tide roost for waders and wildfowl, there are bird species that were listed within the Medway Estuary and Marshes SPA Citation which are located within the 500m zone of potential impact. Therefore, it is evaluated that the wintering and passage birds would be at an international value to nature conservation.

Breeding Birds

4.4.52. The Site is adjacent to the Medway Estuary and Marshes SPA, Ramsar and SSSI. The breeding bird assemblage is listed as reasons for the SPA designation[46]. At classification in 2001, the assemblage included oystercatcher, lapwing, ringed plover, redshank, shelduck, mallard, teal, shoveler, pochard and common tern *Sterna hirundo*. During the breeding season the SPA

[45] https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK9012031&SiteName=&SiteNameDisplay=Medway+Estuary+and+Marshes+SPA&countyCode=&responsiblePerson=&NumMarineSeasonality=11

[46] https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK9012031&SiteName=&SiteNameDisplay=Medway+Estuary+and+Marshes+SPA&countyCode=&responsiblePerson=&NumMarineSeasonality=11

regularly supports: 6.2% of the Great Britain breeding population of avocet; 1.2% of the Great Britain breeding population of little tern *Sterna albifrons*; and 0.6% of the Great Britain population of common tern. The habitat on Site or within the wider Twyford, Klondyke or Former Steel Rolling Mill Site is not suitable for avocets, little tern or common tern. Instead, they are more likely to nest on Chetney Marshes or Deadman's Island which are over 750m from the Site.

4.4.53. During the 2013 breeding bird survey, there was limited potential for nesting birds on the Twyford Site. A pair of oystercatchers nested on the roof of the Gateway Community Centre while house sparrows (red listed) were associated with the derelict sheds adjoining the Gateway Community Centre and the established buddleia. In addition, there were single pairs of moorhens *Gallinula chloropus* and whitethroat *Sylvia communis* with territories associated with the drainage ditch and riparian vegetation along the southern boundary of the Twyford Site. Since the survey, the buildings and buddleia have subsequently been removed and replaced by land raised areas of material with minimal potential for nesting birds.

4.4.54. To the north of the disused railway, the vegetation in the main area of the Twyford Site was cleared in the summer of 2012 during the translocation of reptiles and therefore there were no nesting birds recorded during 2013. There was, however, evidence of single pairs of nesting dunnock and blackbird *Turdus merula* on the flood defences. Since the survey, the main area of the Twyford Site has remained unsuitable for nesting birds while potential for ground nesting birds remains on the flood defences although the grassland is regularly cut during the breeding bird season.

4.4.55. In the Klondyke Site there was evidence in 2013 of nesting blackbird, dunnock and goldfinch *Carduelis carduelis*. Feral pigeons *Columba livia* were present and undoubtedly nested within the complex of industrial units of varying size with patches of partly maintained grass and ornamental trees, small areas of established scrub and the north within The Saltings, and areas of bramble, coarse grass and ruderal vegetation with a number of small trees. With the demolition of the industrial buildings and the maintenance of the vegetation south of The Saltings there is currently limited potential for nesting birds. The scrub and small trees within The Saltings are due to be removed during winter of 2020/21.

4.4.56. On 4th September 2013 during internal inspections of the industrial units on the Klondyke Site, barn owls *Tyto alba* were recorded as nesting. An update survey was then carried out on the 10th April 2018[47] during which two old barn owl pellets (from the previous nesting season) but no recent signs of nesting barn owl were recorded. No evidence of barn owls were recorded in any other structures within the Klondyke Site. Another survey was carried out on the 19th November 2018 prior to the demolition of the Klondyke Industrial Estate buildings during which barn owl pellets and droppings were recorded although no nesting barn owls or evidence of nesting barn owls were found during the survey[48]. The building where the nest was recorded was subsequently demolished during the winter of 2018/2019 and a barn owl nest box has instead been erected on the eastern edge of Klondyke Site adjacent to the Creek. No formal surveys of the barn owl nest box has been carried out although one is programmed to occur spring 2021.

[47] RSK ADAS Ltd (2018) Twyford and Klondyke Site Enabling Works, Remediation and Land Raising Ecological File Note
[48] Native Ecology (November 2018) Klondyke Industrial Estate, Queenborough and Rushenden, Isle of Sheppey, Kent: Internal Building inspections for the presence of barn owls (letter).

4.4.57. During the 2013 survey, there was evidence of birds nesting within the residential areas of Queenborough and Rushenden with house sparrow, starling, collared dove *Streptopelia decaocto* and jackdaw *Corvus monedula* all represented. A swallow *Hirundo rustica* nested in the structure at Coal Washer's Wharf.

KMBRC Data

4.4.58. The survey data has been supplemented by information from KMBRC (January 2021) on birds present between March and August inclusive since 2000 during the main breeding bird season in the area, although not recorded as specifically breeding. This information supports the above survey results but will not be specifically assessed within this report.

4.4.59. The following 26 red listed species were recorded within 1km of the Site: pochard; fieldfare; scaup *Aythya marila*; hen harrier; merlin; ringed plover; lapwing; black-tailed godwit; whimbrel; curlew; red-necked phalarope *Phalaropus lobatus*; herring gull; kittiwake *Rissa tridactyla*; turtle dove *Streptopelia turtur*; cuckoo *Cuculus canorus*; skylark; yellow wagtail *Motacilla flava*; grey wagtail; whinchat *Saxicola rubetra*; ring ouzel *Turdus torquatus*; song thrush; redwing; mistle thrush; starling; house sparrow; and linnet.

4.4.60. The following 52 amber listed species were recorded within 1km of the Site: black-necked grebe *Podiceps nigricollis;* gadwall; Mediterranean gull; spoonbill; mute swan; greylag goose; barnacle goose; Brent goose; black brant; shelduck; wigeon; gadwall; teal; mallard; pintail; garganey *Anas querquedula*; shoveler; smew; honey buzzard *Pernis apivorus*; marsh harrier; osprey *Pandion haliaetus*; kestrel; grey partridge *Perdix perdix*; oystercatcher; avocet; grey plover; dunlin; snipe; bar-tailed godwit; spotted redshank; redshank; greenshank; green sandpiper; wood sandpiper *Tringa glareola*; common sandpiper *Actitis hypoleucos*; turnstone; black-headed gull; common gull; lesser black-backed gull; yellow-legged gull *Larus michahellis*; great black-backed gull; sandwich tern *Thalasseus sandvicensis;* common tern; little tern; guillemot; stock dove; short-eared owl; swift *Apus apus*; house martin *Delichon urbica*; meadow pipit; willow warbler *Physlloscopus trochilus*; and reed bunting.

4.4.61. Of these the following 19 species are on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended): avocet, black-necked grebe; black-tailed godwit; fieldfare; green sandpiper; greenshank; hen harrier; honey buzzard; little tern; marsh harrier; Mediterranean gull; merlin; osprey; pintail; redwing; scaup; spoonbill; whimbrel; and wood sandpiper.

Evaluation

4.4.62. The survey area had limited potential for nesting birds with the number of nesting birds very low. The potential presence of the low number of more common nesting birds on the Site is at a zone of influence value.

Bats

4.4.63. During the survey in 2010, there were three buildings within the Twyford Site that were surveyed for potential for bats. The building adjacent to the Gateway Community Centre on the southern Twyford Site boundary was the only one identified as having a low potential to support roosting bats due to the presence of gaps under external wooden cladding. The other buildings were considered to have no potential for bats. However, as no bats were observed emerging from or entering the building during dusk and dawn surveys, it was concluded that bat roosts were considered to be likely absent. Instead, the incidental records of bats in the vicinity of the buildings were of foraging and commuting common pipistrelle bats indicating that

there is likely to be a small common pipistrelle roost in the vicinity of this area. Subsequent to the survey, the buildings have been all removed and there is no suitable habitat for roosting bats within the Twyford Site although they may occasionally pass over the Twyford Site and the Site.

4.4.64. The habitat within the Klondyke Site during the survey was good for bats as it provided foraging opportunities associated with the waterside and the industrial buildings with brick structures used to provide potential roosting opportunities before being demolished. There is currently no suitable habitat for roosting bats within the Klondyke Site although they may occasionally pass over the Klondyke Site especially along the Creek which is likely to provide a more significant route for commuting bats.

4.4.65. The KBRC data confirms that known bat roosts were within a brick building within the Former Steel Rolling Mill Site which has subsequently been demolished. Other known bat roosts are present in buildings along North Road and Borough Road within Queenborough. Within a 5km radius of the Site the following eight species of bats have been recorded: serotine bat *Eptesicus serotinus*; Daubenton's bat *Myotis daubentoniid*; Leisler's bat *Nyctalus leisleri*; noctule bat *Nyctalus noctule*; Nathusius' pipistrelle bat *Pipistrellus nathusii*; pipistrelle bat (45 kHz) *Pipistrellus pipistrellus*; pipistrelle bat (55 kHz) *Pipistrellus pygmaeus*; and long-eared brown bat *Plecotus auritus*.

Evaluation

4.4.66. Overall, the level of bat activity within the Twyford Site, Klondyke Site and Site was low, with bats considered to be of negligible value and are not considered further in this assessment.

Reptiles

4.4.67. A good population of viviparous lizard and a low population of slow worm were recorded as present during the 2013 reptile surveys. The highest density of reptiles was in the rough grassland within The Saltings, north of the Klondyke Industrial Estate. The area was dominated by a tall grass sward which grew through man-made debris which was scattered throughout the area, offering opportunities for reptiles to seek refuge. In contrast, the area of ruderal vegetation around the boatyard and within the more extensive area of the regularly mown grassland at the entrance of the Klondyke Site was generally sub-optimal for viviparous lizards and slow worms because of the regular mowing regime and high level of human disturbance.

4.4.68. During the 2013 surveys, the majority of the reptiles on the flood defences to the west of the Twyford Site were located in the rough grassland running down the east bank to the ditch. However, the population of viviparous lizards and slow worm across this area were low.

4.4.69. The land within the main Twyford Site and to the south of the dismantled railway, although not surveyed, was estimated in 2013 to have low populations of viviparous lizards and slow worm. This is due to the presence of rough grassland and scrub interspersed with rubble and soil mounds and other debris and having not been previously cleared of reptiles.

4.4.70. Since the 2013 survey, the rough grassland within The Saltings has been retained while the rest of the grassland and scrub areas within the Klondyke Site has been regularly managed and kept short. No reptiles were captured or removed from the Klondyke Site during the 2018/2019 demolition works. During the September to October 2020 reptile survey of the whole of Klondyke Site, while no slow worms or grass snakes were recorded there was a peak count of

six viviparous (common) lizards. Therefore, there was a low population of viviparous lizards and a continued presence of a small number of slow worms was considered possible.

4.4.71. In 2014 ahead of the construction works commencing on the Twyford Site, 114 viviparous lizards and 239 slow worms were captured and released onto the Harty Marshes Reptile Receptor Site and a further 135 viviparous lizards and 309 slow worm were captured and released onto Reptile Receptor Site 2[49]. After the reptile translocation had been completed reptile fencing was erected along the flood defences and the southern boundary of the Twyford Site to minimise the risks of recolonisation of reptiles. Gradually the fencing fell into disrepair but the vegetation within the Twyford Site has been regular cut over the years. It is recognised however that there is potential for the Site to have become repopulated with a low number of viviparous lizards and slow worm from nearby suitable habitats.

Evaluation

4.4.72. There is potential for low populations of viviparous lizards and slow worm to be present within the Site. It is evaluated that the reptile populations are of local value to nature conservation.

Terrestrial Invertebrates

4.4.73. The Twyford Site to the north of the disused railway was surveyed by Keystone Environmental in 2010[50] prior to the vegetation clearance as part of the reptile translocation work during 2012. Of the remaining habitat (which is still present), the ephemeral, short perennial and herbaceous vegetation (along the western boundary of the Twyford Site) was reasonably species diverse and was likely to support a wide variety of invertebrates including nationally rare solitary bees that are known to occur in the Medway and Thames Estuaries and nationally scarce six-belted clearwing moth *Bembecia ichneumoniformis*. Overall, this part of the Twyford Site was considered to be of intrinsically low invertebrate interest.

4.4.74. The land to the south of the disused railway was excluded from the survey in 2010 because it was almost entirely hard standing or existing buildings and considered unlikely to support a diverse or important assemblage of invertebrates. This area of the Twyford Site has now been cleared and land raised and continues to be unlikely to support a diverse or important assemblage of invertebrates.

4.4.75. The complex of the different habitats within The Saltings, in Klondyke Site have potential to support a variety of terrestrial invertebrate species, including rare species associated with habitats which reflect those present within the Medway Estuary and Marshes SSSI and Ramsar Site. The area was surveyed in 2013 and 2019. Key terrestrial invertebrate species that have been identified on the Klondyke Site include:

- *Myopites eximius (galls);*
- *Pantilius tunicatus;*
- *Elasmostethus interstinctus;*
- *Kleidocerys resedae;*
- *Palomena prasina;*

[49] CampbellReith (July 2018) Queenborough and Rushenden Reptile Receptor Site 2, Reptile Translocation and Monitoring Summary Report.
[50] Keystone Environmental (September 2010) Queenborough Preliminary Invertebrate Report

- *Tephritis divisa;*
- *Stictopleurus abutilon;* and
- *Stenodema laevigata.*

Evaluation

4.4.76. The likely presence of rare or protected invertebrates is high on the Klondyke Site but low on the Twyford Site, therefore it is evaluated that the terrestrial invertebrate populations are of local value in the Twyford Site and the Site and of national value in the Klondyke Site.

Other species

4.4.77. No evidence for otter or amphibians has been recorded on the Klondyke Site or Twyford Site since 2010, therefore no further consideration is given to these species in this assessment.

4.4.78. No evidence for water voles has been recorded on the Klondyke Site or the Twyford Site since 2010, however, they have been recorded as present in the wetlands east of the railway line and within the pond (before it was removed) in the Former Steel Rolling Mill Site on the other side of Rushenden Road. Also the drainage ditch to the south of the Site provides suitable habitats for water voles and therefore although not assessed further in this report as there is a low risk of them being present, pre-cautionary mitigation measures are discussed in section 4.6 to ensure none are harmed during construction if they are present.

4.4.79. Several species of principal importance as listed on Schedule 41 of the NERC Act were identified as present, or potentially present within the Site as part of the desk study and/or field surveys. Species potentially present include common toad *Bufo bufo* and hedgehog *Erinaceus europaeus* even though they have not been recorded since 2010 on the Site.

Evaluation

4.4.80. The potential presence of common toad and hedgehog is evaluated to be within the zone of influence to nature conservation. However, as they have not been recorded on the Twyford Site, Klondyke Site or Site since 2010, they are not considered further in this assessment although if found they will be protected by measures specified in the Construction Environmental Management Plan (**Appendix 1**).

Future Baseline

4.4.81. In the absence of the Twyford Pump Station, the Klondyke and Twyford Sites would continue to be subject to construction activities associated with planning application (SW/13/1550) until they are land raised. In due course if a separate planning application is successful and permission is granted then a mixed-use development will be built on both sites as discussed in Chapter 1. During the land raising and settlement periods for both sites, the vegetation will continued to be managed to minimise the repopulation of birds and reptiles.

Ecological Evaluation Summary

4.4.82. The evaluation of the current habitats and species within the survey area that could be affected by the construction and operation of the Twyford Pump Station is summarised in **Table 4.10.**

Table 4.10: Ecological Evaluation Summary of Resources/Receptors that have the potential to be affected by the Construction and/or Operation of the Twyford Pump Station

Resource/Receptor	Location	Level of Value
Medway Estuary and Marshes SPA/Ramsar/SSSI	Adjacent to the western boundaries of the Twyford Site and the Site	International and National
Mesotrophic rough grassland	Within The Saltings in the Klondyke Site and on the flood defences west of the Twyford Site and partially within the Site	Zone of Influence
Salt marsh	Adjacent to the Creek within the Klondyke Site	County
Disturbed ground	Present along the trackways in the boat yard and areas of the Klondyke Site	Zone of Influence
Amenity grassland	Present throughout the Klondyke Site	Zone of Influence
Flowing water	Within the Twyford Site and the Site	Zone of Influence
Wintering and passaging birds	Potential habitat for foraging within the Swale adjacent to the Twyford Site, Klondyke Site and the Site	International
Breeding birds - others	Potential habitat is present within the Twyford Site, Klondyke Site and the Site	Zone of Influence
Reptiles	Within The Saltings in the Klondyke Site and along the western boundary of the Twyford Site and the Site	Local
Terrestrial Invertebrates	Potential suitable habitats within the Twyford Site, Klondyke Site and Site	Local value in the Twyford Site and the Site to National in the Klondyke Site

4.5. Assessment of Effects

4.5.1. The potential impacts, and the significance of the effect on ecological features, are characterised in the absence of mitigation measures, beyond those identified and described in Chapter 3 as embedded into the construction and/or operational phases of the Twyford Pumping Station. The following embedded mitigation measures are considered in this assessment:

- Implementation of the CEMP (**Appendix 1**) during construction;
- Implementation of the Ecology and Landscape Management Plan (**Appendix 2**) during construction and operation.

4.5.2. Impacts may be direct such as when a habitat and/or species is lost to development or indirect such as when adjacent habitats or species are remotely affected, or when factors that relate to the development, but are not actually part of the development itself, include ecology or features of nature conservation importance. For example, increased disturbance to birds or dust smothering of vegetation during construction phase of a development. The effects during

construction are anticipated to be of short term duration (temporary) while effects during operation are anticipated to be of long term duration (permanent) unless otherwise stated.

4.5.3. Impacts are only considered in detail when there is a reasonable likelihood of an effect on a feature of nature conservation importance.

4.5.4. Further details on the Twyford Pumping Station and construction activities are provided in Chapter 3 and are therefore not reproduced in detail in this chapter.

Construction

Medway Estuary and Marshes SPA/Ramsar/SSSI

4.5.5. The construction activities associated with the Twyford Pumping Station will not result in loss of habitats within the adjacent Medway Estuary and Marshes SPA, Ramsar and SSSI as the Site is outside of the designated site.

4.5.6. Public Footpath ZB48 will be potentially temporarily closed during construction of the outfall through the flood defences. This will not have a significant effect on the Medway Estuary and Marshes SPA, Ramsar or SSSI.

4.5.7. Emissions from construction traffic will be broadly concurrent with existing industrial and construction operations surrounding the Site and so will not result in any indirect impacts on the Medway Estuary and Marshes. Indirect impacts on wintering, passage and breeding birds which form the qualifying species of the SPA are discussed separately below.

4.5.8. Through the implementation of the CEMP (**Appendix 1**) which will control lighting as well as emissions to land, air and water preventing adverse effects on the designated sites, the effect will be a temporary neutral effect at international and national level to the Medway Estuary and Marshes SPA, Ramsar and SSSI.

Habitats

4.5.9. The Site comprises some temporarily stockpiles of topsoil which have become vegetated, the open and culverted ditch and the mesotrophic rough grassland on the flood defences. All the vegetation has been regularly managed through mowing and none of these habitats meet any criteria for Priority Habitats. The removal of the habitats will result in a loss of 0.51 ha of neutral grassland, 0.12 ha of development land sealed surface and 0.31 ha of artificial unvegetated unsealed surface and an impact of small magnitude and consequently a minor adverse effect at a zone of influence level until the Site is seeded through the implementation of the Ecology and Landscape Management Plan (**Appendix 2**).

4.5.10. Dust emissions arising from topsoil stripping and excavations as well as emissions to water will be managed through the implementation of the CEMP (**Appendix 1**) which will comply with best practice pollution prevention guidance resulting in temporary negligible impacts and consequently neutral effects at a zone of influence level.

4.5.11. Overall, during construction, the loss of habitats within the Site will result in temporary effects of neutral to minor adverse significance at a zone of influence level.

Wintering and Passage Birds

4.5.12. Waders and wildfowl are known to be susceptible to disturbance from noise and visual impacts with the potential zone of disturbance extending up to 500m which includes part of Deadman's Island and Rushenden Marshes WeBS sectors (**Figure 4.2**). Disturbance includes the

displacement of birds from their feeding areas either by causing them to move away from the area when the disturbance factor starts, or by causing the birds to avoid the areas which they habitually utilise.

4.5.13. There will be no potential impacts between April and late October, when the majority of the works are programmed to occur because there will be no concentrations of wading migrants or winter visitors at this time. Instead, there is potential for adverse effects to occur on the wintering and passaging birds between November and March inclusive, when the concentrations of wading migrants or winter visitors are present. Although, the main roosts for the interest species associated with the SPA and Ramsar Site are located over 750m from the Site and therefore will not be affected. During the construction activities, especially any on the flood defences, potential impacts may be expected on birds feeding on the mudflats during the intertidal periods in autumn and winter.

4.5.14. At low tide the birds have the full extent of the mud to feed on and so will be least disadvantaged if displaced from the mud within 500m of the Site. The greatest impact is instead likely to occur between mid-tide through high tide to mid-tide period. At Rushenden there is a period over high tide when birds are not expected to be present at the mud is covered from approximately one hour before high tide and is not uncovered until approximately one hour after high tide.

4.5.15. As the tide rises the areas of mud available for feeding decrease and the birds are pushed closer to the shore and thus the Site. As the tide rises, those areas of mud on the upper shore which are covered last are particularly important for birds as these areas may be the last they can forage over until the tide goes out again. This is most important during periods of cold and inclement weather. Impacts on birds at this stage of the tide is most likely to be caused by noise and visible activity.

4.5.16. It is recognised that birds often become habituated, so it is reasonably expected that they will tolerate some regular and repetitive noise and visual activity. Noise and visual disturbance that is intermittent, infrequent and, in the case of noise, penetrating, may be expected to have the most impact. Construction works have been ongoing on the wider Twyford Site since 2014 and have occurred over winter on the Klondyke Site in 2018/2019 and are due to commence again shortly and therefore some degree of habituation is likely to have occurred.

4.5.17. The Twyford Pumping Station works will be largely screened by the flood defences and therefore noise is expected to have greater impact than visual disturbance. There will be some works on the flood defences when the outfall from the pumping station is installed. Therefore, to minimise impacts on birds between November and March inclusive, the construction activities have been programmed to be behind the flood defences and therefore screened visually and acoustically from the wintering and passaging birds during this period.

4.5.18. Furthermore, the implementation of the CEMP (**Appendix 1**) during the construction works will minimise the noise and visual effects on the wintering birds.

4.5.19. Overall, the effect will be a temporary neutral effect at an international level in regards to wintering and passage birds.

Breeding Birds

4.5.20. There is a low potential for nesting birds within the Site due to the ongoing vegetation management. However, if they are present disturbance will be minimised through the effective

implementation of the CEMP (**Appendix 1**) which includes the preference to clear vegetation outside of the breeding bird season. If clearance operations are required during the breeding season, a qualified ecologist will undertake a thorough inspection of all vegetation within a period of up to two days prior to removal to ensure that no nests are destroyed or disturbed. In addition, there is also a provision in the CEMP for weekly checks by the Ecological Clerk of Works (EcOW) between March and August for breeding birds. If an active nest is found, ground clearance, tree felling or vegetation clearance around the nest (including a buffer area determined by the ecologist), shall not be permitted until the breeding attempt has ended.

4.5.21. Construction activities will also potentially result in noise, air and water pollution and visual impacts causing potential disturbance and displacement of breeding birds either on a temporary or permanent basis and may result in nests being abandoned within the Site or its immediate vicinity. These impacts will also be minimised through the implementation of the noise, dust and water control measures within the CEMP as well as works being carried out in accordance with the best practice pollution prevention guidance.

4.5.22. Overall, construction activities will have a permanent neutral effect at a zone of influence level to breeding birds within the Site.

Reptiles

4.5.23. Low populations of viviparous lizards and slow worm are potentially located along the ditch banks and the flood defences within the Site. The temporary loss of habitat suitable for reptiles during construction will result in a temporary minor adverse effect at a local level.

Terrestrial Invertebrates

4.5.24. Terrestrial invertebrates are potentially located along the ditch banks and the flood defences within the Site. The loss of habitat suitable for terrestrial invertebrates during construction activities will result in a temporary minor adverse effect at a local level.

Operation

Medway Estuary and Marshes SPA/Ramsar/SSSI

4.5.25. Once operational the Twyford Pumping Station will discharge water to a location approximately 115m south of the existing outfall associated with the existing pumping station at a rate of 400 l/s. The water quality will be either the same or better than the water discharged from the existing pumping station as the water will pass through a vegetated ditch/pond which will allow settlement of sediment and adsorption of nutrients including nitrogen and phosphorus to occur. This will improve the water quality being discharged into the Swale compared to the existing situation. The flow rate of the discharged water will remain low enough not to cause any likely significant effect on the habitats or qualifying species on the Medway Estuary and Marshes SPA, Ramsar and SSSI.

4.5.26. Once operational there will be few activities associated with the Twyford Pumping Station occurring within the Site apart from occasional site inspections and authorised access to the flood defences. The pedestrian access along Footpaths ZB48 and ZB49 will be re-instated post-construction, however this will cause no change to disturbance to birds associated with the Medway Estuary and Marshes SPA, Ramsar and SSSI compared to the baseline.

4.5.27. There will be no noise or dust on the mudflats during operation of the Twyford Pumping Station as there will be no activities occurring on the site that may cause noise or dust.

4.5.28. Overall, there will be a permanent neutral effect at an international and national level on the Medway Estuary and Marshes SPA, Ramsar and SSSI.

Habitats

4.5.29. As a result of the implementation of the Ecology and Landscape Management Plan (**Appendix 2**), the slopes to the proposed surface water ditch and pond will be seeded with the following mix:

- Cock's-foot *Dactylus glomerata* (25%);
- Perennial ryegrass *Lolium perenne* (20%);
- Yorkshire fog *Holcus lanatus* (5%);
- Timothy-grass *Phelum pratense* (25%);
- Creeping bent grass *Agrostis stoloniferous* (5%);
- Marsh foxtail *Alopecurus geniculatus* (3%);
- Rough blue grass *Poa trivalis* (3%);
- Blue grass *Poa pratensis* (12%); and
- Sweet vernal grass *Anthoxanthum odoratum* (2%).

4.5.30. Furthermore, within the ditch/pond aquatic plant species will naturally establish. Together, once established the grass and aquatic plants will create a more diverse habitat compared to the original habitat before construction commenced on the Twyford Site and the temporary self-seeding plants currently present.

4.5.31. The area of the flood defences where vegetation was removed to facilitate construction activities will be left to allow the species in the topsoil to naturally re-establish.

4.5.32. This will result in a permanent moderate beneficial effect at a zone of influence level.

Wintering and Passage Birds

4.5.33. Once operational there will be few activities associated with the un-manned Twyford Pumping Station occurring within the Site apart from occasional site inspections and authorised access to the flood defences. The pedestrian access along Footpaths ZB48 and ZB49 will be re-instated post-construction, however this will cause no change compared to the baseline.

4.5.34. The Twyford Pumping Station will discharge water to a location approximately 115m south of the existing outfall associated with the existing pumping station. The water quality will be either the same or better than the water discharged from the existing pumping station as the water will pass through a vegetated ditch/pond which will allow settlement of sediment and adsorption of nutrients including nitrogen and phosphorus to occur. This will improve the water quality being discharged into the Swale compared to the existing situation. The flow rate of the discharged water will be equivalent to the existing flows and remain low enough not to cause any likely significant effect on the habitats or qualifying species on the Medway Estuary and Marshes SPA, Ramsar and SSSI.

4.5.35. Overall, there will be a permanent effect of no change at an international level.

Breeding Birds

4.5.36. During operation, there will be some limited opportunities for wildfowl to nest within the new ditch and pond as well as ground nesting birds within the grassland on the Site. Overall, there will be permanent neutral effects at a zone of influence level.

Reptiles

4.5.37. During operation, once the new enhanced grassland habitats have become established, there will be new and enhanced reptile habitat created resulting in a permanent minor beneficial effect at a local level in respect to reptiles.

Terrestrial Invertebrates

4.5.38. During operation, once the new enhanced grassland and aquatic habitats have become established, there will be new and enhanced terrestrial invertebrate habitats created which will resulting a permanent minor beneficial effect at a local level in respect to terrestrial invertebrates.

4.6. Mitigation Measures

4.6.1. This section provides a description of the additional mitigation and enhancement measures proposed to minimise the potential adverse effects identified by the assessment as set out previously. The mitigation measures will reduce the severity of impacts, and hence the levels at which effects are considered significant. It also includes measures that will provide additional enhancements to the biodiversity of the Site.

4.6.2. The final details of any additional mitigation measures are likely to be secured through the planning conditions for the Twyford Pumping Station and will form part of any detailed environmental management undertaken. The contractor, relevant statutory agencies and nature conservation organisations may be involved in this.

4.6.3. During construction, an Ecological Clerk of Works (ECoW) will be appointed and present on the Site during any construction activities that are identified to potentially have a significant adverse effect on any flora and fauna on the Site and/or the surrounding area. The ECoW will work alongside the Principal Contractor to ensure that the construction activities are undertaken in compliance with the CEMP (**Appendix 1**) and Ecology and Landscape Management Plan (**Appendix 2**).

Protection of Reptiles

4.6.4. Based on previous experience at the Twyford Site, it is recognised that even though reptile translocation has been carried out twice so far on the Twyford Site since 2013 and the vegetation has been managed since then, there remains a potential for a low population of viviparous lizards and slow worms to be present within the Site. Therefore, a precautionary approach to protect the reptiles that could be within the grassland areas will be developed in agreement with KCC Ecologist ahead of construction commencing and secured through a planning condition. Prior to any activities to protect the reptiles being carried out, seven presence/absence survey visits will be carried out to provide a current indication of their presence and potential numbers.

4.6.5. The reptile protection works will be carried out in compliance with the recommended guidelines (HGBI, 1998)[51] or equivalent. Measures could include supervision of a suitably experienced ecologist during the removal of any areas of tall grassland which would occur in dry weather when the temperature is above 15^0C between April and September. Furthermore, a toothed digger bucket will be used to remove the vegetation and topsoil. If any reptiles are discovered, they will be captured and released on Harty Marshes Reptile Receptor Site Extension that was created in November 2020[52] (**Appendix 3**).

Protection of Water Voles

4.6.6. The construction activities will involve works within 5m of the bank toe of the drainage ditch to the south of the Site, to facilitate the construction of a connection between the drainage ditch and the pond associated within the Twyford Pumping Station. Given the low-level risk of water vole presence in the ditch, a precautionary water vole field sign search will be carried out prior to the commencement of any works within 5m of the bank toe.

4.6.7. In the event that water voles are recorded during the precautionary field sign search and site preparation works, such as vegetation cutting and ground scraping will be carried out under a water vole displacement licence to facilitate the works within 5m of the bank toe.

4.7. Residual Effects

4.7.1. **Table 4.4** provides a summary of the residual effects resulting from the Twyford Pumping Station after effective implementation of the embedded and additional mitigation measures proposed above.

Table 4.4: Residual Biodiversity Effects

Development Phase	Ecological Feature Affected	Residual Effect
Construction	Statutory Designated Sites	Temporary neutral effect at international and national level
	Habitats	Temporary neutral to minor adverse effect at a zone of influence level
	Wintering and passaging birds	Temporary neutral effect at an international level
	Breeding birds	Permanent neutral effect at zone of influence level
	Reptiles	Temporary minor adverse effect at a local level
	Terrestrial Invertebrates	Temporary minor adverse effect at a local level
Operation	Statutory Designated Sites	Permanent neutral effect at an international and national level
	Habitats	Permanent moderate beneficial effect at a zone of influence level
	Wintering and passaging birds	Permanent neutral effect at an international level
	Breeding birds	Permanent neutral effect at a zone of influence level
	Reptiles	Permanent minor beneficial effect at a local level
	Terrestrial Invertebrates	Permanent minor beneficial effect at a local level

[51] Herpetofauna Groups of Britain and Ireland (1998) Evaluating local mitigation/translocation programmes: Maintain
[52] CampbellReith (November 2020) Queenborough & Rushenden, Harty Marshes Reptile Receptor Site Extension Update Report

4.8. Cumulative Effects

4.8.1. This section summarises the cumulative effects of the Twyford Pumping Station in combination with the construction and post-construction of development platforms on the Twyford Site, Klondyke Site and Former Steel Rolling Mill Site. All the schemes are anticipated to have an overlapping construction programme as well as be in operation at the same time. To this end, this section summarises the residual cumulative effects during construction followed by the cumulative effects post-construction or operation of the four developments.

4.8.2. If there is a requirement for additional mitigation measures to be implemented to minimise any potential significant adverse cumulative effects, these will be highlighted and considered in the assessment.

Construction

Statutory Designated Sites

4.8.3. There will be no loss of habitats within the adjacent Medway Estuary and Marshes SPA, Ramsar and SSSI.

4.8.4. Emissions from construction traffic associated with the schemes will be broadly concurrent with existing industrial and construction operations surrounding the sites and so will not result in any indirect impacts on the Medway Estuary and Marshes. Indirect impacts on wintering, passage and breeding birds which form the qualifying species of the SPA are discussed separately below.

4.8.5. The implementation of the CEMPs for the schemes, which will control lighting as well as emissions to land, air and water, will prevent adverse effects on the integrity of the designated sites, which will result in a temporary neutral cumulative effect at international and national level to the Medway Estuary and Marshes SPA, Ramsar and SSSI.

Habitats

4.8.6. The schemes will result in the loss of existing habitats within the construction footprint which will be replaced through the implementation of the Ecology and Landscape Management Plans for the schemes with further enhancements to Twyford, Klondyke and the Former Steel Rolling Mill Site forming part of future mixed-use development on the land raised platforms.

4.8.7. Dust emissions arising from topsoil stripping, excavations, remediation and land raising as well as emissions to water will be managed through the implementation of the CEMPs which will comply with best practice pollution prevention guidance. This will result in temporary negligible impacts and consequently negligible effects at a zone of influence level.

4.8.8. Overall, during construction, the loss of habitats within the Sites will result in temporary cumulative effects of neutral to minor adverse significance at a zone of influence level.

Wintering and Passage Birds

4.8.9. Waders and wildfowl are known to be susceptible to disturbance from noise and visual impacts with the potential zone of disturbance extending up to 500m as discussed in Section 4.5. There will be no potential impacts between April and late October, when the majority of the works on each of the Sites are programmed to occur because there will be no concentrations of wading migrants or winter visitors at this time. Instead, there is potential for adverse effects to occur on the wintering and passaging birds between November and March inclusive, when the concentrations of wading migrants or winter visitors are present. Although, the main roosts for

the interest species associated with the SPA and Ramsar Site are located over 750m from the Site and therefore will not be affected. During the construction activities, especially any on the flood defences, potential impacts may be expected on birds feeding on the mudflats during the intertidal periods in autumn and winter.

4.8.10. It is recognised that birds often become habituated, so it is reasonably expected that they will tolerate some regular and repetitive noise and visual activity. Noise and visual disturbance that is intermittent, infrequent and, in the case of noise, penetrating, may be expected to have the most impact. Construction works have been ongoing on the wider Twyford Site since 2014 and have occurred over winter on the Klondyke Site in 2018/2019 and are due to commence again shortly and therefore some degree of habituation is very likely to have occurred. It is noted that wintering birds have been monitored over during construction works at both Twyford Site and Klondyke Site between November and March especially when noisy activities occurred close to the western site boundaries and no disturbance has been recorded to date.

4.8.11. The Twyford Pumping Station works will be largely screened by the flood defences and therefore noise is expected to have greater impact than visual disturbance. There will be some works on the flood defences when the outfall from the pumping station is installed. Therefore, to minimise impacts on birds between November and March inclusive, the construction activities have been programmed to be away from the flood defences and therefore the wintering and passaging birds during this period.

4.8.12. Furthermore, the implementation of the CEMPs during the construction works at each site will minimise the noise and visual effects on the wintering birds.

4.8.13. Overall, the effect will be a temporary neutral cumulative effect at an international to wintering and passage birds.

Breeding Birds

4.8.14. There is a low potential for nesting birds due to the ongoing vegetation management across all the sites. However, if they are present disturbance will be minimised through the effective implementation of the CEMP which includes the preference to clear vegetation outside of the breeding bird season.

4.8.15. Construction activities on each site will also potentially result in noise, air and water pollution and visual impacts causing potential disturbance and displacement of breeding birds either on a temporary or permanent basis and may result in nests being abandoned within the Site or its immediate vicinity. These impacts will also be minimised through the implementation of the noise, dust and water control measures within the CEMPs as well as works being carried out in accordance with the best practice pollution prevention guidance.

4.8.16. Overall, construction activities will have a permanent neutral cumulative effect at a zone of influence level to breeding birds within the sites.

Reptiles

4.8.17. Low populations of viviparous lizards and slow worm are potentially located along the ditch banks and the flood defences within the Site as well as within the Klondyke Site. The reptiles have already been captured and removed from the Twyford and Former Steel Rolling Mill Sites. The temporary loss of habitat suitable for reptiles during construction will result in a temporary minor adverse cumulative effect at a local level.

Terrestrial Invertebrates

4.8.18. Terrestrial invertebrates are potentially located along the ditch banks and the flood defences within the Site as well as along the wider flood defences within the Twyford Site and in The Saltings within Klondyke Site. The loss of habitat suitable for terrestrial invertebrates during construction activities will result in a temporary minor adverse cumulative effect at a local level.

Operation

Medway Estuary and Marshes SPA/Ramsar/SSSI

4.8.19. The Twyford Pumping Station will discharge water to a location approximately 115m south of the existing outfall associated with the existing pumping station and will discharge at a rate of 400 l/s. The water quality will be either the same or better than the water discharged from the existing pumping station as the water will pass through a vegetated ditch/pond which will allow settlement of sediment and adsorption of nutrients including nitrogen and phosphorus to occur. This will improve the water quality being discharged into the Swale compared to the existing situation. The flow rate of the discharged water will remain low enough not to cause any likely significant effect on the habitats or qualifying species on the Medway Estuary and Marshes SPA, Ramsar and SSSI.

4.8.20. Once operational there will be few activities associated with the schemes occurring apart from occasional site inspections of the land raised platforms and the Twyford Pumping Station and authorised access to the flood defences. The pedestrian access along Footpaths ZB48 and ZB49 will be re-instated post-construction, however this will cause no change compared to the baseline.

4.8.21. There will be no noise or dust on the mudflats during operation of the schemes as there will be no activities occurring on the site that may cause noise or dust.

4.8.22. Overall, there will be a permanent neutral cumulative effect at an international and national level on the Medway Estuary and Marshes SPA, Ramsar and SSSI.

Habitats

4.8.23. As a result of the implementation of the Ecology and Landscape Management Plans parts of the Site, Klondyke Site and Former Steel Rolling Mill Site that do not form the raised development platforms will be seeded or planted. The Twyford Site will not be planted or seeded.

4.8.24. Furthermore, within the ditch/pond within the Site and the pond and swale in the Former Steel Rolling Mill Site the aquatic plant species will naturally establish. Together, once established the grass and aquatic plants will create a more diverse habitat compared to the original habitats before construction commenced.

4.8.25. The area of the flood defences within the Site and the wider Twyford Site where vegetation was removed to facilitate construction activities will be left to allow the species in the topsoil to naturally re-establish.

4.8.26. This will result in a permanent moderate beneficial cumulative effect at a zone of influence level.

Wintering and Passage Birds

4.8.27. Once operational there will be few activities associated with the schemes apart from occasional site inspections and authorised access to the flood defences. The pedestrian access along

Footpaths ZB48 and ZB49 will be re-instated post-construction, however this will cause no change compared to the baseline.

4.8.28. The Twyford Pumping Station will discharge water to a location approximately 115m south of the existing outfall associated with the existing pumping station. The water quality will be either the same or better than the water discharged from the existing pumping station as the water will pass through a vegetated ditch/pond which will allow settlement of sediment and adsorption of nutrients including nitrogen and phosphorus to occur. This will improve the water quality being discharged into the Swale compared to the existing situation. The flow rate of the discharged water will be equivalent to the existing flows and remain low enough not to cause any likely significant effect on the habitats or qualifying species on the Medway Estuary and Marshes SPA, Ramsar and SSSI.

4.8.29. Overall, there will be a permanent neutral cumulative effect at an international level.

Breeding Birds

4.8.30. During operation, there will be some limited opportunities for wildfowl to nest within the new ditch and pond as well as ground nesting birds within the grassland on the Site, Klondyke Site and Former Steel Rolling Mill Site. There will also be no impacts on the nesting sites associated with qualifying species of the Medway Estuary and Marshes SPA, Ramsar and SSSI. Overall, there will be permanent neutral cumulative effects at a zone of influence level.

Reptiles

4.8.31. During operation, once the new enhanced grassland habitats within the Site, Klondyke Site and Former Steel Rolling Mill Site have become established, there will be new and enhanced reptile habitat created resulting in a permanent minor beneficial cumulative effect at a local level in respect to reptiles.

Terrestrial Invertebrates

4.8.32. During operation, once the new enhanced grassland and aquatic habitats within the Sites have become established, there will be new and enhanced terrestrial invertebrate habitats created which will resulting a permanent minor beneficial cumulative effect at a local level in respect to terrestrial invertebrates.

4.9. Summary

4.9.1. The Site is located adjacent to the Swale within the Upper Medway Estuary and Marshes SPA, Ramsar and SSSI. The Site is characterised by disturbed ground where topsoil from the wider Twyford Site has been temporarily stored and is covered in vegetation, with a culverted drain flowing through the Site and grassed flood defences on the western boundary. The Site and its surroundings support wintering, passaging and breeding birds, reptiles and terrestrial invertebrates.

4.9.2. During construction, through the implementation of the CEMP and Ecology and Landscape Management Plan and careful timing of construction activities, there will be temporary neutral effects at international and national levels for statutory designated sites and wintering and passaging birds, temporary minor adverse effects on reptiles and terrestrial invertebrates at a local level, and a permanent neutral effect on breeding birds at a zone of influence level.

4.9.3. During operation, through the implementation of the Ecology and Landscape Management Plan there will be permanent neutral effects at international and national levels for statutory designated sites and wintering and passaging birds, permanent minor beneficial effects on reptiles and terrestrial invertebrates at a local level, and a permanent neutral effect on breeding birds at a zone of influence level.

4.9.4. The Proposed Development in combination with the creation of development platforms at the Twyford, Klondyke and Former Steel Rolling Mill Site will not result in any additional significant effects during construction and operation that are above and beyond those for the Proposed Development on its own as a result of the implementation of CEMPs and Ecology and Landscape Management Plans.

5.0 HISTORIC ENVIRONMENT

5.1. Introduction

5.1.1. This chapter assesses the likely significant effects of the Twyford Pumping Station in terms of the historic environment.

5.1.2. The chapter describes: the assessment methodology; the baseline conditions at the Site and in the surrounding area; the likely significant environmental effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; the likely residual effects after these measures have been employed.

5.1.3. This chapter is designed to be read in conjunction with Chapter 6 Landscape Effects especially in relation to the Queenborough Conservation Area and its associated Listed Buildings.

5.2. Legislation and Planning Policy

5.2.1. The historic environment assessment has been undertaken within the context of relevant planning policies, guidance documents and legislative instruments. These documents and policies identify the historic environment resource as a non-renewable, fragile and finite resource, the conservation of which accords with the principles of sustainable development, and a priority is placed on its conservation, including the setting out of tests to ensure any damage or loss is permitted only where it is properly justified. The key documents and policies are summarised below.

Legislation

5.2.2. The main legislation affording protection to heritage assets, relevant to this assessment are listed below:

- **Ancient Monuments and Archaeological Areas Act 1979**[53] provides for nationally important archaeological sites to be statutorily protected as Scheduled Monuments. Under this act Scheduled Monument Consent must be sought for any works which may affect a designated Scheduled Monument; and
- **Planning (Listed Buildings and Conservation Areas) Act 1990** [54] provides Conservation Areas and Listed Buildings with statutory protection through the planning process. This protection is achieved by the inclusion of suitable buildings within the lists of buildings of special architectural interest (Listed Buildings) and the designation of Conservation Areas. Works affecting Listed Buildings and Conservation Areas are subject to additional planning controls administered by Local Planning Authorities.

Planning Policy Context

National Planning Policy

The National Planning Policy Framework (NPPF)[55]

5.2.3. The principle national guidance on the importance, management and safeguarding of heritage assets within the planning process is Section 16: Conserving and Enhancing the Historic

[53] Her Majesty's Stationary Office (1979) Ancient Monuments and Archaeological Areas Act 1979
[54] Her Majesty's Stationary Office (1990) Planning Process (Listed Buildings and Conservation Areas) Act 1990
[55] Ministry of Housing, Communities and Local Government (February 2019) National Planning Policy Framework

Environment. The aim of the NPPF Section 16 is to ensure that Local Planning Authorities, developers and owners of heritage assets, adopt a consistent and holistic approach to conserving the historic environment.

5.2.4. NPPF Section 16, Paragraphs 184 to 202 identifies the approach to be taken by planning authorities in considering applications for consent that may affect heritage assets, defined as a building, monument, site, place, area or landscape positively identified as having a degree of significance meriting consideration in planning decisions.

Planning Practice Guidance: Conserving and enhancing the historic environment[56]

5.2.5. The Planning Practice Guidance: Conserving and enhancing the historic environment, which was published online in 2014 and updated in February 2018, reiterates that the appropriate conservation of heritage assets forms one of the 'Core Planning Principles', requiring a flexible and thoughtful approach. Furthermore, it highlights that neglect and decay of heritage assets are best addressed through ensuring that heritage assets remain in an active use that is consistent with their conservation. Importantly, the guidance states that if complete, or partial loss of a heritage asset is justified, the aim should then be to capture and record the evidence of the asset's significance and make the interpretation publicly available.

5.2.6. Key elements of the guidance relate to assessing harm. An important consideration should be whether the proposed works adversely affect a key element of the heritage asset's special architectural or historic interest. Additionally, it is the degree of harm, rather than the scale of development, that is to be assessed. The level of 'substantial harm' is considered to be a high test that may not arise in many cases. Essentially, whether a proposal causes substantial harm will be a judgement for the decision maker, having regard to the circumstances of the case and the NPPF. Importantly, harm may arise from works to the asset or from development within its setting.

5.2.7. Setting is defined as the surroundings in which an asset is experienced and may be more extensive than the curtilage. A thorough assessment of the impact of proposals upon setting needs to take into account, and be proportionate to, the significance of the heritage asset and the degree to which proposed changes enhance or detract from that significance and the ability to appreciate it.

Local Planning Policy

Bearing Fruits 2031: The Swale Borough Local Plan 2017[57]

5.2.8. SBC adopted Bearing Fruits 2031: The Swale Borough Local Plan in 2017. It set out the vision and overall development strategy for the area and how it will be achieved for the period between 2014 and 2031. It identifies where development will take place and how the natural environment and built heritage of the Borough will be protected and enhanced. The relevant policy to this assessment is Policy CP 8 Conserving and enhancing the historic environment.

'To support the Borough's heritage assets, the Council will prepare a Heritage Strategy. Development will sustain and enhance the significance of designated and non-designated

[56] Department for Communities and Local Government (February 2018) Planning Policy Guidance Conserving and enhancing the historic environment (ID:18a)
[57] Swale Borough Council (July 2017) Bearing Fruits 2031: The Swale Borough Local Plan

heritage assets to sustain the historic environment whilst creating for all areas a sense of place and special identity. Development proposals will, as appropriate:

1. *Accord with national planning policy in respect of heritage matters, together with any heritage strategy adopted by the Council;*
2. *Sustain and enhance the significance of Swale's designated and non-designated heritage assets and their settings in a manner appropriate to their significance and, where appropriate, in accordance with Policies DM 32-DM 36;*
3. *Respond to the integrity, form and character of settlements and historic landscapes;*
4. *Bring heritage assets into sensitive and sustainable use within allocations, neighbourhood plans, regeneration areas and town centres, especially for assets identified as being at risk on national or local registers;*
5. *Respond positively to the conservation area appraisals and management strategies prepared by the Council;*
6. *Respect the integrity of heritage assets, whilst meeting the challenges of a low carbon future; and*
7. *Promote the enjoyment of heritage assets through education, accessibility, interpretation and improved access.'*

Swale Local Plan Review 2021[58]

5.2.9. Swale Borough Council is currently carrying out a Regulation 19 consultation between the 8th February and 30th April 2021. The consultation is in regards to a review which sets out the amount and location of new housing and employment and the planning policies to guide development in the borough for the period 2022 to 2038.

5.2.10. Emerging policy DM 38 Development Involving Listed Buildings states:

'Development proposals, including any change of use, affecting a listed building, and/or its setting, will be permitted provided that:

1. *The listed building's special architectural or historic interest, its setting and any features of special architectural or historic interest which it possesses, are preserved, paying special attention to the:*
   a. *Design, including scale, materials, situation and detailing;*
   b. *appropriateness of the proposed use of the building; and*
   c. *desirability of removing unsightly or negative features or restoring or reinstating historic features.*
2. *When considering the impact of proposed works and/or a proposed development on the significance of a listed building, great weight will be given to the building's conservation (and the more important the listed building, the greater the weight will be). This is irrespective of whether any potential harm amounts to substantial harm, total loss or less than substantial harm to its significance. Where a development proposal will lead to less than substantial harm to the significance of a listed building, this harm will be weighed*

[58] Swale Borough Council (February 2021) Local Plan Review 2021. Pre-Submission Document (Regulation 19)

against the public benefits of the proposal including, where appropriate, securing its optimum viable use.

3. *The total or part demolition of a listed building is wholly exceptional, and will only be permitted provided that there is:*

   a. *Evidence that any public benefits are substantial and these cannot otherwise be provided without substantially harming the significance of a heritage asset;*

   b. *Evidence that the nature and/or condition of the heritage asset precludes all reasonable uses or re-uses of the asset;*

   c. *Evidence of long-term redundancy and proactive marketing for all possible uses of the heritage asset for a minimum of five years;*

   d. *Evidence of applications, made to a professional standard, for grant funding to help secure the conservation of the listed building;*

   e. *Evidence that the asset cannot otherwise be brought back in to use without substantially harming its significance;*

   f. *Evidence that preservation through charitable or community ownership is not possible or suitable; and*

   g. *Evidence that the cost of maintaining and repairing the building outweighs its significance and the value derived from its continued use.*

4. *If as a last resort, the Borough Council is prepared to consider the grant of a listed building consent for demolition, it may, in appropriate circumstances, consider whether the building could be re-erected elsewhere to an appropriate location. When re-location is not possible and demolition is permitted, arrangements will be required to allow access to the building prior to demolition to make an appropriate documentary record of it and to allow for the salvaging of materials and features.'*

5.2.11. Policy DM 39 Development Affecting a Conservation Area states:

'Development (including changes of use and the demolition of unlisted buildings or other structures) within, affecting the setting of, or views into and out of a conservation area, will be required to preserve or enhance all features that contribute positively to the area's special character or appearance. Furthermore, the Borough Council will expect development proposals to:

i. *Respond positively to its conservation area character appraisal & management plan documents where these have been prepared;*

ii. *Retain the layout, form of streets, spaces, means of enclosure and buildings, and pay special attention to the use of architectural detailing and materials, surfaces, landform, vegetation and land use;*

iii. *Remove features that detract from the character of the area and reinstate those that would enhance it; and*

iv. *Retain unlisted buildings or other structures that make, or could make, a positive contribution to the character or appearance of the area.*

Planning applications for development within or adjacent to a conservation area will be required to include a Heritage Statement which demonstrates a clear understanding of the significance of the conservation area, any related individual or group heritage assets affected by proposals and the impact on heritage significance, as applicable.

Historic commercial premises such as shops and pubs in active use provide vitality (through window displays and signage), which can make a positive contribution to the character and appearance of a conservation area. As such, any new or replacement signage within conservation areas will be required to be of the highest possible standard and contribute to a safe and attractive environment, and advertisements (including hoardings, illumination of hoardings, illuminated fascia signs, free-standing display panels, and estate agent boards) which require consent must not cause a public safety hazard or contribute to clutter or a loss of amenity. Schemes submitted for approval will be expected to:

i. be of a high quality and sensitive to its visual appearance in relation to its siting (including the building or structure on which it is to be sited) and the surrounding street scene, especially in the case of listed buildings;

ii. not contribute to an unsightly proliferation or clutter of signage in the vicinity;

iii. not cause a hazard to pedestrians or road users;

iv. not cause visual intrusion by virtue of light pollution into adjoining properties and avoid light pollution of nearby wildlife habitats; and

v. not have flashing or visually jarring internal or external illumination and be appropriate and relevant to the overall character and architectural detailing of the building(s). New development within Swale's conservation areas and their settings are required to be of high-quality contextual design so that they conserve or enhance a conservation area's significance. Harm to the significance of a conservation area will not be permitted unless there is a clear and convincing justification. Substantial harm to the significance of a conservation area will be strongly resisted.'

5.2.12. Policy DM 43 Archaeological Heritage states:

1. *'The Council will promote the enjoyment of Swale borough's archaeological resource through the protection and enhancement of archaeological sites, monuments and historic landscape features, and will seek to encourage and develop their educational, recreational and tourist potential through research, public access, management and interpretation.*

2. *Where possible developers should seek to use Swale's archaeological assets to shape their development proposals, provide interest and character and protect the assets.*

3. *The framework for the management and enjoyment of Swale's archaeological heritage is the Swale Heritage Strategy 2020 - 2032 (adopted 2020).*

4. *Development proposals affecting heritage assets with an archaeological interest must be accompanied by a desk-based assessment, and if necessary by archaeological fieldwork, that:*

    i. *Characterises the nature, extent and condition of the archaeological deposits in the development area;*

ii. *Assesses the significance of the deposits and the contribution made by their setting;*

iii. *Describes and assesses the impact of the development proposals on the archaeological deposits, their significance, and their setting; and*

iv. *Describes how the archaeological deposits will be protected during development. Where this is not possible the assessment should clearly justify why this is not possible and should describe the proposals for mitigating any impacts.*

5. *Development proposals leading to substantial harm to the archaeological interest of designated heritage assets such as Scheduled Monuments, Registered Parks and Gardens, Protected Military Remains or other heritage assets of comparable significance will normally be refused.*

6. *Where development proposals affect non-designated heritage assets with an archaeological interest, the Borough Council would expect the archaeological deposits to be preserved in-situ. Where this is not possible clear justification will be required. Where the justification is accepted, a programme of archaeological recording may be required to be carried out. The type/extent of fieldwork will be appropriate to the significance of the archaeological deposits and must be carried out by an appropriately qualified contractor following a written specification agreed by the Borough Council. The programme of recording will include all phases of desk-based assessment and fieldwork, post-excavation analysis, publication of the results and deposition of the site archive in an appropriate repository.'*

5.3. Assessment Methodology and Significance Criteria

5.3.1. The approach adopted for the historic environment assessment was undertaken within the remit of the NPPF and in accordance with current best archaeological practice and the appropriate national standards and guidelines, including:

- The Management of Research Projects in the Historic Environment (MoRPHE)[59];
- Standards and Guidance for Historic Environment Desk-Based Assessment[60];
- Chartered Institute for Archaeologists' Code of Conduct[61]; and
- The Setting of Heritage Assets[62].

Desk-Based Study

5.3.2. A desk study was undertaken in 2013 within a 1km radius of the Twyford and Klondyke Sites (which included the Site) to provide context for the known and potential resources within and surrounding the Twyford and Klondyke Sites and identify any designated or non-designated heritage assets[63]. During the desk study the following organisations were contacted:

- The Kent Historic Environment Record (KHER);

[59] English Heritage (2006). The Management of Research Projects in the Historic Environment.
[60] Chartered Institute for Archaeologists (2017) Standards and guidance for Historic Environment Desk-Based Assessment. Reading.
[61] Chartered Institute for Archaeologists (2014) Code of Conduct
[62] Historic England (2015) the Setting of Heritage Assets. Historic England Good Practice Advice in Planning: 3
[63] CampbellReith (December 2013) Queenborough and Rushenden, Phase 2 – Twyford and Klondyke Sites, Cultural Heritage

- Queenborough, Isle of Sheppey, Kent, Historic Area Appraisal[64];
- Kent History and Library Centre;
- National Heritage List for England (NHLE);
- Kent Landscape Information System (KLIS); and
- Multi-Agency Geographic Information for the Countryside (MAGIC) website[65].

5.3.3. To inform the Twyford Pumping Station, the information obtained 2013 was compared to current information (January 2021) on MAGIC and also Kent County Council's Heritage Maps[66] to ensure that any information available since 2013 has been included in the assessment. No new heritage assets were identified.

Site Investigations

5.3.4. The following site investigations have been carried out across the Twyford Site (including the Site), Klondyke Site and Former Steel Rolling Mill Site:

- Archaeological Watching Brief within the Twyford Site (2015)[67];
- Archaeological test pits and boreholes in the Former Rolling Mill Site (November 2018)[68]; and
- Archaeological boreholes in the Klondyke Site (July 2019)[69].

Limitations and Assumptions

5.3.5. Data used to compile this report consists of secondary information derived from a variety of sources. The assumption is made that this data, as well as that derived from other secondary sources, is reasonably accurate.

5.3.6. The records held by KHER are not a record of all surviving heritage assets, but a record of the discovery of a wide range of archaeological and historical components of the historic environment. The information held within it is not complete and does not preclude the subsequent discovery of further heritage assets that are, at present unknown.

5.3.7. It can be difficult to predict accurately the presence and likely significance of buried assets, and consequently the impact upon them, based primarily on desk-based sources. The principal source of information is the KHER, which lists all known archaeological sites and finds. The information provides an initial indication of assets present rather than a definitive list of all potential archaeological assets because the full extent of a buried heritage resources cannot be known prior to site-specific archaeological field investigation.

Impact Assessment and Significance Criteria

5.3.8. To arrive at a judgement on the significance of effect, the assessment needs to consider the relative importance of the individual elements of the historic environment resource (heritage assets) and how these are likely to be affected. The difference in the nature and scale of

[64] English Heritage (2006) Queenborough, Isle of Sheppey, Kent, Historic Area Appraisal
[65] Magic Map Application (defra.gov.uk)
[66] Heritage Maps (kent.gov.uk)
[67] Oxford Archaeology (April 2016) Queenborough and Rushenden Phase 2 – The Former Pyramid Works of Alfred Johnson and Son, Queenborough, Kent. Archaeological Watching Brief Report.
[68] CampbellReith (October 2019) Former Steeling Rolling Mill Site, Queenborough & Rushenden, Updated Archaeology Report
[69] CampbellReith (October 2019) Queenborough & Rushenden, Phase 2 – Klondyke Site. Archaeology Report

archaeological, built heritage and historic landscape features necessitates the use of different methodologies to determine the significance of effect of any proposed development.

Methodology for Evaluation of the Significance of Heritage Assets

5.3.9. 'Significance' lies in the value of a heritage asset to this and future generations. Known and potential heritage assets within the Site and its vicinity have been identified from national and local designations, HER data and expert opinion. The determination of the significance of heritage assets is based on the statutory designation (which is described below under the sub-headings Archaeology, Built Heritage and Historic Landscape) and/or professional judgement against the following values, and has taken into account the likely nature, date, extent, survival, condition, rarity and group value:

- **Evidential value**: the potential for the physical remains to yield evidence of past human activity. This might take into account date, rarity, state of preservation, diversity/complexity, contribution to published priorities, supporting documentation, collective value and comparative potential;
- **Aesthetic value**: this derives from the ways in which people draw sensory and intellectual stimulation from the heritage asset, taking into account what other people have said or written;
- **Historical value**: the ways in which past people, events and aspects of life can be connected through heritage assets to the present, such a connection often being illustrative or associative; and
- **Communal value**: this derives from the means of a heritage asset for people who know about it, or for whom it figures in their collective experience or memory. Communal values are closely bound up with historical, particularly associative, and aesthetic values, along with educational, social or economic values.

Archaeology

5.3.10. The value or significance of archaeological features has been assessed using the Secretary of State's non-statutory criteria for the selection of monuments for scheduling, as modified by English Heritage (now Historic England) for the designation of ancient monuments as part of its Monument Protection Plan (MPP). The criteria for archaeological features are:

- Survival;
- Documentation (archaeological and historical);
- Group value (association and clustering);
- Diversity (features);
- Potential; and
- Amenity value.

5.3.11. These criteria are applicable to the assessment of all sites, whether scheduled or not.

Built Heritage

5.3.12. The assessment of the value of built heritage (or significance of the asset) follows the Secretary of State's criteria for the inclusion of buildings on the statutory list, defined as:

- Architectural interest;
- Historic interest;
- Close historical association; and
- Group value.

Historic Landscape

5.3.13. There is no statutory guidance for evaluating historic landscapes, although certain elements of the landscape may have statutory designations, such as Registered Parks and Gardens (Grades I, II* and II), Registered Battlefields, Scheduled Monuments, Listed Buildings and historic hedgerows, which individually may be valued as important or very important. However, the overall value of the historic landscape is not necessarily determined by the presence or absence of statutorily designated sites and/or areas.

5.3.14. The value of the historic landscape has been assessed using a modified version of the criteria for assessing the value of archaeological sites and monuments previously mentioned. The criteria used are:

- Documentation;
- Rarity;
- Diversity;
- Amenity value;
- Fragility and vulnerability;
- Time depth;
- Survival/condition;
- Typicality; and
- Potential.

Ranking of Significance of the Heritage Asset

5.3.15. The significance of a receptor/resource is based on the relative importance of the receptor using the scale in **Table 5.1** below.

Table 5.1: Methodology for Determining Significance of a Heritage Asset

Significance of Asset	Examples of Receptor/Resource
Very High	The receptor/resource has very little ability to absorb change without fundamentally altering its present character, or is of international importance.
High	The receptor/resource has little ability to absorb change without fundamentally altering its present character, or is of national importance.
Moderate	The receptor/resource has moderate capacity to absorb change without significantly altering its present character, or is of high importance.
Low	The receptor/resource is tolerant of change without detriment to its character, is of low or local importance.

5.3.16. **Table 5.2** presents the significance of individual elements of the historic environment resource (archaeology, built heritage and historic landscape).

Table 5.2: Scale of Significance of Heritage Assets

Significance of Heritage Assets	Archaeology	Built Heritage	Historic Landscape
International importance (Very high value)	World Heritage Sites inscribed for their archaeological or built heritage qualities. Sites of international importance.	Standing remains inscribed as universal importance such as World Heritage Sites. Other buildings of recognised international importance.	World Heritage Sites inscribed for their historic landscape qualities. Historic landscapes of international importance.
National Importance (High value)	Scheduled Monuments or monuments in the process of being scheduled. Undesignated sites and monuments of schedulable quality and importance. Previously unknown sites of schedulable quality and importance discovered during evaluation or mitigation.	Grade I, II* and II Listed Buildings. Other Listed Buildings that have been shown to have exceptional qualities in their fabric or historical association not adequately reflected in the listing. Registered Parks and Gardens Grade I, II* and II. Conservation Areas containing very important buildings.	Designated historic landscapes of outstanding interest. Undesignated landscapes of high quality and importance, and of demonstrable national importance.
Regional importance (Medium value)	Local authority designated heritage sites. Previously unknown and undesignated sites that would justify Local Authority designation (i.e. sites of regional importance). Sites with specific and substantial importance to the local community.	Historic buildings that can be shown to have exceptional qualities or historical association. Conservation Areas, historic townscapes or built-up areas with historic integrity in their buildings, or built settings.	Designated special historic landscapes. Undesignated historic landscape that would justify special historic landscape designation. Landscapes of regional importance. Historic landscapes with specific and substantial importance to the wider community.
Local importance (Low value)	Undesignated sites of local importance. Sites with specific and substantial importance to local interest groups, but with limited wider importance. Archaeological sites whose importance is limited by poor preservation and/or poor survival of contextual associations. Sites and features of limited value in themselves or whose importance is limited. These may include those for which detailed information is available in primary sources and where archaeological investigation would add no significant information.	'Locally Listed' Buildings. Historic (unlisted) buildings of modest quality in their fabric or historical association. Historic townscape or built-up areas of limited historic integrity in their buildings, or built settings.	Undesignated historic landscapes of local importance. Historic landscape with specific and substantial importance to local interest groups, but with limited wider importance. Historic landscapes whose importance is limited by poor preservation and/or poor survival of contextual associations. Historic landscapes of limited value including those for which detailed information is available in primary sources and where further investigation would add no significant information.
Negligible	Sites with very little or no surviving	Buildings of no architectural or historical note,	Landscapes with no significant historical interest.

Significance of Heritage Assets	Archaeology	Built Heritage	Historic Landscape
	archaeological interest.	buildings of intrusive character.	
Unknown	The importance of the resource cannot be ascertained.	The importance of the buildings cannot be ascertained.	The importance of the resource cannot be ascertained.

Prediction of Impacts and Significance of Effects

5.3.17. The likely effects upon historic environment receptors are dependent upon the significance of the heritage asset and the magnitude of the impact.

5.3.18. The magnitude of an impact is described as very large, large, medium, small or negligible. Impacts are neither beneficial nor adverse in nature. Such terms are relative to the receptor affected by the impact (i.e. a particular impact can result in a beneficial effect on one receptor and an adverse effect on another), and the criteria associated with them are summarised in **Table 5.3**.

Table 5.3: Criteria used to Define the Magnitude of an Impact

Relative level of predicted impact	Criteria
Very large	Very large scale loss of resource and/or quality and integrity of resource; very severe damage to key characteristics, features or elements. Very large scale or major improvement of resource quality; extensive restoration or enhancement; very major improvement of attribute quality.
Large	Large scale loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements. Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
Medium	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements. Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Small	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements. Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on an attribute or a reduced risk of negative impact occurring.
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements. Very minor benefit to or positive addition of one or more characteristics, features or elements.
No Change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

5.3.19. The relative significance of an effect is largely a product of the magnitude and duration of the impact and the significance of the heritage asset, but the assessment is moderated by professional judgement and takes into account the considerations described above.

5.3.20. The significance of an environmental effect is determined by the interaction of the significance of the heritage asset and magnitude of impact, whereby the effects can be beneficial or adverse as shown on **Table 5.4**.

Table 5.4: Methodology for Assessing Significance

Sensitivity/Value of Receptor	Magnitude of Effect				
	Very Large	Large	Medium	Small	Negligible
Very High	Substantial Significance	Substantial Significance	Moderate Significance	Moderate Significance	[1]
High	Substantial Significance	Moderate Significance	Moderate Significance	Minor Significance	[2]
Medium	Moderate Significance	Moderate Significance	Minor Significance	[2]	Neutral
Low	Moderate Significance	Minor Significance	[2]	Neutral	Neutral
Negligible	[1]	[2]	Neutral	Neutral	Neutral
[1] The choice between 'Moderate Significance', 'Minor Significance' and 'Neutral' will depend on the specifics of the effect and will rely upon professional judgement and reasoning.					
[2] The choice between 'Minor Significance' and 'Neutral' will depend on the specifics of the effect and will rely upon professional judgement and reasoning.					

5.4. Baseline Conditions

5.4.1. The following section provides a summary of the archaeological and historical development of the Site and its environs, based on information held by the KHER and previous investigations and interventions in the area which are discussed in Section 5.3. The distribution of the archaeological resource is shown in **Figure 5.1**.

Previous Archaeological Interventions

5.4.2. No previous archaeological investigations prior to 2015 have been undertaken within the Site or the surrounding Twyford, Klondyke and Former Steel Rolling Mill Sites, however interventions have been recorded within the study area which are described below, along with the findings of the investigations that have occurred in 2015, 2018 and 2019 within the study area.

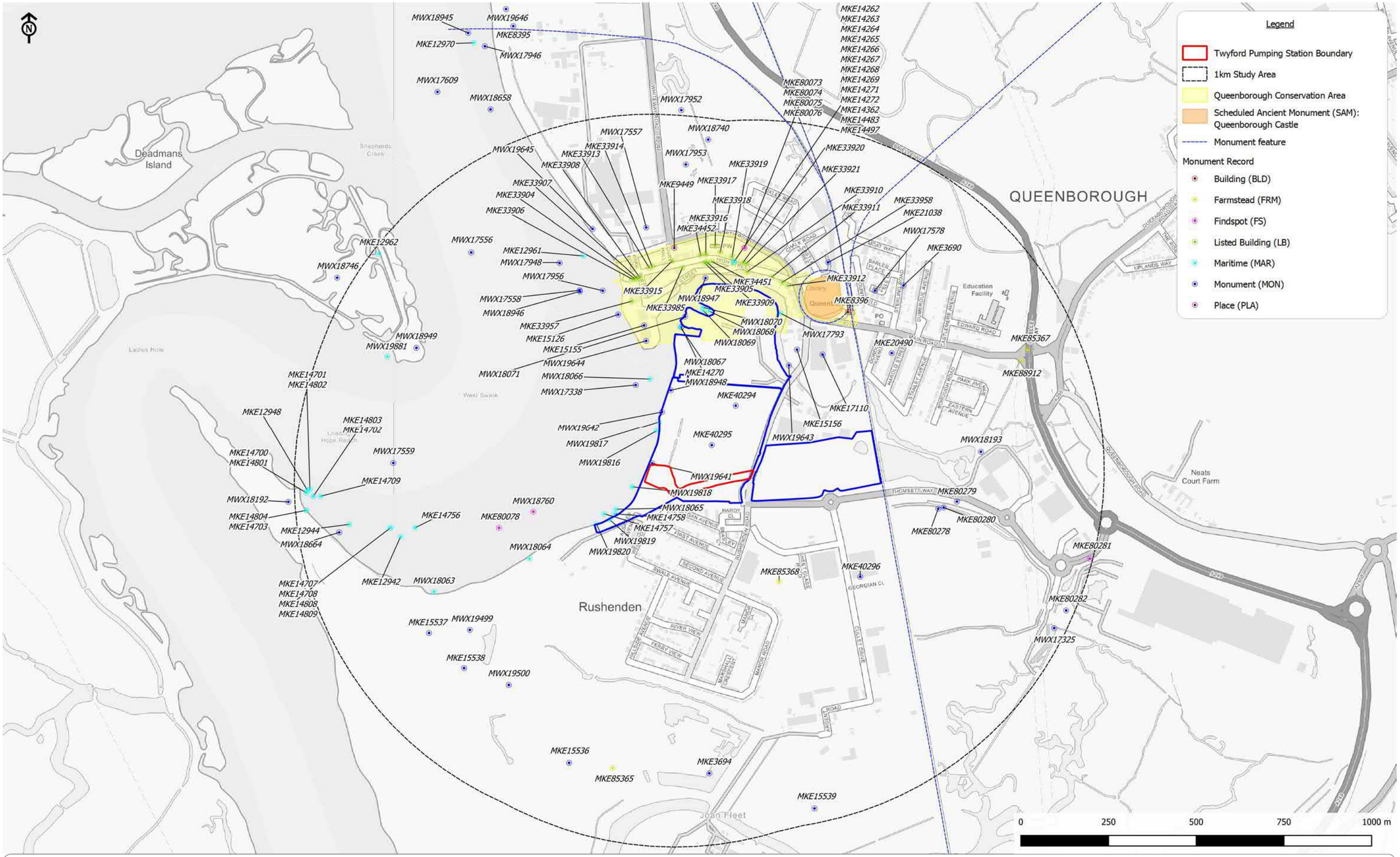
Archaeological and Historical Background

5.4.3. Archaeological potential is dependent upon human activity during antiquity in the area under consideration. This in turn is dependent upon environmental conditions providing a suitable habitat for human existence. Such human habitation can leave remains such as built and upstanding structures, buried features such as foundations or ruins, or scattered and buried artefacts such as tools or bones which can indicate when the area was occupied.

5.4.4. The principle archaeological periods used within the assessment are listed in **Table 5.5**.

Table 5.5: Archaeological Periods used in the Assessment

Period	Approximate Duration
Prehistoric: Palaeolithic	c. 500,000 BC – c. 10,000 BC
Prehistoric: Mesolithic	c. 10,000 BC – c. 4,300 BC
Prehistoric: Neolithic	c. 4,300 BC – c. 2,350 BC
Prehistoric: Bronze Age	c. 2, 350 BC – c. 701 BC
Prehistoric: Iron Age	c. 701 BC – c. AD 43



Queenborough and Rushenden

Client: Homes England

Figure 5.1:
Historic Environment Records

Scale: 1:10000@A3

Job Number: 11465
Drawn by - Checked by: RP - MC
Drg No - Status/Revision: GIS252 - B
File location: N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\Environmental Report (pdf in Outputs)
Date (Revision History): 23/03/2021 (A, First Issue, 01/03/21, RP; B, Boundary Update, 23/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

Period	Approximate Duration
Romano-British	c. AD 43 – c. AD 409
Early Medieval	c. AD 410 – c. AD 1065
Medieval	c. AD 1066 – c. AD 1500
Post-medieval	c. AD 1500 – C. AD 1789
Modern	c. AD 1789 – C. 1970

Prehistoric

Palaeolithic to Neolithic

5.4.5. Prehistoric evidence from within the study area is relatively sparse. Typically, Holocene sediment bodies in the Medway Estuary consist of clay-silt units alternating with organic rich silts or peats. Locally coarser grained sediments may also occur in the sequence and include sands and gravel units (typically in the mid-channel positions or close to the mouth of the Medway). The thickest sequences of sediments lie along the axis of the river valley/estuary and can be up to 25m thick in places, thinning upstream and towards the channel markings. In places these Holocene sediments overlie Pleistocene sands and gravels and these have been well exposed during the excavations for the Medway Tunnel and more recently along the west side of the Medway Estuary where a series of Later Middle and Upper Pleistocene sediments have been identified. Pleistocene sediments are present along the southern margin of the Swale but are not known to extend into the area of western Sheppey.

5.4.6. Closer to the Site, Holocene sediments have been described at Motney Hill and Queenborough. At both sites, initial flooding into the Tertiary bedrock surface took place under brackish conditions and subsequently peat development, indicative of regression of the sea, was documented. The sequences at Queenborough indicate flooding began around 7,400 years ago (calibrated) when sediments began to accumulate around -7m O.D. Sedimentation only began at Motney Hill around 5,500 years ago when flooding began at around -1m O.D. (Russel et al, 2011).

5.4.7. Archaeological material has been located in a number of places associated both with the drier ground contexts of the higher ground beyond the river/estuarine alluvium, as well as material present beneath the alluvium in contexts sealed by deposition of clay-silts and peats associated with sea level change in the lower Medway. Specific geoarchaeological investigation south-east of the Site along the alignment of Thomsett Way suggested the presence of a buried land surface in places.

5.4.8. The bedrock at the Klondyke Site is London Clay Formation which exhibits surface expression both to the south and north of the Site. The topographic low between these two 'islands' of Tertiary bedrock is fille with alluvium according to the British Geological Survey mapping of the area. The modern drainage through the area is occupied by The Creek that follows a path closer to the northern Tertiary outcrop.

5.4.9. The results of the deposit modelling and borehole sampling and analysis concluded that typically the Holocene sediment bodies in the Medway Estuary consist of clay-slit units alternating with organic rich silts or peats. Northing was recovered from the cores or

assessment at the Klondyke Site or Former Steel Rolling Mill Site to indicate human activity in the vicinity of the Site during the sediment accumulation period.

5.4.10. Within the Klondyke and the Former Steel Rolling Mill Sites, the topographic surface at the top of the Tertiary sediments represents the approximate shape of the surface of the ground in the earlier Holocene prior to rising sea levels about 6,000 years ago. During this period, the Klondyke Site was on the northern margin of a topographic low that would have formed an inlet or creek extending from the Medway eastwards to the higher ground of the Isle of Sheppey with the stratigraphy representing mid to high saltmarsh situations with freshwater pools or possible streams entering the coastal marshes.

5.4.11. The stratigraphy of the Former Steel Rolling Mill Site represents a series of low channel or creek like features, marginal mudflat and salt marsh environments with isolated areas of reed swamp and peat formation with the topographic edge of the floodplain lying along the southern boundary of the Former Steel Rolling Mill Site. Consequently, the sequences present may provide a Middle to Late Holocene palaeoenvironmental record for the eastern Medway region.

Bronze Age

5.4.12. The earliest evidence of human activity dates to the Bronze Age. An excavation 990m to the east of the Site revealed Bronze Age pottery within a pit, postholes and naturally formed water channels. The postholes could indicate a possible structure at this site.

Iron Age

5.4.13. Evidence of the Iron Age was found at Neatscourt comprising a number of pits, a ditch and a gully. The finds and features at this location were though to relate to salt production.

Romano-British

5.4.14. Recorded Romano-British evidence comprises a series of pits as well as ditches interpreted as drainage features perhaps to manage the marshland, found at an excavation 600m to the east of the Site. A midden deposits was also identified close to the edge of the marsh at the same location.

Anglo-Saxon

5.4.15. To date there are no recorded sites or findspots on the KHER dating to the Anglo-Saxon period within the study area. However, in the 9th century, the Medway area was invaded by the Vikings and it is thought that a Viking presence was held on the Isle of Sheppey through the winter of AD85[70]. It is thought that the settlement existed a Queenborough before the town was founded in the medieval period. It has also been suggested that there was an earlier castle built upon the site of the Medieval Queenborough Castle.

Medieval

5.4.16. Queenborough was known as Bynnee in the early medieval period meaning 'within the river'. It originated as a tiny fishing hamlet by a creek. It was transformed in the 14th century with the town becoming Quenesburgh in 1367 under the reign of Edward III after Queen Philippa who

[70] Wessex Archaeology (2006) Queenborough Castle, Isle of Sheppey, Kent: Archaeological Evaluation and Assessment of Results. Ref. 59470.01

resided in the castle. Queenborough is the only town to have been founded between the Black Death and the 17th century and the town retains its medieval layout today.

5.4.17. Construction of Queenborough Castle with its unique concentric design commenced in 1361 and was complete by 1375. It was built as a coastal defence to protect the town and also as a Royal household. The castle was considered redundant in the Civil War and was demolished in 1650. The monument exists as a grassed area with no visible remains above ground. A Time Team evaluation of the castle site did not reveal much evidence for structural remains as the masonry had been removed during the demolition for use elsewhere. However, isolated in-situ masonry remains were recorded, as well as the 17th century trenches excavated to remove the masonry.

5.4.18. A medieval moated site was excavated 370m north east of the Klondyke Site, comprising a platform containing building foundations of three or four rooms enclosed by a moat. This site was attributed to 14th century date. Other evidence in the study area includes three medieval salt production mounds, field boundaries, evidence of Oyster dredging in the Swale and isolated metal finds of a lead alloy token and two copper alloy buckles.

Post-Medieval

5.4.19. The post-medieval period saw the beginnings of the industrial use of the area coupled with the already existing agricultural use. Four examples of post-medieval farmsteads are recorded across the study area which are known to have been demolished. A copperas works existed 60m to the west of the Klondyke Site within Queenborough, the location provided by the KHER is the approximate site of these works and a description from 1634 records an acre of land used for the processing. Copperas was a green iron sulphate used in the dyeing process and was known to have been in production at Queenborough since 1579.

5.4.20. A large portion of the evidence dated to the post-medieval period relates to maritime evidence identified during the Kent Coastal Survey undertaken by Wessex Archaeology to determine presence and nature of maritime remains at Kent's coast. Eight derelict barges as well as another six wrecks and wooden boats are attributed to the post-medieval period. A post-medieval wooden boat lies adjacent to the western Twyford Site boundary and was identified on the site visit in 2013.

5.4.21. Isolated metal finds dating to the post-medieval period have also been recorded across the study area as a result of metal detecting surveys.

5.4.22. After centuries of minimal growth, Queenborough began to expand in the early 18th century as evidenced by the Georgian houses in the High Street, mostly brick, which signalled a period of rebuilding and expansion. There was also a late 18th century Guildhall.

Modern

5.4.23. The industrial and maritime focus of Queenborough which began in the post-medieval period flourished in the 19th century. However, until the late 19th century, Queenborough remained a small maritime community albeit with a significant industrial dimension. Industries including Halls Tar works which was located on the northern side of the Creek utilised the Creek for transporting supplies.

5.4.24. It was not until the arrival of the railway on Sheppey in 1860, coupled with Parliamentary Enclosure in 1855-6 (when common land was used to graze sheep, which, along with oyster

fishing, was the main source of income for the town) that the economic fortunes of Queenborough started to revive. From 1875, a rail link was established between Queenborough Station and a new pier for steam ships that carried passengers and goods by sea to the Continent. From the 1880s a variety of new industrial businesses took advantage of the sea and rail connections. They were mostly concerned with the production of tar, glue and industrial chemicals, and were located around the Creek. Housing associated with the new industries was also built from around 1900 onwards on the east side of the railway line and to the north of the High Street.

5.4.25. From 1904, the Rushenden Industrial Estate was laid out, with an associated residential area to the south at Rushenden, completed after World War II. The town continued to grow in a piecemeal fashion until the 1980s, when Queenborough, like the rest of Sheppey, was experiencing economic and social decline (English Heritage, 2006).

5.4.26. The maritime use of the area can be seen through the construction of Queenborough Quay and the wreck sites of 11 Spritsail barges attributed to the 19th century. Queenborough pier was also constructed during the mid 19th century, 900m to the north east of Klondyke Site.

5.4.27. The earliest Ordnance Survey mapping from 1882 shows the majority of the Klondyke Site, Twyford Site and the Site had been reclaimed from the marsh. The land in the Twyford Site and Site shows drainage features dividing the land into what may be either agricultural or pasture land. The flood defence earthworks towards the west of the Klondyke and Twyford Sites as well as the Site are evident. The northern part of the Klondyke Site in The Saltings is labelled on the 2nd edition map. The 1st and 2nd edition maps show Chalk Wharf at the western boundary of the Twyford Site as well as an associated tramway. A cobbled surface identified on the site visit is likely to be of 19th century date as it was located at the approximate position of Chalk Wharf, this is a tentative date and is unconfirmed. An additional Wharf is shown further south on the 3rd edition map within the Twyford Site (just north of the Site).

5.4.28. Also within the Klondyke and Twyford Sites were the Sheppey Glue and Chemical Works as well as the Pottery Works and a Glass Works. This indicates that most of the Twyford and Klondyke Sites as well as the Site were occupied by industrial buildings at this time and continued to be until recently. Although from the 1960s the underlying trend in Rushenden Industrial Estate was that of decline, with the closure of many firms. From the 1990s, the Glass Works on the Twyford Site ceased to be active and the buildings were demolished, while the buildings within the Klondyke Industrial Estate were demolished in 2018/19.

5.4.29. Modern evidence is comprised of seven wreck sites assigned a modern date, the Queenborough Light Railway and the Sheppey Railway, as well as World War II features and an anti-aircraft battery.

Undated

5.4.30. Some heritage assets in the study area have not been assigned a secure date. Nine wrecks of barges have been identified but not assigned a date. A cobbled surface at the approximate location of Chalk Wharf at the Twyford Site is likely to be of 19th century date but this remains unconfirmed on the basis of the available information. Similarly, the bow of a boat not recorded on the KHER was also visible on the site visit in 2013 but could not be assigned a date.

5.4.31. There are a number of earthworks identified within the study area. It is likely that many of these relate to salt production at Queenborough. However, a rectangular enclosure could be

seen cut into the mud adjacent to the western boundary of the Twyford Site. Earthworks are recorded within the north eastern boundary of the Klondyke Site. These were identified from Ordnance Survey maps and interpreted as a series of mounds forming an enclosure. This area was not accessible on the site visit in 2013 so the presence of these features is unconfirmed.

Archaeology

5.4.32. Potential buried archaeological remains within the Site, Twyford Site and Klondyke Site are likely to be of 19th or 20th century date based on the available evidence. The archaeological recording carried out by Oxford Archaeology focussed on the central part of the Twyford Site (which included the Site) where the pottery kilns associated with the early 20th century pottery factory formally known as the Pyramid Works are shown on historic maps and aerial photographs. During the watching brief 16 out of 18 identified kiln bases were revealed by controlled mechanical excavation, all of which were found to be of very similar construction, although in a very poor state of preservation. The outline of the kilns were surveyed for comparison with the historic maps, and the best preserved example was cleaned and recorded in more detail.

5.4.33. A wharf was already in existence at Chalk Wharf, along the western boundary of the Twyford Site, in 1882 and it is possible that the cobbled surface was associated with the 19th and 20th century wharf. Any remains associated with the wharf are considered to be of local importance and are therefore of low value. The flood defences, created in the 19th and 20th century, are considered to be of low significance.

5.4.34. Maritime remains located along the western boundary of the Twyford Site and within the boundary of the Klondyke Site have been identified as undesignated heritage assets on the KHER. These comprise the remains of post-medieval boats, 19th century and modern derelict barges. These remains are considered to be of low significance.

5.4.35. It is possible that unrecorded archaeological remains dating to the earlier periods may survive within the Site in areas that have not suffered any 19th century or modern impact, however the potential for survival of these remains is considered to be low due to the depths of made ground recorded across the Site. Due to the unknown presence, extent or importance of any archaeological remains present, a level of significance cannot be determined.

Previous Impacts

5.4.36. Consultation of cartographic and documentary sources suggests that the Site was probably marshland until the land was reclaimed in the post-medieval or 19th century. The southern part of the Twyford Site, including the Site, is known to have been reclaimed and used as either pasture or agricultural land by 1882, whilst the northern part of the Twyford Site, the Klondyke Site and the Former Steel Rolling Mill Site remained a marsh. Subsequent to this, the sites were redeveloped a number of times for industrial uses. Ground intrusive activity associated with the construction and operation of these industrial complexes (including building foundations and piles, basements, buried tanks, landscaping, surfacing, accesses, processing areas and utilities) may have impacted upon any predating deposits that were present within their footprint.

5.4.37. Therefore, due to the industrial activities that occurred on the Site from the 19th century onwards there is limited potential for any heritage assets prior to 19th century to have survived within the Site. Furthermore, the construction activities relating to the wider Twyford Site

reduce the chance of unknown heritage assets surviving even further. Therefore, beyond the pottery kiln remains that have already been recorded, any surviving heritage assets are likely to be of low to negligible significance.

Designated Heritage Assets

5.4.38. The nearest designated heritage assets to the Site are within Queenborough separated from the Site by the wider Twyford Site and Klondyke Site. Within Queenborough is the Queenborough Conservation Area and Grade II Listed Buildings along the southern side of the High Street as well as Evans Row. Queenborough Conservation Area and the Listed Buildings are considered to be of high significance. Other Grade II* and II Listed Buildings have not been identified as sensitive receptors due to their distance from the Site and the intervening development. These are shown on **Figure 5.1**.

5.4.39. The Conservation Area is designated due to the number of historic buildings within it, the medieval street layout of the High Street and the area of saltmarsh that lies within the northern area of the Klondyke Site known as The Saltings. The Saltings represents the former coastal landscape which would have included a much wider area of saltmarsh. Views from the northern side of the Creek over the saltmarsh out into the Swale are considered to be of particular value to the character of the Conservation Area[71].

5.4.40. Queenborough Castle Scheduled Monument has not been identified as a potentially sensitive receptor to the Twyford Pumping Station due to the intervening development at the corner of Rushenden Road and North Road. It is not anticipated that the Twyford Pumping Station will exceed the height of these buildings so the visual effect will be negligible. Queenborough Castle has therefore been excluded from any further assessment.

Historic Landscape Character

5.4.41. The Historic Landscape Character of the Site and wider area encompassing Queenborough, Rushenden as well as the Twyford, Klondyke and western half of the Former Steel Rolling Mill Sites is mapped by Kent County Council as HLC 9.6 '*Post 1801 Settlement (general)*'[72]. This is likely to refer to the urban expansion of Queenborough due to its industrialisation in the 19th century. The eastern half of the Former Steel Rolling Mill Site is mapped as HLC 5.1 '*Small irregular enclosures*'. To the west of the Twyford Site and the Site are HLC 8.7 '*Mud flats*' within the Swale while to the south and south-west of Rushenden are HLC 5.3 '*Irregular enclosures*'.

Future Baseline

5.4.42. In the absence of the Twyford Pumping Station, the Klondyke and Twyford Sites would continue to be subject to construction activities associated with planning application SW/13/1550 until they are land raised. In due course if a separate planning application is successful and permission is granted then a mixed-use development will be built on both sites as discussed in Chapter 1. During the land raising and settlement periods for both sites, there would be no effects on the archaeology or historic landscape. There would be some effects on the Queenborough Conservation Area associated with the works due to be carried out within The Saltings through the removal of vegetation and remediation before it is then replanted. By

[71] Swale Borough Council (2011) Queenborough Conservation Area Appraisal
[72] Heritage Maps (kent.gov.uk)

leaving the Site in its current state there would be no change to archaeology or historic landscape character associated with the Site.

5.5. Assessment of Effects

5.5.1. The potential impacts, and the effect on heritage assets, are characterised in the absence of mitigation measures, beyond those identified and described in Chapter 3 as embedded into the construction and/or operational phases of the Twyford Pumping Station. The following embedded mitigation measure is considered in this assessment:

- Implementation of the Construction Environmental Management Plan (CEMP) (**Appendix 1**) during construction.

5.5.2. Impacts may be direct or indirect. The effects during construction are anticipated to be of short term duration (temporary) while effects during operation are anticipated to be of long term duration (permanent) unless otherwise stated.

5.5.3. Impacts are only considered in detail when there is a reasonable likelihood of an effect on a feature of historic environment significance.

5.5.4. Further details on the Twyford Pumping Station and construction activities are provided in Chapter 3 and are therefore not reproduced in detail in this chapter.

Construction Effects

Archaeology

5.5.5. The predicted effects upon the archaeological resource during the construction phase are likely to be associated with ground disturbances and excavations including:

- Excavation of drainage ditch and pond; and
- Installation of below ground services and utilities.

5.5.6. The excavation into the ground has the potential to result in the complete or partial removal of any unknown sub-surface archaeological remains within the footprint of the construction activities. Such an effect would be permanent and irreversible and, consequently, the predicted magnitude of impact prior to mitigation is considered to be major if this occurs. However, the importance of the potential buried archaeological remains within the Site are considered to be low to negligible, and therefore the significance of the permanent effect will be neutral.

5.5.7. The construction of the Twyford Pumping Station does not include any changes or remediation beyond the flood defences at the western boundary of the Twyford Site. If such activities were to take place, there could be potential loss of or damage to maritime remains within or close to the Site boundary. The Twyford Pumping Station will have a neutral effect on these remains.

Designated Heritage Assets

5.5.8. The construction activities associated with the Twyford Pumping Station will be screened from the Queenborough Conservation Area and associated Grade II Listed Buildings along the southern side of the High Street and Evans Row by the ongoing construction activities within the wider Twyford Site and the Klondyke Site. Furthermore, the implementation of the CEMP will control the use, type and location of temporary task lighting to avoid effects on the settings

of the designated assets. Therefore, there will be temporary impacts of negligible magnitude resulting in neutral effects.

Historic Landscape Character

5.5.9. The Site is within HLC 9.5 'Post 1801 Settlement (general)' as described in Section 5.4. Although the construction activities, through the implementation of the CEMP, will change the features within the Site, the overall character of the Site will not change significantly as it will still be Post 1801 Settlement. There will be no effects on the other nearby HLCs due to the presence of intervening buildings and topography. Therefore, there will be a temporary impact of small magnitude resulting in a neutral effect.

Operational Effects

5.5.10. Any effects on archaeological remains will occur during construction and therefore there will be no additional effects during operation.

5.5.11. During operation the Queenborough Conservation Area and associated Listed Buildings will continue to be screened from the Site by the intervening topography within Twyford and Klondyke Sites. Furthermore, there will be no lighting during operation to affect the setting of the designated heritage assets. Therefore, there will be permanent neutral effects.

5.5.12. The Twyford Pumping Station will comprise of features already within the HLC 9.5 'Post 1801 Settlement'. There will be no effects on the other nearby HLCs due to the presence of intervening buildings and topography. Therefore, there will be a permanent impact of small magnitude resulting in a permanent neutral effect.

5.6. Mitigation Measures

5.6.1. There are no significant adverse effects predicted to result from the construction and operation of the Twyford Pumping Station, therefore no additional mitigation or enhancement measures are proposed.

5.7. Residual Effects

5.7.1. **Table 5.6** provides a summary of the residual effects resulting from the Twyford Pumping Station after effective implementation of the embedded mitigation measures proposed above.

Table 5.6: Residual Historic Environment Effects

Development Phase	Ecological Feature Affected	Residual Effect
Construction	Archaeology	Permanent neutral effect
	Designated heritage assets	Temporary neutral effect
	Historic landscape character	Temporary neutral effect
Operation	Archaeology	Permanent neutral effect
	Designated heritage assets	Permanent neutral effect
	Historic landscape character	Permanent neutral effect

5.8. Cumulative Effects

5.8.1. This section summarises the cumulative effects of the Twyford Pumping Station in combination with the construction and post-construction of development platforms on the Twyford Site,

Klondyke Site and Former Steel Rolling Mill Site. All the schemes are anticipated to have an overlapping construction programme as well as be in operation at the same time. To this end, this section summarises the residual cumulative effects during construction followed by the cumulative effects post-construction or operation of the four developments.

5.8.2. If there is a requirement for additional mitigation measures to be implemented to minimise any potential significant adverse cumulative effects, these will be highlighted and considered in the assessment.

Construction

Archaeology

5.8.3. All the sites have been subject to archaeological investigation carried out in agreement with Kent County Council Archaeology. Any remaining 19th and 20th century remains are of low significance. The removal of hardstanding and remediation within the Klondyke Site and the Former Steel Rolling Mill Site along with the excavation of ditches, pond and installation of services and utilities within the Site have the potential to result in the complete or partial removal of any unknown sub-surface archaeological remains within their construction footprint. Such an effect will be permanent and irreversible, and consequently, the predicted magnitude of the impact will be major in these areas. The significance of unknown potential archaeological remains are considered to be low to negligible and therefore the significance of permanent cumulative effect will be neutral.

5.8.4. The proposed land raising across the Twyford, Klondyke and Former Steel Rolling Mill Sites will preserve any archaeological remains that survive at depths exceeding that affected by the contamination and hardstanding. Whilst these remains will be preserved in-situ, the construction of the development platforms will prevent any future investigation of any remains present. This is considered to have a negligible impact upon the archaeological remains of low-negligible significance resulting in permanent cumulative neutral effects.

5.8.5. The construction activities at the Site as well as at Twyford and Klondyke Sites do not include any changes or remediation beyond the flood defences to the west or dredging with the Creek. If such activities were to take place there could be potential loss of or damage to maritime remains within or close to the construction activities. At present the developments will have a permanent cumulative neutral effect upon these remains.

Designated Heritage Assets

5.8.6. Queenborough Conservation Area extends into the northern area of the Klondyke Site (The Saltings). The Saltings is considered to be a key characteristic of the Conservation Area due to its views over the marshland. Despite the 20th century earthwork flood defences, the low lying nature of the marshland is integral to its setting. The low lying ground to the north east of the flood defences is not being significantly altered apart from the pre-treatment of localised areas of contamination and this process is anticipated to have a neutral effect on the Conservation Area.

5.8.7. The land to the south and south east of the flood defence bund is also part of the Conservation Area and this area is proposed to undergo ground remediation is some areas to a depth of 4.9 to 5.4m AOD and ground build up to construct the development platform in other areas. The introduction of the development platform into the area will have a negligible impact on the

setting of the Conservation Area, as the removal of the buildings within the Klondyke Industrial Estate do not contribute to the historic character of the area.

5.8.8. The Grade II Listed Buildings along with High Street and Evans Row are to the north of the sites and the Creek within the historic core of Queenborough. As the primary settings of the buildings are towards the High Street to the north, it will only be views from the rear of the properties that will be affected by the developments, which will be of secondary importance. This will result in temporary negligible impacts and neutral effects.

Historic Landscape Character

5.8.9. Although the construction of the Twyford Pumping Station and the development platforms within the other sites, will change the features within HLC 'Post 1801 Settlement (general)', the overall character of the Site will not change significantly as it will still be Post 1801 Settlement. There will be no effects on the other nearby HLCs due to the presence of intervening buildings and topography. Therefore, there will be a temporary cumulative impact of small magnitude resulting in a neutral effect.

Operation

5.8.10. Any effects on archaeological remains will occur during construction and therefore there will be no additional effects during operation.

5.8.11. The Queenborough Conservation Area and associated Listed Buildings will continue to be screened from the Site by the intervening topography within Twyford and Klondyke Sites which in turn will have a negligible impact and neutral effect on these features while the development platforms remain unused. Furthermore, there will be no lighting during operation to affect the setting of the designated heritage assets. Therefore, there will be permanent cumulative neutral effects.

5.8.12. The Twyford Pumping Station will comprise of features already within the HLC 9.5 'Post 1801 Settlement'. There will be no effects on the other nearby HLCs due to the presence of intervening buildings and topography. Therefore, there will be a permanent cumulative impact of small magnitude resulting in a neutral effect.

5.9. Summary

5.9.1. The Site is characterised by previously developed land which has been cleared, remediated and then used to temporarily store topsoil. It is set within the wider Twyford Site which is subject to land raising to create a development platform which screens views of the Site from the north and east. The Twyford Site was subject to archaeological recording during the removal of the hardstanding and remediation works prior to the land raising. No other archaeological evaluation is required for the Site.

5.9.2. The Twyford Pumping Station on its own will have neutral effects on archaeology, built heritage assets and historic landscape character during construction and operation. There will also be no significant effects when considered cumulatively with the Twyford, Klondyke and Former Steel Rolling Mill Sites.

6.0 LANDSCAPE EFFECTS

6.1. Introduction

6.1.1. This chapter assesses the likely significant effects of the Twyford Pumping Station in terms of the landscape and visual amenity effects.

6.1.2. The chapter describes: the assessment methodology; the baseline conditions at the Site and in the surrounding area; the likely significant environmental effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; the likely residual effects after these measures have been employed.

6.1.3. This chapter is designed to be read in conjunction with Chapter 5 Historic Environment especially in relation to the Queenborough Conservation Area and its associated Listed Buildings.

6.2. Legislation and Planning Policy

6.2.1. Landscape planning designations and policies are used to provide an indication of the value attributed to countryside, landscape and townscape as well as visual resources. No legislation has been identified that is directly relevant to this assessment.

Planning Policy Context

National Planning Policy

The National Planning Policy Framework (NPPF)[73]

6.2.2. The policies in the National Planning Policy Framework (NPPF) are a material consideration in dealing with planning applications for development. The NPPF should be read and interpreted as a whole (Paragraph 3) and paragraphs relevant to this assessment are listed below.

- Chapter 2 'Achieving sustainable development' – Paragraph 8 bullet c), 11 and 12;
- Section 8 'Promoting healthy and safe communities' – Paragraphs 96 and 98;
- Section 12 'Achieving well-designed places' – Paragraphs 124, 127 and 128;
- Section 15 'Conserving and enhancing the natural environment' – Paragraphs 170 and 171. Paragraph 172 is not relevant to this assessment as the Site is not located within an Area of Outstanding Natural Beauty (AONB) or National Park; and
- Section 16 'Conserving and enhancing the historic environment' – Paragraphs 184, 189, 192 and 202.

National Planning Practice Guidance – Natural Environment July 2019[74]

6.2.3. National Planning Policy Guidance provides further context to the NPPF. In relation to landscape matters, the National Planning Policy Guidance on the Natural Environment, explains the key issues in implementing policy to protect biodiversity and natural environment and provides advice on how the character of landscapes can be used to inform planning decisions and what green infrastructure is and why it is important to delivering sustainable developments.

[73] Ministry of Housing, Communities and Local Government (June 2019) National Planning Policy Framework
[74] Ministry of Housing, Communities and Local Government (July 2019) National Planning Policy Guidance – Natural Environment

Local Planning Policy

Bearing Fruits 2031: The Swale Borough Local Plan 2017[75]

6.2.4. SBC adopted Bearing Fruits 2031: The Swale Borough Local Plan in 2017. It set out the vision and overall development strategy for the area and how it will be achieved for the period from 2014-2031. It identifies where development will take place and how the natural environment and built heritage of the Borough will be protected and enhanced. The policy relevant to this assessment is Policy CP 7 Conserving and enhancing the natural environment – providing for green infrastructure which states:

'The Council will work with partners and developers to ensure the protection, enhancement and delivery, as appropriate, of the Swale natural assets and green infrastructure network and its associated strategy. Development proposals will, as appropriate:

1. *Recognise and value ecosystems for the wider services they provide, such as for food, water, flood mitigation, disease control, recreation, health and well-being;*
2. *Protect the integrity of the existing green infrastructure network as illustrated by the Natural Assets and Green Infrastructure Strategy Map, having regard to the status of those designated for their importance as set out by Policy DM24 and Policy DM28;*
3. *Where assessment indicates that it is necessary to enhance and extend the network (including when management, mitigation and/or compensatory actions are required to address adverse harm), be guided by the Green Infrastructure Network and Strategy Map, prioritising actions toward identified Biodiversity Opportunity Areas;*
4. *Ensure that there is no adverse effect on the integrity of a SAC, SPA or Ramsar site, alone or in combination with other plan and projects, as it would not be in accordance with the aims and objectives of this Local Plan;*
5. *Require the completion of project specific Habitats Regulations Assessment, in accordance with Policy DM28, to ensure there are no likely significant effects upon any European designated site. For residential sites within 6km of an access point to any of the North Kent Marshes, development must contribute to its Strategic Access Management and Monitoring Strategy;*
6. *Contribute to the objectives of the Nature Partnerships and Nature Improvement Areas in Kent;*
7. *Make the enhancement of biodiversity and landscape as their primary purpose;*
8. *Promote the expansion of Swale's natural assets and green infrastructure, including within new and existing developments, by:*
    a. *delivering a high standard of design quality to maximise the social, economic, health and environmental benefits of green infrastructure;*
    b. *providing a focus for social inclusion, community development and lifelong learning;*

[75] Swale Borough Council (July 2017) Bearing Fruits 2031: The Swale Borough Local Plan

c. taking into account the guidelines and recommendations of relevant management plans and guidance, Biodiversity Action Plans and Supplementary Planning Documents;

d. contributing to the protection, conservation and management of historic landscapes, archaeological and built heritage assets;

e. achieving, where possible, a net gain of biodiversity;

f. providing new recreational facilities in accordance with Policy DM17, exploiting opportunities to link urban and countryside areas and to create new footpath and cycle links;

g. taking account of and integrating with natural processes, such as flood risk and utilising sustainable urban drainage; and

h. including proposals to 'green' existing and proposed developed areas by increasing opportunities for nature in domestic gardens, streets and buildings, including street trees and in and around formal open spaces and sports provision.'

Swale Local Plan Review 2021[76]

6.2.5. Swale Borough Council is currently carrying out a Regulation 19 consultation between the 8th February and 30th April 2021. The consultation is in regards to a review which sets out the amount and location of new housing and employment and the planning policies to guide development in the borough for the period 2022 to 2038. Emerging policy DM 25 Conserving and enhancing valued landscapes states:

'The value, character, amenity and tranquillity of the Borough's landscapes will be protected, enhanced and managed.

Part A. For all landscapes:

1. *The scale, layout, build and landscape design of development will be informed by landscape and visual impact assessment having regard to the Council's Landscape Sensitivity Assessment and the Landscape Character and Biodiversity Appraisal SPD, including, as appropriate, their guidelines, and the key characteristics, sensitivity, condition and capacity of character area(s)/landscapes, taking opportunities to enhance the landscape where possible, including the removal of visually intrusive features.*
2. *Development proposals will demonstrate the link between landscape protection and enhancement and biodiversity protection and enhancement in all schemes.*
3. *Landscape and visual impact assessments will consider the cumulative impacts of both built and permitted development, including impact from noise, lighting and traffic on tranquillity….'*

6.3. Assessment Methodology and Significance Criteria

6.3.1. The methodology for the landscape and visual amenity assessment is based on the 'Guidelines for Landscape and Visual Impact Assessment: Third Edition' (GLIVA3)[77] which is widely regarded by the landscape profession as the 'industry standard', and 'An Approach to

[76] Swale Borough Council (February 2021) Local Plan Review 2021. Pre-Submission Document (Regulation 19)
[77] Landscape Institute and Institute of Environmental Management and Assessment (April 2013) "The Guidelines for Landscape and Visual Impact Assessment. Third Edition "(GLVIA3) Spons

Landscape Character Assessment'[78] by Natural England (October 2014) and 'An approach to landscape sensitivity assessment – to inform spatial planning and land management'[79] by Natural England (June 2019) have also been referenced. Landscape and visual assessment include a combination of objective and subjective judgements and it is therefore important that a structured and consistent approach is used. Wherever possible, tables or matrices are used so that the landscape and visual effects are recorded and quantified in a systematic and logical manner.

6.3.2. The 'Landscape Effects' and 'Visual Effects' are defined as follows:

- Landscape effects; These consist of direct and indirect effects or changes in the fabric, character, individual features or elements and condition, (quality) of the landscape i.e. landscape receptors within the Site or surrounding area; and
- Visual effects: These are the predicted effects on views available to the public from publicly accessible areas and residential dwellings i.e. visual receptors. Specific effects result from changing the consistent elements within an existing view. This may be caused by construction of a new feature/element, or the obstruction or modification of an existing view. The overall effect upon visual amenity can range from degradation to enhancement.

6.3.3. This chapter describes the effects of the Twyford Pumping Station on both landscape and visual receptors in terms of the sensitivity of the receptors (landscape resources and/or views and visual receptors); the magnitude of change on the receptors; and the significance of effects.

The Study Area

6.3.4. The study area for the analysis of the physical landscape is focused on the immediate locality of the Site but also includes its surroundings to place the Site into its wider landscape context. The study area for the visual amenity assessment has been defined as the whole area from which the Site and/or the Twyford Pumping Station would be visible, where the Site can be identified by reference to the wider Twyford Site and the flood defences. The study area has also been designed to reflect the study area previously used for the assessment of the Twyford and Klondyke Sites[80] but takes into consideration changes that have occurred within the study area since December 2013.

Assessment of Landscape Effects

6.3.5. The landscape assessment is concerned with changes in the physical landscape in terms of elements/features that may give rise to changes in the character of the Site and immediate surrounding landscape. Changes may result in adverse or beneficial effects. The assessment will be carried out using a combination of desktop research and field survey work to establish the landscape baseline, against which changes and consequential effects may be assessed.

6.3.6. To reach an understanding of the effects of development on a landscape resource, it is necessary to consider the different aspects of the landscape, as follows:

[78] Natural England, October 2014 "An Approach to Landscape Character Assessment" Natural England Publications
[79] Natural England, June 2019 "An approach to landscape sensitivity assessment – to inform spatial planning and land management" Natural England Publications.
[80] CampbellReith (December 2013) Queenborough and Rushenden, Phase 2 – Twyford and Klondyke Sites. Landscape Character and Visual Amenity Appraisal

- **Elements/Features**: The individual elements or features that make up the landscape or site, including prominent or eye-catching features such as hills, valleys, woods, trees and hedges, ponds, buildings and roads. They are generally quantifiable and can be easily described;
- **Patterns/Site Characteristics**: Elements or combinations of elements that make up a particular pattern and contribute to the character of an area/site, including perceptual characteristics such as tranquillity and wildness; and
- **Character**: The distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape and how this is perceived by people. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement. It creates the particular sense of place of different areas of the landscape. Character is identified through the process of characterisation which classifies maps and describes areas of similar character.

Landscape Sensitivity

6.3.7. The assessment will include a combination of objective and subjective judgements. The Twyford Pumping Station will be assessed against the baseline information to enable an evaluation of the effects that would occur upon the existing landscape resource. Landscape receptors will be assessed firstly in terms of their sensitivity, which is a combination of their susceptibility to the type of change or development proposed and the value attached to the landscape receptor.

6.3.8. The evaluation of susceptibility and landscape value has been made using the criteria presented in **Table 6.1.**

Table 6.1: Landscape Susceptibility/Value Criteria

Rank	Value Evaluation Criteria	Susceptibility Evaluation Criteria
High	High importance and rarity. No or limited potential for substitution. National or Regional scale designated landscape e.g. World Heritage Site, National Parks, Area of Outstanding Natural Beauty, Special Landscape Area or feature considered an important component of the landscape.	The receptor is likely to be in a good condition and vulnerable, and is a landscape or feature (landform, woods, trees and hedgerows, ponds, buildings and roads) that is unlikely to accommodate the specific form of development without undue negative consequences i.e. being out of scale or out of character and effective mitigation measures would be difficult to achieve and very limited potential for substitution or enhancement.
Moderate	Moderate importance and rarity. Some/limited potential for substitution. Regional or Local designated landscape e.g. conservation area, registered park or garden, country park, area of high landscape value or Tree Preservation Order (TPO) or feature considered a distinctive component of the area. Undesignated areas but value expressed through non-official publications or demonstrable use.	The receptor is likely to be in a fair condition, and is a landscape or feature (landform, woods, trees and hedgerows, ponds, buildings and roads) which is reasonably able to accommodate the specific form of development without negative consequence i.e. in scale and/or character, not wholly out of character and effective mitigation measures would be possible to achieve and has the potential for substitution or give rise to enhancement.
Low	Low importance and rarity with little or no statutory status and likely to be poorly maintained or damaged.	The receptor is likely to be in a poor condition and is a landscape or feature (landform, woods, trees and hedgerows, ponds, buildings and roads) which is reasonably able to accommodate the specific form of development with minor negative consequences and

Rank	Value Evaluation Criteria	Susceptibility Evaluation Criteria
		can accommodate the type of change proposed with little or no effect upon its overall integrity i.e. in scale and/or character, not wholly out of character and effective mitigation measures if needed would be possible with considerable potential for substitution and enhancement.

6.3.9. The condition of the landscape is a measure of the physical state of the landscape which informs the baseline assessment of the landscape and has been assessed using the criteria set out in **Table 6.2** as a guide.

Table 6.2: Landscape Condition/Quality

Landscape Condition/Quality	Criteria
Good	Where the landscape and its features are in good repair/quality and have a high contribution to landscape character
Moderate	Where the landscape and its features are in average repair/quality and make a moderate contribution to landscape character.
Low	Where the landscape and its features are in poor repair/quality and make a low contribution to landscape character.

6.3.10. **Table 6.3** has been used to determine the sensitivity of landscape to change:

Table 6.3: Landscape Sensitivity

		Susceptibility		
		High	Moderate	Low
Landscape Value	High	Very High	High	Medium
	Moderate	High	Medium	Low
	Low	Medium	Low	Negligible/Low

Landscape Magnitude of Change

6.3.11. The magnitude of change is concerned with the degree of change, and its duration. Change may be adverse or beneficial. It can also be long term (more than 5 years), medium term (2-5 years) or short term (1 to 2 years). The criteria for magnitude of change are set out in **Table 6.4**.

Table 6.4: Landscape Magnitude of Change

Magnitude of Change	Criteria
Large	Substantial or total loss or comprehensive enhancement of the landscape resource
Medium	Moderate loss or enhancement of the landscape resource
Small	Partial or slight loss/alteration or moderate enhancement of the landscape resource
Small/Negligible	Very slight loss/alteration or slight enhancement of the landscape resource
Negligible/No Change	No/very minor loss/alteration or minor enhancement of the landscape resource.

Assessment of Visual Effects

6.3.12. The appraisal of visual effects includes a combination of objective and subjective judgements. The Twyford Pumping Station will be assessed against the baseline information to enable an evaluation of the effects that would occur upon the existing views. In the assessment of views there is likely to be a continuum in the degree of visibility of the Twyford Pumping Station from no view to open view. To assist in the description and comparison of the effect on views, the following factors will be considered:

- The extent of the view that would be occupied by the development (degree of visual intrusion i.e. full, partial, glimpse, none);
- The proportion of the development or particular features that would be visible (full, most, partial, limited, none);
- The distance of the observer from the development and whether viewers at that location would focus on the development due to proximity, or the development would form one element in a panoramic view; and
- Whether the view is transient or one of a sequence of views, as from a moving vehicle or Public Rights of Way (PRoW).

6.3.13. The significance of visual effects will be described as a consideration of effect in terms of:

- Sensitivity of the visual receptor (viewer) is dependent on the following:
  - the value attributed to a given view; and
  - the susceptibility of visual receptors at that location to the type of development proposed.
- Magnitude of visual impact:
  - A combination of the degree of change to the view resulting from the development with consideration of the extent of the area over which the changes would be visible, the period of exposure to the view and its reversibility.

Sensitivity of the Visual Receptor

6.3.14. The sensitivity of the visual receptor as shown in **Table 6.5** is influenced by the following factors:

- Location and context of the view;
- Characteristics of the view e.g. whether it is continuous or intermittent and static or transient;
- Importance of the view and the activity or expectations of the receptor;
- Numbers of people affected;
- Popularity of the view; and
- Significance of the view in relation to valued landscapes or features.

Table 6.5: Visual Susceptibility/Value Criteria

Rank	Value Evaluation Criteria	Susceptibility Evaluation Criteria
High	View from a location that is likely to be of national importance, either designated or with national cultural associations, where the view obtained forms and important part of the experience.	People with a particular interest in the view and with a prolonged viewing opportunity: • People at their place of residence; and • People engaged in outdoor recreation, including users of PRoW, whose attention is likely to be focussed on the landscape.
Moderate	View from a location that is likely to be of local importance, either designated or with local cultural associates, where the view obtained forms part of the experience.	People with a partial interest in the view and their surroundings: • People engaged in outdoor sport and recreation, where their appreciation of their surroundings is incidental to their enjoyment; and • People travelling along recognised 'scenic routes' or where their appreciation of the view contributes to the amenity experience of their journey.
Low	View from a location that is not designated, with minimal or no cultural associations.	People with a minimal interest in the view and their surroundings as their focus is on other activities: • People in moving vehicles travelling through or past the affected landscape; and • People at their place of work.

6.3.15. **Table 6.6** has been used to determine the sensitivity of visual receptors to change:

Table 6.6: Visual Receptor Sensitivity

		Susceptibility		
		High	Moderate	Low
Value of Views	High	Very High	High	Medium
	Moderate	High	Medium	Low
	Low	Medium	Low	Negligible/Low

Magnitude of Change to Visual Amenity

6.3.16. The magnitude of change is based on the degree of change including the scale of change, contrast or integration of the change, duration of the change and distance and angle of the view. Changes may be adverse or beneficial in nature. It can also be long term (more than 5 years), medium term (2-5 years) or short term (1 to 2 years). The criteria for magnitude of change is set out in **Table 6.7**.

Table 6.7: Magnitude of Change to Visual Amenity

Magnitude of Change	Criteria
Large	Typically the proposals form a dominant or immediately apparent features within the view that significantly affects and changes overall landscape character. Views affected would typically be direct and close range in nature.
Medium	Typically the proposals would form a visible and recognisable new element within the view that affects and chance overall landscape character.
Small	Typically the proposals constitute a distinct feature within the view that would not change the existing overall landscape character.

Magnitude of Change	Criteria
Small/Negligible	Typically the proposals constitute only a minor component of the wider view, which might be missed by the casual observer or receptor. Awareness of the proposals would not have a marked effect on the overall quality of views.
Negligible/No Change	Typically only a view small part of the proposals is discernible, and/or they are at such a distance that they are scarcely appreciated. The proposals would have very little effect on views that would typically be long range and/or oblique in nature.

Landscape and Visual Amenity Significance of Effect

6.3.17. The significance of effect is a function of the sensitivity of the landscape resource and/or visual receptors to change and the magnitude of change. Although not a requirement of an assessment such as this (not subject to Environmental Impact Assessment), an assessment of significance of effect has been carried out for completeness and transparency. The significance of an effect is not absolute and must be identified in relation to each individual development and its unique location with professional judgement applied to determine the significance of each effect. Landscape and visual amenity effects can be beneficial or adverse depending on the development proposals and the landscape resources affected. **Table 6.8** presents the matrix to determine significance of effect.

Table 6.8: Methodology for Assessing Significance

Sensitivity/Value of Receptor	Magnitude of Effect				
	Very Large	Large	Medium	Small/Negligible	Negligible/No Change
Very High	Substantial Significance	Substantial Significance	Moderate Significance	Moderate Significance	[1]
High	Substantial Significance	Moderate Significance	Moderate Significance	Minor Significance	[2]
Medium	Moderate Significance	Moderate Significance	Minor Significance	[2]	Neutral
Low	Moderate Significance	Minor Significance	[2]	Neutral	Neutral
Low/Negligible	[1]	[2]	Neutral	Neutral	Neutral
[1] The choice between 'Moderate Significance', 'Minor Significance' and 'Neutral' will depend on the specifics of the effect and will rely upon professional judgement and reasoning.					
[2] The choice between 'Minor Significance' and 'Neutral' will depend on the specifics of the effect and will rely upon professional judgement and reasoning.					

Limitations and Assumptions

6.3.18. The following limitations have been identified for the assessment:

- During the site visits, weather conditions and seasonal factors influenced the visual assessment and photographic record of the Site. Every effort has been made to ensure that the photographs and their locations are "representative" of the Site and its surroundings; and

- Access to assess the predicted visual amenity effects from private individual properties has not been possible for all the residential dwellings surrounding the Site, and the assessment of likely effects has been made from vantage points and representative views taken from the nearest available public viewpoint.

6.3.19. The following assumptions have been made during the assessment:

- The construction programme for the core elements of the Twyford Pumping Station is as set out in Chapter 3;
- The number / type of users of the PROW within the study area has been made / assessed on the basis of the wear and state of footpath routes and from observations during the site visits. The state and predicted use of these routes has also informed the 'value' assessment of these routes;
- Residents who live or use properties that look towards the Site are habituated to a certain degree by the changes and activities that occur over time;
- The implementation of the landscape (amenity planting and habitat creation) proposals set out in Chapter 3, will be phased and implemented either in advance (where possible) or immediately at the end of the construction works;
- The provision of areas of open space and following the establishment and maturing of the landscape planting, and the green infrastructure associated with the Twyford Pumping Station will have beneficial effects.

6.4. Baseline Conditions

6.4.1. This section sets out the existing landscape and visual context of the Site and surrounding study area in terms of:

- Landscape designations;
- The landscape character and features of the Site;
- The landscape character of the surrounding area;
- The nature and extent of the Site's visibility and identification of key views and visual receptors; and
- The sensitivity of the landscape and visual receptors to change.

Landscape Designations

6.4.2. The Site is not within any landscape designations, although to the north within the study area is Queenborough Conservation Area and associated Listed Buildings along the southern side of the High Street and at Evans Row as discussed in detail in Chapter 5. Furthermore, Medway Estuary and Marshes SPA, Ramsar and SSSI is located to the west of the Site as discussed in detail in Chapter 4.

Landscape Context

6.4.3. The Site is set within the south western corner of the wider Twyford Site and forms an irregular parcel of brownfield land between Queenborough and Rushenden. It is bound by raised development platform to the west; the disused railway line to the south; the flood defences with The Swale beyond to the east and a ditch and raised development platform to the north.

6.4.4. As discussed in Chapter 5, the Site and wider Twyford Site was previously used for industry and in particular glass and pottery works which were serviced by new railway sidings feeding into the Sheerness Branch railway line to the east before the buildings were demolished in the 1990s and removal of hardstanding and remediation that has occurred since 2014. The Site currently comprises an undulating surface made from the temporary storage of topsoil associated with the wider Twyford Site works. There is a ditch passing through the Site.

6.4.5. To the north, the Klondyke Site was the site of Klondyke Industrial Estate, until it was demolished in 2018/2019, and an area of rough grassland to the north (The Saltings). The industrial area had a haphazard distribution of industrial and commercial warehouses of various ages and sizes. Many of the buildings had red brick walls and corrugated iron roofs. The buildings were interspersed by areas of gravel or tarmac access roads and rough grassland with some scrub. The largest expanse of rough grassland is located between the warehouses and the southern bank of the Creek within 'The Saltings'. Since the demolition of the buildings to ground slab, the Klondyke Site has been temporarily characterised by hardstanding and areas of rough grassland.

6.4.6. To the east lies the Former Steel Rolling Mill Site, which is another derelict brownfield site. The former buildings associated with the steel rolling mill have been demolished to ground slab and the vegetation in the eastern area of the site has been cleared to ground level prior to the removal of the hardstanding, remediation and land raising.

6.4.7. To the south of the Twyford Site is located is a new residential development known as Nelson's Vue which overlooks the Site. Nelson's Vue is located on land that has been recently raised between First Avenue in Rushenden and the wider Twyford Site. The raised nature of the development screens views between the rest of Rushenden and the Site from the south.

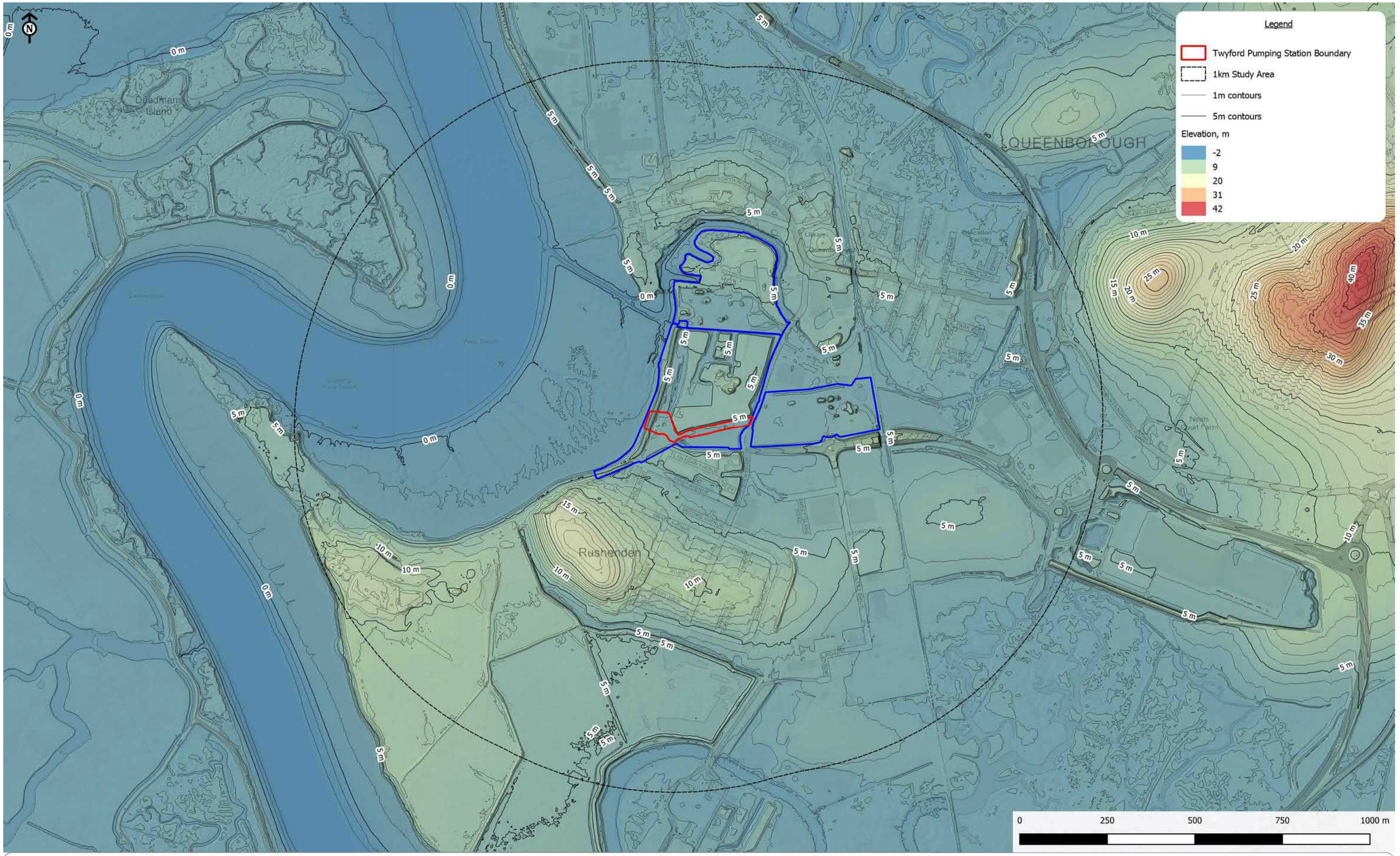
6.4.8. To the west, the study area is characterised by the Swale, with its wide water channel and expanses of mud flats during low tide which separate the Isle of Sheppey from the low lying marshes on Deadman's Island, Tailness Marshes and Chetney Marshes which are located within the Medway Estuary and Marshes SPA, Ramsar and SSSI.

6.4.9. Further afield, the larger settlements of Sheerness and Minister are situated approximately 1.5km to the north and east respectively. The Sheppey crossing is approximately 2km to the south, and Kingsnorth power station is located approximately 3.5km to the north east on the opposite bank of the River Medway. These two latter structures are prominent features in this relatively open, large scale landscape.

Topography

6.4.10. The topography of the Site and the study area is shown on **Figure 6.1**. The topography of the study area is that of a low lying, flat estuarine landscape with a range from -5m AOD up to 25m AOD.

6.4.11. There are no significant large scale natural terrestrial topographic features within the study area and the surrounding landscape. Areas of elevated land are restricted to three small hills. Rushenden Hill reaches a height of 15m AOD and is located to the south west of the Site immediately adjacent to the settlement of Rushenden. Doos Hill is barely distinguishable reaching a height of between only 5 and 10m AOD and is located to the north east of Queenborough. The highest of the three hill is Barrow Hill, which rises to approximately 25m AOD and is located approximately 1.25km to the east of the Site.



Queenborough and Rushenden

Client: Homes England

Figure 6.1:
Topography

Scale: 1:10000@A3

Job Number: 11465
Drawn by - Checked by: RP - MC
Drg No - Status/Revision: GIS253 - B
File location: N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\Environmental Report (pdf in Outputs)
Date (Revision History): 23/03/2021 (A, First Issue, 01/03/21, RP; B, Boundary Update, 23/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

6.4.12. At the local scale, topographic features within the Site and its surroundings, take the form of manmade features including drainage ditches, flood defence bunds, railway embankments and land raised for development. The Site consists a flat area located at a level of between 0 m and 5m AOD, with temporary mounds of vegetated topsoil which rises to the west for the flood defence bund adjacent to the Swale. To the east and north the Site is surrounded by the raised land within the wider Twyford Site.

6.4.13. The defining topography of the study area is therefore characterised by the low lying flat estuarine landscape, the Swale and River Medway with their associated tributary and creek systems, and the numerous local scale, linear earthworks and bund features, often associated with development.

6.4.14. The topography of the study area and surrounding landscape has played a significant role in establishing its overall landscape character and has in turn played an important role in influencing the nature and form of built development in the area.

Site Vegetation

6.4.15. The vegetation within the Site and the wider Twyford Site was cut to ground level in 2014 to facilitate the construction activities within the wider Twyford Site. Since then, the grass and naturally establishing vegetation has been kept short through regular mowing and strimming during each spring, summer and autumn. Furthermore, the vegetation along the flood defence within the Site is also regularly cut.

Public Rights of Way (PRoW)

6.4.16. PRoW ZB49 passes through the Site and the wider Twyford Site as it follows the disused railway line connecting Rushenden Road with a small number of properties on the western side of Rushenden Hill overlooking the Swale. It has been temporarily closed for the duration of the construction works within the wider Twyford Site.

6.4.17. PRoW ZB48 passes through the Site and wider Twyford Site and is currently open. It starts at the junction between Chalk Wharf Road and Rushenden Road. It follows Chalk Wharf Road between the Twyford Site and Klondyke Site to the western extent of the road and the flood defences where it turns to the south-west to follow along the top of the flood defences to then follow the banks of the Swale around to Coal Washer's Wharf, which is west of Rushenden. Officially the definitive route of PRoW ZB48 is around the Klondyke Industrial Estate rather than along Chalk Wharf Road, however the official route has not been accessible for many years leading to the permissive route along Chalk Wharf Road.

Landscape Character

National Character Area 81. Greater Thames Estuary[81]

6.4.18. The Site and the study area are located within the National Character Area 81 Greater Thames Estuary. The key characteristics of the Greater Thames Estuary 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.*

[81] NCA Profile: 81 Greater Thames Estuary - NE473 (naturalengland.org.uk)

- *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.'*

6.4.19. Although the Site and its surroundings contribute to the character of this National Character Area, the geographical extent of the area is vast in comparison with that of the Site. Therefore, in considering the nature of the Twyford Pumping Station, it is not relevant to assess it in the context of a national landscape classification. The assessment of potential impacts upon this National Character Area will therefore not be undertaken as part of this process.

The Landscape Assessment of Kent[82]

6.4.20. In 2004, Kent County Council published the 'Landscape Assessment of Kent' which drew together existing landscape character assessments of the county and updated these studies to conform to the character assessment guidance at that time. Additional work on the condition and sensitivity of the Kent landscape was carried out and used to formulate character-based strategies to ensure the continued distinctiveness of Kent's landscapes.

6.4.21. The assessment excluded urban areas, and as such provides no analysis of the key characteristics, quality, value and condition of the Site, or much of the study area, and therefore cannot be used as a baseline against which to assess potential impacts.

Project Landscape Character Areas

6.4.22. Due to the shortfalls of the existing national and regional landscape character assessments as outlined above, and in particular the exclusion of urban areas, it has been necessary to identify project-specific landscape character areas at a scale appropriate to the defined study area, to establish an accurate baseline from which to assess potential impacts upon landscape character. This also occurred when assessing the Landscape Character and Visual Amenity of the Twyford and Klondyke Sites, and therefore this assessment uses character areas that were previously identified with updated descriptions and boundaries provided where the characteristics and features have altered since 2013[83].

6.4.23. The character areas included within this assessment are those that would potentially be affected by the Twyford Pumping Station and are described below and shown on **Figure 6.2**. LCA 3 – Queenborough, LCA 4 – Minster, LCA6 – Queenborough, LCA 7 -Sheppey Court and Diggs Marshes, and LCA 9 – South Sheppey Saltmarshes and Mudflats that would be unaffected due to the distance from the Site or presence of intervening buildings and topography have been scoped out of this assessment.

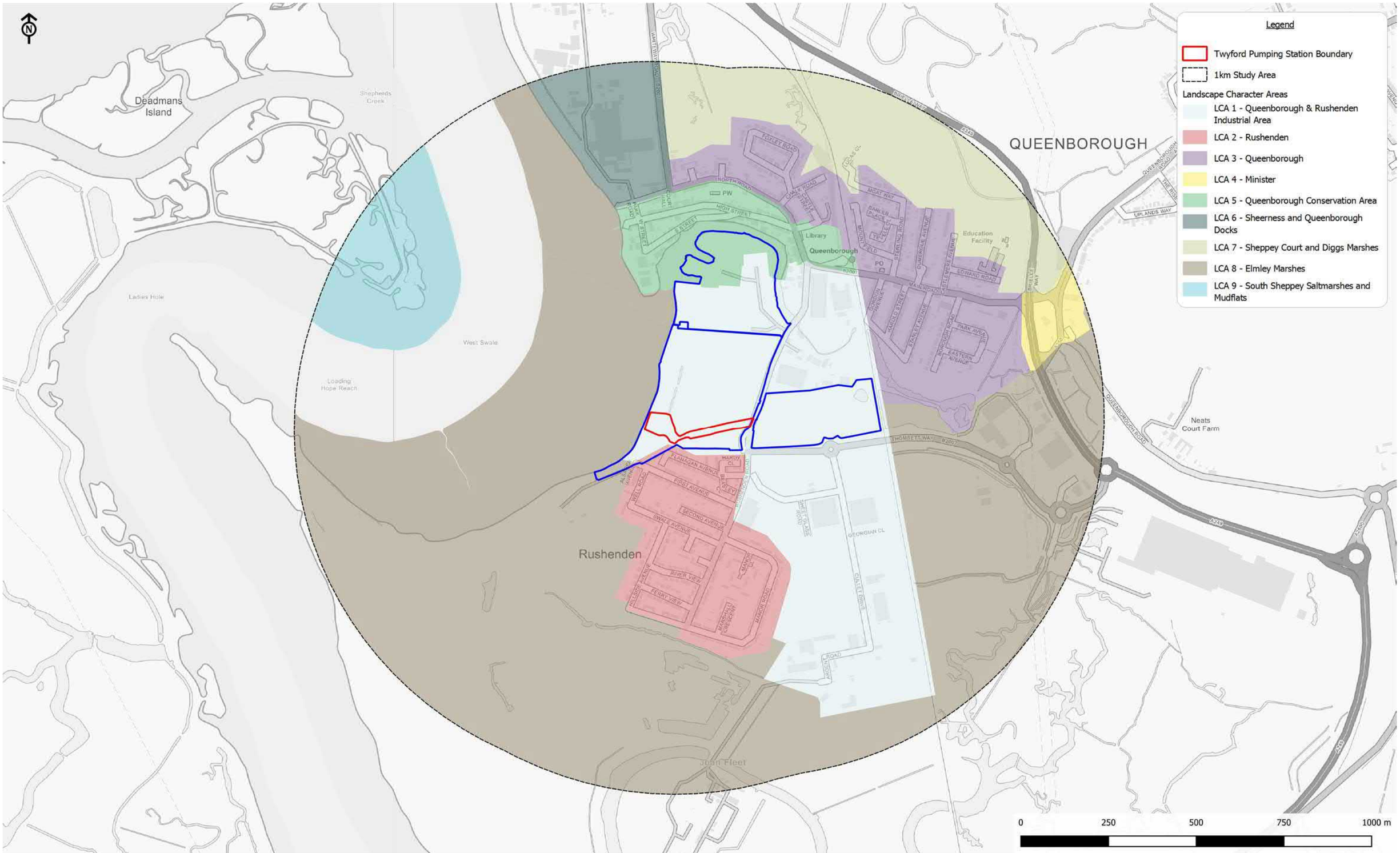
LCA 1 – Queenborough & Rushenden Industrial Area

6.4.24. This character area relates to the large scale industrial/urban area located between the residential areas of Queenborough to the north and Rushenden to the south. This represents a significant area within the urban landscape and is a significant contributor to the collective character of Queenborough and Rushenden.

6.4.25. This character area encompasses the Site as well as the wider Twyford, Klondyke and Former Steel Rolling Mill Sites. It includes an area that is or has historically been used as extensive industrial development, with large scale industrial buildings and expansive areas of hardstanding. It is bounded to the east by the railway line, to the south by the residential area of Rushenden and the flat Elmley Marshes, to the west by the Swale, and to the north by the Creek, which forms the southern edge of the historic part of Queenborough.

6.4.26. Development within this area dates largely from the 20th Century and is associated predominantly with large-scale industrial growth of Queenborough which occurred between 1900 and 1930 following the arrival of the railway line. This area has expanded gradually southwards along the railway line, has seen industrial developments and redevelopments, but

[82] Kent County Council (2004) The Landscape Assessment of Kent
[83] CampbellReith (December 2013) Queenborough and Rushenden, Phase 2 – Twyford and Klondyke Sites, Landscape Character and Visual Amenity Appraisal



Queenborough and Rushenden

Client: Homes England

Figure 6.2:
Landscape Character Areas

Scale: 1:10000@A3

Job Number: 11465
Drawn by - Checked by: RP - MC
Drg No - Status/Revision: GIS254 - B
File location: N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\Environmental Report (pdf in Outputs)
Date (Revision History): 23/03/2021 (A, First Issue, 10/03/21, RP; B, Boundary Update, 23/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

has remained fundamentally unaltered in character. The history of the area is described in Section 5.4.

6.4.27. The key characteristics of this area are as follows:

- Large scale 20th Century industrial buildings with extensive areas of hard surfacing, external storage, disused and remanent railway sidings, modern car parking;
- Large areas of a transient nature associated with ongoing land raising and construction activities; and
- Large areas of derelict and degraded landscape.

6.4.28. It is recognised that the industrial development which occurred within this area during the early 20th century played a significant role in the economic and cultural growth of Queenborough and the Isle of Sheppey. The original historic context has nevertheless been degraded by recent modern redevelopment patterns and by economic decline. Furthermore, the industrial buildings that were within the Klondyke Industrial Estate and on the Twyford and Former Steel Rolling Mill Sites have been demolished down to ground slab with the land now being subject to the transitory activities associated with land raising and remediation. There are no cultural or historic features noted as worthy of conservation within this area, and the quality and condition of the majority of the area is considered to be ordinary and of little distinctiveness and rarity, with much potential for enhancement.

6.4.29. The landscape value is assessed as medium while the susceptibility to change of this character area is assessed to be low with the landscape condition and quality also assessed as low. Therefore, the overall landscape sensitivity is low.

LCA 2 – Rushenden

6.4.30. This character area relates to the settlement of Rushenden located at the southern tip of the urban area within the study area. It is separated from Queenborough by large industrial areas as described above in LCA 1 – Queenborough & Rushenden Industrial Area.

6.4.31. This character area is separated from the Site by an area of intervening land at the southern extent of the wider Twyford Site within the disused railway corridor, where PRoW ZB49 is located. It is bounded to the north and east by the adjacent industrial areas of LCA 1, and to the south and west by the marshland landscape of the Elmley Marshes.

6.4.32. The area comprises a recently built residential estate Nelson's Vue on land raised above the houses to the south. South of Nelson's Vue, along First Avenue and its surroundings, the houses were constructed pre-war and comprise small, brick built, terraced 2-storey properties, with settlement expanding gradually into the early 1970's. The later parts of the settlement comprise a mix of brick-built two storey, semi-detached, townhouses and single storey bungalows (along the eastern edge). The architectural styles of the buildings within this area are generic and lacking in local distinctiveness, constructed from standard quality materials.

6.4.33. The key characteristics of this area are:

- Uniform mid-late 20th century residential estate arranged in a grid pattern, comprising one to two storey brick properties with concrete tiled roofs;
- Modern brick houses raised above their surroundings; and
- Pre-war small, brick built, terraced 2-storey properties.

6.4.34. The landscape value is assessed as low while the susceptibility to change of this character area is assessed to be low with the landscape condition and quality also assessed as low. Therefore, the overall landscape sensitivity is low.

LCA 5 - Queenborough Conservation Area

6.4.35. This character area relates to the area defined by the existing 'Queenborough Conservation Area' boundary. It covers the oldest and most historic part of the settlement of Queenborough, located to the north and immediately adjacent to the Creek, and the site of the original Medieval settlement and port west of and incorporating Queenborough Castle. This LCA is considered to contribute significantly to the wider collective character of Queenborough and Rushenden.

6.4.36. This character area encompasses The Saltings in the northern part of the Klondyke Site and the adjacent Creek, which together form the location of the original medieval port and harbour of Queenborough. The Saltings is assessed to be in poor landscape condition through the long-term temporary storage of waste materials, skips and other detracting features.

6.4.37. The LCA is bounded by North Road to the north and by modern urban development to the north of the road, to the east by the railway line, the south by LCA 1 Queenborough & Rushenden Industrial Area and to the west by the Swale.

6.4.38. The key characteristics of this area are:

- Queenborough Castle;
- A fine collection of Georgian buildings, including Guildhall and Swale House;
- Rare late examples of Medieval planted port town and royal borough with planned High Street, town quay and Parish Church;
- Distinctive maritime character, creek side harbour and jetty to the Swale; and
- Built evidence of the later 19th Century prosperity of the town, including the railway station and former school.

6.4.39. The landscape value and susceptibility to change of the character area are moderate as acknowledged by its designation as a Conservation Area and presence of Listed Buildings. The landscape condition is considered to be good, being an attractive landscape with a strong sense of place and local distinctiveness. There are also high quality locally characteristic materials and detailing with only limited scope for improvement and no significant detracting features. The overall landscape sensitivity of this LCA is therefore assessed as medium to high.

LCA 8 – Elmley Marshes

6.4.40. This character area relates to the area defined by the 'Swale Landscape Character and Biodiversity Appraisal'[84]. It encompasses Swale to the west, Rushenden Marshes to the south of Rushenden and the Queenborough & Rushenden Industrial Estate and Neatscourt Marshes to the east of the railway line.

6.4.41. The key characteristics of this area have been defined by this assessment as:

- Flat alluvial marshland with sinuous reed filled ditches. Traditional gates and fences leading into ditches prevent cattle crossing into other fields;

[84] Swale Borough Council (September 2011) Swale Landscape Character and Biodiversity Appraisal

- Atmospheric and tranquil landscape with large open and often dramatic skies;
- Rough grassland largely used for cattle and sheep grazing;
- Important wetland habitats designated for their internationally important assemblages of wildlife;
- Important transport routes A249, railway and link bridges onto island;
- Large-scale landscape with little sense of enclosure;
- Boats in the Swale; and
- Strong sense of place, remote and isolated.

6.4.42. The character area incorporates a large and internationally significant landscape which includes the Medway Estuary and Marshes SPA, Ramsar and SSSI. This has led to strong ecological interest where the ditches and grasslands are traditionally managed and maintained for the migrating and breeding bird populations. The area is particularly notable for the internationally important numbers of wintering and passage wildfowl and waders as well as the breeding bird assemblage (see Chapter 4).

6.4.43. Isolated traditional brick farm buildings are occasional features. Closer to Queenborough the influence of industry and the urban fringe is more keenly felt. Industrial areas south of the Swale at Ridham and Kemsley intrude into views off the island to the south.

6.4.44. The landscape condition of this LCA has been assessed by the Swale assessment as being good, this is based on:

'The landscape is generally coherent and visually unified. The main detractors around Neatscourt Marshes in the west are the transport embankments and overhead power lines.'

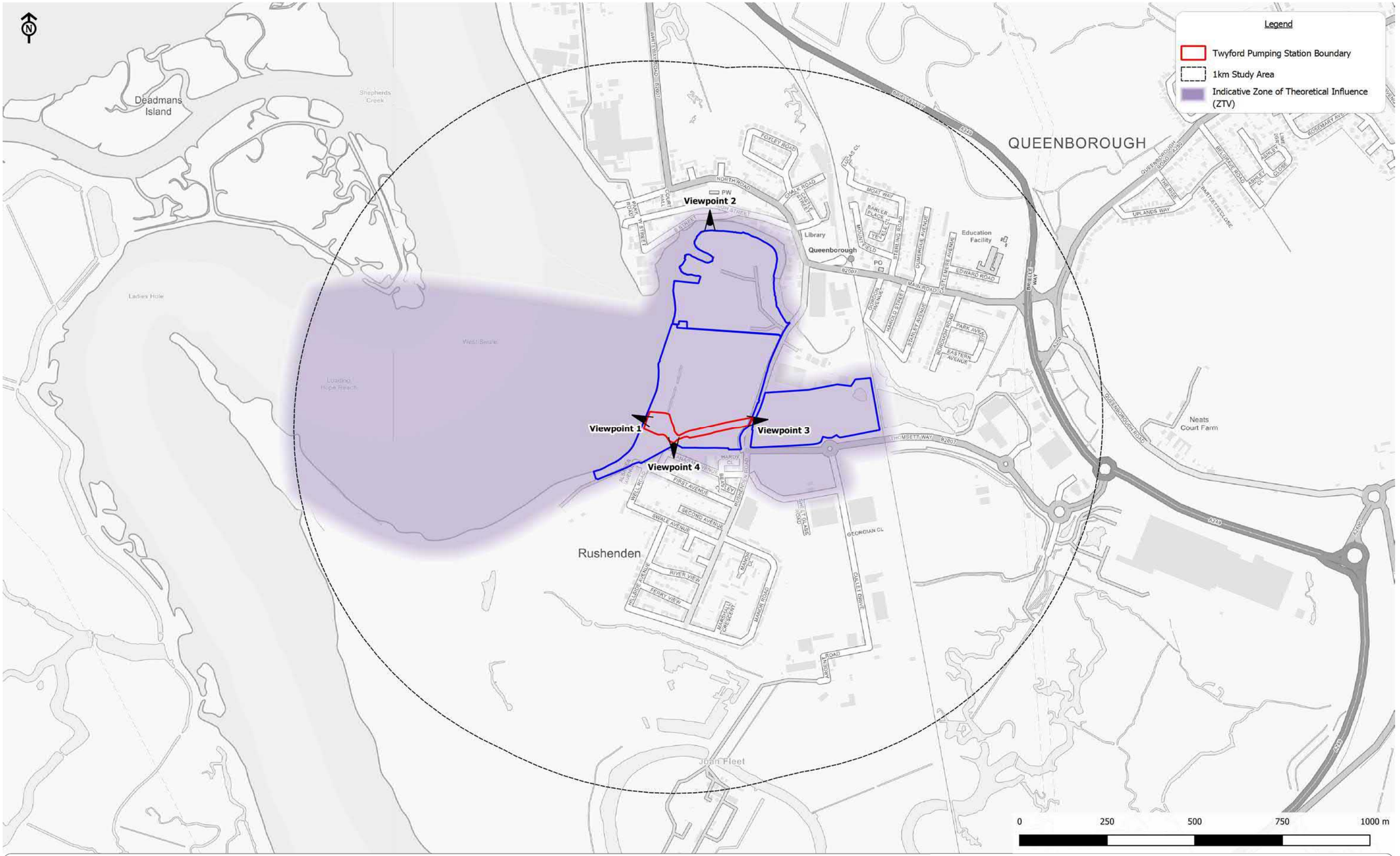
6.4.45. The landscape value condition and quality is assessed as high while the susceptibility to change of this character area is assessed to be moderate. Therefore, the overall landscape sensitivity is high.

Visual Context and Accessibility

Zone of Theoretical Visibility

6.4.46. An indicative Zone of Theoretical Visibility (ZTV) for the study area is shown on **Figure 6.3**. The ZTV is based on the desktop analysis of topography and built form that was carried out for the Twyford and Klondyke Sites and described in the Landscape Character and Visual Amenity Appraisal (CampbellReith, December 2013). The original ZTV has been used as a tool to identify those areas from which potential views should be considered, and to gain a general understanding of the extent of the Site's zone of potential visual influence. Since the original ZTV was carried out construction activities have been carried out on the Twyford, Klondyke and Former Steel Rolling Mill Sites which has involved the demolition of buildings and land raising on the wider Twyford Site which has modified the ability to see the Site. Therefore the ZTV was checked on Site on the 3rd March 2021.

6.4.47. The Site has a fairly tight zone of visibility, being highly contained to the north, east and south by the land raising within the wider Twyford Site and the surrounding development beyond. There is the potential for some longer distance views directly to the west of the Site from the Swale and beyond, but these are generally from publicly inacesssible locations and anything



Queenborough and Rushenden

Client: Homes England

Figure 6.3:
Indicative Zone of Theoretical Visibility (ZTV) and Viewpoints

Scale:	1:10000@A3
CampbellReith OS Copyright:	© Crown copyright. All rights reserved. Licence number 100020027
Contains Ordnance Survey data	© Crown copyright and database right 2021.
Job Number:	11465
Drawn by - Checked by:	RP - MC
Drg No - Status/Revision:	GIS255 - B
File location:	N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\Environmental Report (pdf in Outputs)
Date (Revision History):	23/03/2021 (A, First Issue, 10/03/21, RP; B, Boundary Update, 23/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

behind the flood defences will be screened from view. The main views from the west are restricted to locations along the PRoW ZB48 which runs along the Site's western boundary, along the top of the flood defences.

6.4.48. To the north views are generally limited to locations along the flood defences along the eastern boundary of the wider Twyford Site and the higher areas within the northern areas of the Klondyke Site and partially from the rear of the properties located on the south side of South Street.

6.4.49. To the east, views are generally restricted to glimpsed views along Rushenden Road between the land raising areas and Nelson's Vue. Localised glimpsed views are also possible from the high points from Thomsett Way such as the roundabout east of the bridge over the railway.

6.4.50. To the south, views are generally restricted to the northern dwellings within Nelson's Vue with glimpsed views between the dwellings along Flanagan Avenue in Nelson's Vue from the dwellings along First Avenue in Rushenden.

Visual Receptors

6.4.51. Views towards the Site from public vantage points have been identified as being primarily from:

- The open water channel of the Swale;
- Public roads, notably from Rushenden Road and Thomsett Way;
- Residential properties to the south (Nelson's Vue and First Avenue, Rushden) and the north (South Street, Queenborough); and
- Public Rights of Way, notably ZB48 and ZB49.

6.4.52. The selected publicly accessible representative viewpoint locations are described below and are identified on **Figure 6.3**.

View 1 – PRoW ZB48

6.4.53. This view is representative of the views generally available from along this PRoW, within the Site boundary and from the top of the flood defences. This view is likely to be experienced predominantly by walkers and local fishermen who fish from Chalk Wharf. This view is also considered indicative of the views that would be available from craft navigating the Swale, albeit that views into the Site behind the flood defences will be largely screened from the Swale.

6.4.54. The direct views east from this location are clear, open, full and continuous views through the tall green protec mesh fencing of the entire Site as well as the wider Twyford and Klondyke Sites with the Former Steel Rolling Mill Site in the background, with the elevated nature of the PRoW providing a good vantage point.

6.4.55. Key components of this view include:

- Expansive areas within the wider Twyford Site of raised land that has naturally become vegetated;
- Green protec mesh fencing in the foreground between the PRoW and eastern slope of the flood defence;
- Areas of rough grassland in the foreground along the eastern slopes of the flood defences and surrounding the adjacent ditch;

- The elevation of industrial units and buildings (in the background);
- The elevation of the raised new residential dwellings at Nelson's Vue and the older dwellings along First Avenue beyond; and
- Open expansive sky.

Photograph 1a: View east from PRoW ZB48 over the Site (23/07/20)

6.4.56. From this location, however, the key viewing direction is towards the west and away from the Site. This view offers clear, open, expansive and continuous views of the Swale. The key components of this existing view include:

- Expansive open area of tidal mud flats and saltmarsh;
- Large scale industrial components such as cranes and chimneys in the far distance, associated with development on the Isle of Grain; and
- Open expansive sky.

Photograph 1b: View west over the Swale (23/07/20)

6.4.57. The overall viewing experience from this location is assessed to be transient but slow moving, prolonged and continuous and associated with occasional recreational activity. The principal viewing direction is however, considered to be away from the Site over the Swale.

6.4.58. The visual amenity value of the view over the Site is assessed to be low with high susceptibility to change resulting in medium sensitivity. This is because the view from the PRoW over the Site (to the east) is considered to be ordinary, composed of generic medium quality materials where the view is dominated by the raised land associated with the wider Twyford Site which represent visual detractors. It is recognised however, that there are views in the opposite direction (to the west) from the PRoW which provide good clear views across a highly valued and attractive locally distinctive landscape associated with the Swale which is within the Medway Estuary and Marshes SPA, Ramsar and SSSI.

View 2 – South Street

6.4.59. The view from South Street overlooking the Creek and The Saltings to the south is representative of the views from street level available from the southern edge of Queenborough and within Queenborough Conservation Area. This view is likely to be experienced by the residential properties along South Street, walkers and people accessing boats on the Creek.

6.4.60. The Site is largely obscured from view. The foreground is dominated by the tidal mudflats and water channel boats moored up on the southern bank and the wooden pontoons. Beyond the Creek the land rises to form The Saltings, which is an area of rough grassland, with scattered scrub and trees. There are some cranes and cars parked near the Creek. There are glimpsed and limited views of the flood defences adjacent to the Twyford Site in the mid-distance of the view, with the residential dwellings along First Avenue in the distance beyond the Site which are

framed against the rising Rushenden Hill on the skyline. There are also distant electricity pylons silhouetted against the skyline.

6.4.61. The key components of this existing view include:

- The Creek and quayside elements with tidal mud flats and water channel;
- Moored boats;
- Cranes and vehicles associated with the boats on the southern banks of the Creek;
- The rough grassland, scrub and trees of The Saltings within the Klondyke Site;
- Distant glimpsed views of properties along First Avenue in Rushenden in the distance; and
- Electricity pylons silhouetted against the skyline.

Photograph 2: Views towards the Site from South Road, Queenborough (03/03/21)

6.4.62. The overall viewing experience from this location is assessed to be transient but slow moving, prolonged and continuous and associated with recreational activity. The principal viewing direction is towards the Site.

6.4.63. The visual amenity value of the view over the Site is assessed to be moderate with medium susceptibility to change resulting in medium sensitivity as the view is from within Queenborough Conservation Area. Features of historic and cultural value are evidenced within the view, and these combine to enhance its amenity.

6.4.64. The visual amenity condition of this view is good. It is a view of a pleasant landscape containing features of cultural and historic value. However, it also contains visual detractors

associated with the boat yard which form noticeable components of the view while in the process of being decommissioned. The view is also interesting and is gained from a location which is considered 'safe' and associated with recreational and functional activity.

View 3 – Rushenden Road

6.4.65. This view between the planters separating Rushenden Road and the adjacent layby is representative of the glimpsed views generally available from the southern section of Rushenden Road and the start of PRoW ZB49 at its eastern end (which is currently temporarily closed while there are construction activities ongoing on the wider Twyford Site). This view is likely to be experienced frequently by walkers and the general public along Rushenden Road on foot and by motor vehicle, and in particular by residents of Rushenden.

6.4.66. The direct view towards the Site from this location, between the planters, provides distant partial views of most of the Site along PRoW ZB49 and the associated disused railway which form a corridor and valley between the raised land associated with Nelson's Vue to the south and the wider Twyford Site to the north. The flood defences and the green protec mesh fence along the ridge line on the western boundary of the Site form the background to the view with distant pylons silhouetted above the flood defences on the sky line. The raised land on either side of PRoW ZB49 has naturally vegetated while the PRoW and its surrounding area are characterised by hard standing.

6.4.67. Key components of this view include:

- Vegetated raised land either side of the lower hardstanding corridor associated with PRoW ZB49 and the disused railway corridor;
- Vegetated flood defences with a green protec mesh fence on the horizon;
- Distant electricity pylons on the skyline;
- Nelson's Vue new residential dwellings to the south; and
- Open views of the sky.

Photograph 3: Views towards the Site from Rushenden Road (03/03/21)

6.4.68. The viewing experience from this location for pedestrians is transient but slow moving, prolonged and continuous and associated equally with recreational and functional activities. For individuals within vehicles, the viewing experience is likely to be transient and fast moving, with the Site occupying a glimpsed distant and peripheral position relative to the main viewing direction, which is likely to be aligned along Rushenden Road.

6.4.69. The visual amenity value of the view over the Site is assessed to be low with medium susceptibility to change resulting in low sensitivity. This is because the view from the start of the PRoW and Rushenden Road towards the Site is considered to be ordinary, composed of generic medium quality materials, where the view is dominated by the raised land associated with the wider Twyford Site and Nelson's Vue which represent visual detractors.

View 4 – Frances Row

6.4.70. This is representative of the views available generally from residential properties along the north-western edge of Rushenden, and in particular Frances Row. This view will be experienced predominantly by residents of the adjacent surrounding properties and walkers through Nelson's Vue.

6.4.71. From this location there is an open and full view through the green protec mesh fencing surrounding the wider Twyford Site into the Site and the wider Twyford Site which form the focus of the view. In the far distance the tops of buildings associated with the southern edge of Queenborough are visible over the raised land and the high points of the Klondyke Site beyond. The grass covered flood defences frame the view to the west.

6.4.72. Key components of this view include:

- Green protec mesh fencing around the wider Twyford Site;
- Raised land which has naturally become vegetated;
- The grass covered flood defences; and
- Open expansive view of the sky.

Photograph 4: Views towards the Site from Frances Row (03/03/21)

6.4.73. The viewing experience from this location is assessed to be transient but slow moving, prolonged and continuous. The principal viewing direction is directed away from the Site along Frances Row.

6.4.74. The visual amenity value of the view over the Site is assessed to be low with low susceptibility to change resulting in low sensitivity. It is a view with no cultural associations which would be viewed by people with minimal interest in the view and their surroundings as their focus is on other activities.

Future Baseline

6.4.75. In the absence of the Twyford Pump Station, the Klondyke and Twyford Sites would continue to be subject to construction activities associated with planning application SW/13/1550 until they are land raised. In due course if a separate planning application is successful and permission is granted then a mixed-use development will be built on both sites as discussed in Chapter 1. During the land raising and settlement periods for both sites, the vegetation will continue to be

managed and the local topography of the Sites would be altered to create the development platforms. The land uses within the Site would be retained and management of the landscape will continue on a similar basis as the existing situation.

6.5. Assessment of Effects

6.5.1. The potential impacts, and the significance of the effect on landscape and visual amenity assets, are characterised in the absence of mitigation measures, beyond those identified and described in Chapter 3 as embedded into the construction and/or operational phases of the Twyford Pumping Station. The following embedded mitigation measure is considered in this assessment:

- Implementation of the Construction Environmental Management Plan (CEMP) (**Appendix 1**) during construction; and
- Implementation of the Ecology and Landscape Management Plan (**Appendix 2**) during operation.

6.5.2. Impacts may be direct or indirect. The effects during construction are anticipated to be of short term duration (temporary) while effects during operation are anticipated to be of long term duration (permanent) unless otherwise stated.

6.5.3. Impacts are only considered in detail when there is a reasonable likelihood of an effect on a feature of landscape or visual amenity significance.

6.5.4. Further details on the Twyford Pumping Station and construction activities are provided in Chapter 3 and are therefore not reproduced in detail in this chapter.

Construction Effects

Landscape

6.5.5. Construction activities will inevitably generate landscape changes. The principal activities that will potentially affect the fabric, quality and character of the landscape during construction of the Proposed Development are:

- Loss of vegetation;
- Change in topography;
- Temporary loss of public access;
- Noise intrusion; and
- Visual intrusion/amenity.

6.5.6. The impact of the construction activities will be for a relatively short period as the construction activities are only due to occur for approximately six months. Furthermore, the impacts will be minimised through the implementation of the CEMP (**Appendix 1**) which will include measures to control lighting and the location of the Site compound while also protecting retained vegetation in and around the Site. Furthermore, the movement of materials between stockpiles will be limited so that they do not shift over time thereby adding to the sense of fragmentation and instability of the landscape.

Site Landscape Features

6.5.7. During construction, site clearance will involve the removal of the temporary stockpiles of topsoil and its associated vegetation across the Site. In addition, vegetation will be removed on the flood defences in the works' footprint. Once the site clearance has occurred the land will be reprofiled through the excavation of the pond and ditches which will lower areas of the Site below the existing ground levels and allow the creation of culverts and the installation of the equipment and plant associated with the Pumping Station below ground. These activities will create a new temporary landscape of differing contrasting landscape character and elements with continual change and activity across the Site. However, the key landscape features within the Site including the flood defences and ditches outside of the Site will be protected and retained.

6.5.8. Overall, there will be an impact of medium magnitude on low sensitivity site features which will result in temporary short term minor adverse effects.

Site Landscape Pattern/Character

6.5.9. During construction, the introduction of new, contrasting temporary elements within the Site will form a new landscape pattern and temporary and transient change to the character of the Site. Furthermore, increases in movement and noise levels albeit temporary will generate a series of shifting patterns across different parts of the Site during construction. As these changes extend over the Site and as differing areas are completed the landscape character of the Site will change.

6.5.10. This will result in an impact of medium magnitude on low sensitivity landscape pattern/character which will result in temporary short term minor adverse effects.

Project Landscape Character Areas

LCA 1 – Queenborough & Rushenden Industrial Area

6.5.11. The detracting features of the construction activities and associated movement of vehicles and plant will occur within a small and discrete proportion (0.94 ha out of 61.54 ha) of LCA 1 which is well screened from the surrounding area by the raised land within the wider Twyford Site. The construction activities will also be in keeping with the transient nature of the area with the surrounding construction activities associated with the wider Twyford, Klondyke and Former Steel Rolling Mill Sites as well as the industrial activities in the rest of LCA 1. Therefore, there will be an impact of small magnitude on low landscape sensitivity resulting in a temporary short term neutral effect.

LCA 2 – Rushenden

6.5.12. The detracting features of the construction activities and associated movement of vehicles and plant will be separated from LCA 2 by the drainage ditch south of the disused railway corridor and PRoW ZB49. They will be in keeping with their surroundings where there are other similar construction activities occurring and will only be visible from part of the northern edge of the character area so will not detract from the key characteristics of LCA 2. Therefore, there will be a small/negligible impact on low landscape sensitivity resulting in a temporary short term neutral effect.

LCA 5 – Queenborough Conservation Area

6.5.13. The detracting features of the construction activities and associated movement of vehicles and plant will be separated from LCA5 by the wider Twyford Site and the southern part of the Klondyke Site. Views of the construction activities will be distant, glimpsed and in keeping with the surrounding construction activities associated with the wider Twyford Site and Klondyke Site. Therefore, there will be a negligible impact on medium to high landscape sensitivity resulting in a temporary short term neutral effect.

LCA 8 – Elmley Marshes

6.5.14. The detracting features of the construction activities and associated movement of vehicles and plant on the flood defences will occur on the boundary with the Elmley Marshes and temporarily provide a small discrete area of construction activities that are apparent from the open landscapes to the west of the Site and will locally modify the setting of the character area and views towards the Site. However, as there are other industrial and urban activities along the boundaries of the character area, this will result in localised impacts of small/negligible magnitude on a landscape of high sensitivity resulting in temporary short term effects of minor adverse significance.

Visual Effects

6.5.15. The four representative viewpoints have been selected to represent typical views of the Site from publicly accessible locations. The concentration of construction activities within the small site, will result in localised changes to views of the Site through the: removal of landscape elements resulting in changes in topography, land use and vegetation cover; and the introduction of new temporary elements including material stockpiles, site compound, lighting fencing or hoardings around the site boundary. In addition, there will be increased movement of plant and vehicles within the Site and along Rushenden Road. The effects of the construction activities will be minimised through the implementation of the CEMP (**Appendix 1**).

6.5.16. **Table 6.9** summarises the visual effects on the viewpoints associated with the construction activities.

Table 6.9: Visual Effects from Viewpoints during Construction

Viewpoint	Visual Receptor	Visual Effect	Magnitude of Impact	Significance of Effect
1	Views from PROW ZB48	Views over the Site are close, open, full and transient from the Public Footpath. Due to the proximity of the viewpoint, the presence of moving plant and vehicles as well as the construction activities will be evident and prominent from a small section of the Public Footpath where it approaches and then passes the construction activities. However, the key viewing direction is towards the west and away from the Site and the Site is located within the wider Twyford Site where there are also land raising activities.	Small	Temporary short term minor adverse effect
2	Views from South Street	The Site is in the distance within the transitory view and is scarcely discernible due to the raised land surrounding it within the Twyford Site and the intervening features within the	Negligible	Temporary short term neutral effect

Viewpoint	Visual Receptor	Visual Effect	Magnitude of Impact	Significance of Effect
		foreground associated with the Creek and Saltings in the Klondyke Site. During construction there may potentially be localised short term glimpsed views of construction activities along with moving plant and vehicles on the raised flood defences but they will be in keeping with the other construction and boating activities within the transient view.		
3	Rushenden Road	The Site is framed in the transitory view by the surrounding raised land associated with Nelson's Vue new dwellings to the south and the creation of the development platform to the north. The flood defences form the backdrop of the Site. There will be partial to glimpsed views of concentrated construction activities along with moving plant and vehicles from Rushenden Road between the planters along the disused railway corridor and associated PRoW ZB49. These will not change the character of the view as they are set within the wider Twyford Site with construction activities associated with land raising and will be periphery to the primary views along Rushenden Road in the direction of travel.	Small	Temporary short term neutral effect
4	Frances Row	Open transitory views of concentrated construction activities along with moving plant and vehicles will be obtained in the middle distance from Frances Row. They will be framed by the grassed flood defences in the west and the vegetated raised land associated with the wider Twyford Site in the east and north. The construction activities will constitute a distinct feature but would not change the existing overall landscape character as there are construction activities occurring in the wider Twyford Site.	Small	Temporary short term neutral effect

Operation Effects

Landscape

6.5.17. The operation of the Twyford Pumping Station will inevitably generate landscape changes. On completion of the construction activities, the Proposed Development has the potential to cause impacts upon:

- Topography;
- Queenborough Conservation Area; and
- Local landscape character.

6.5.18. The effects will be minimised through the implementation of the Ecology and Landscape Management Plan (**Appendix 2**)

Site Landscape Features

6.5.19. Once operational, the ground level of the Site will be lower compared to the existing situation associated with the temporary topsoil stockpile and will be lower than the surrounding flood defences to the west and the raised land associated with the wider Twyford Site to the east and north. The topography will screen the majority of views of the Site from the surrounding area. The main feature of the Site will be the pond with its grassed banks and the surrounding access track. The proposed Pumping Station compound will be discretely positioned at the toe of the flood defences with most of the equipment and plant located underground and therefore hidden from view. The key visible feature will be the erection of security fencing around the compound area and the control kiosk.

6.5.20. Overall, there will be an impact of medium magnitude on low sensitivity site features which will result in permanent minor beneficial effects.

Site Landscape Pattern/Character

6.5.21. Once operational, there will be a permanent change to the pattern/character of the Site. The discordant stockpiles of topsoil which create a long term albeit temporary unfinished character generally associated with construction sites, will change into a permanent pattern/character centred on the pond/ditch surrounded by grassed banks with the small Pumping Station compound at the toe of the embankment. This will be in keeping with the other ditches within the wider Twyford Site and create a softened edge to the development platform within the wider Twyford Site at the toe of the grassed flood defences. There will be limited movement and noise during operation mostly which will be occasionally interrupted by monitoring and management visits to the Pumping Station.

6.5.22. Overall, this will result in an impact of medium magnitude on low sensitivity landscape pattern/character which will result in permanent minor beneficial effects.

Project Landscape Character Areas

LCA 1 – Queenborough & Rushenden Industrial Area

6.5.23. The pond/ditch and Pumping Station compound will replace the current discordant stockpiles of topsoil which currently create a long term albeit temporary unfinished character generally associated with construction sites with a permanent pond surrounded by grassed banks with the small Pumping Station compound at the toe of the embankment. The new features will be in keeping with the existing ditches within the wider Twyford Site and the nearby existing Pumping Station to the north.

6.5.24. As the ground levels of the Site will be lower compared to the surrounding raised land and flood defences, the Twyford Pumping Station will be screened from the majority of LCA 1 and will not detract from the key industrial characteristics of the surrounding area.

6.5.25. Therefore, there will be an impact of small magnitude on low landscape sensitivity resulting in a permanent neutral effect.

LCA 2 – Rushenden

6.5.26. The pond and Pumping Station compound will replace the current discordant stockpiles of topsoil which currently create a long term albeit temporary unfinished character generally

associated with construction sites, with a permanent pond surrounded by grassed banks with the small Pumping Station compound at the toe of the embankment. The new features will be in keeping with the existing ditches within the wider Twyford Site and the nearby existing Pumping Station to the north and will soften views from the north-western edge of LCA 2 where it is visible.

6.5.27. As the ground levels of the Site will be lower compared to the surrounding raised land and flood defences and Nelson's Vue residential dwellings, the Twyford Pumping Station will be screened from the majority of LCA 2 and will not detract from its key characteristics.

6.5.28. Therefore, there will be a small/negligible impact on low landscape sensitivity resulting in a permanent neutral effect.

LCA 5 – Queenborough Conservation Area

6.5.29. The Twyford Pumping Station once operational will not be visible from the Queenborough Conservation Area due to the intervening topography associated with the Klondyke and Twyford Sites. Therefore, there will be negligible impacts on the medium to high landscape sensitivity resulting in a permanent neutral effect.

LCA 8 – Elmley Marshes

6.5.30. The Twyford Pumping Station once operational will not be visible from the Elmley Marshes as it will be screened by the flood defences. Therefore, there will be no change on the high landscape sensitivity resulting in a permanent neutral effect.

Visual Effects

6.5.31. The four representative viewpoints have been selected to represent typical views of the Site from publicly accessible locations. Once operational, there will be localised changes to views of the Site through the presence of the pond with its grassed banks, the access track and the Pumping Station compound at the toe of the flood defences. The effects on views will be minimised through the implementation of the Ecology and Landscape Management Plan (**Appendix 2**).

6.5.32. **Table 6.10** summarises the visual effects on the viewpoints associated with the construction activities.

Table 6.10: Summary of Visual Effects from Viewpoints during Operation

Viewpoint	Visual Receptor	Visual Effect	Magnitude of Impact	Significance of Effect
1	Views from PROW ZB48	Due to the proximity of the viewpoint, the pond with its grassed banks and access track, will be evident and prominent from a small section of the Public Footpath where it approaches and then passes the Site. The fenced Pumping Station compound with its kiosk will be less noticeable as it will be tucked into the toe of the flood defences. However, the key viewing direction is towards the west and away from the Site and the Site is located within the wider Twyford Site where there are also land raising activities.	Small	Permanent minor beneficial effect
2	Views from	The Site is in the distance within the transitory	No Change	Permanent

Viewpoint	Visual Receptor	Visual Effect	Magnitude of Impact	Significance of Effect
	South Street	view and will not be visible due to the intervening topography associated with the wider Twyford and Klondyke Sites		neutral effect
3	Rushenden Road	There will be partial to glimpsed views of the access track surrounding the pond and the fenced Pumping Station compound including the kiosk in front of the flood defences. These views will not change the character of the existing view as they will be set within the wider Twyford Site with construction activities associated with land raising and the hardstanding along the disused railway corridor and PRoW ZB49. In addition, the views will be periphery to the primary views along Rushenden Road in the direction of travel.	Small	Permanent neutral effect
4	Frances Row	Open transitory views of the access track surrounding the pond and the fenced Pumping Station compound with its kiosk will be obtained in the middle distance. They will be framed by the grassed flood defences in the west and the vegetated raised land associated with the wider Twyford Site in the east and north. The new structures will constitute a distinct feature in the views but would not change the existing overall landscape character as there are construction activities occurring in the wider Twyford Site.	Small	Permanent neutral effect

6.6. Mitigation Measures

6.6.1. There are no significant adverse effects predicted to result from the construction and operation of the Twyford Pumping Station, therefore no additional mitigation or enhancement measures are proposed.

6.7. Residual Effects

6.7.1. **Table 6.11** provides a summary of the residual effects resulting from the Twyford Pumping Station after effective implementation of the embedded mitigation measures proposed above.

Table 6.11: Residual Landscape and Visual Effects

Development Phase	Ecological Feature Affected	Residual Effect
Construction	Site landscape features	Temporary minor adverse effect
	Site landscape pattern/character	Temporary minor adverse effect
	LCA 1 – Queenborough & Rushenden Industrial Area	Temporary neutral effect
	LCA 2 - Rushenden	Temporary neutral effect
	LCA 5 – Queenborough Conservation Area	Temporary neutral effect
	LCA 8 – Elmley Marshes	Temporary minor adverse effect
	Views from PROW ZB 48 (Viewpoint 1)	Temporary minor adverse effect
	Views from South Street (Viewpoint 2)	Temporary neutral effect
	Views from Rushenden Road (Viewpoint 3)	Temporary neutral effect

	Views from Frances Row (Viewpoint 4)	Temporary neutral effect
Operation	Site landscape features	Permanent minor beneficial effect
	Site Landscape Pattern/Character	Permanent minor beneficial effect
	LCA 1 – Queenborough & Rushenden Industrial Area	Permanent neutral effect
	LCA 2 - Rushenden	Permanent neutral effect
	LCA 5 – Queenborough Conservation Area	Permanent neutral effect
	LCA 8 – Elmley Marshes	Permanent neutral effect
	Views from PROW ZB 48 (Viewpoint 1)	Permanent minor beneficial effect
	Views from South Street (Viewpoint 2)	Permanent neutral effect
	Views from Rushenden Road (Viewpoint 3)	Permanent neutral effect
	Views from Frances Row (Viewpoint 4)	Permanent neutral effect

6.8. Cumulative Effects

6.8.1. This section summarises the cumulative effects of the Twyford Pumping Station in combination with the construction and post-construction of development platforms on the Twyford Site, Klondyke Site and Former Steel Rolling Mill Site. All the schemes are anticipated to have an overlapping construction programme as well as be in operation at the same time. To this end, this section summarises the residual cumulative effects during construction followed by the cumulative effects post-construction or operation of the four developments.

6.8.2. If there is a requirement for additional mitigation measures to be implemented to minimise any potential significant adverse cumulative effects, these will be highlighted and considered in the assessment.

Construction

Landscape

6.8.3. The construction activities will inevitably generate landscape changes through the loss of vegetation, change in topography, demolition of buildings and structures and temporary loss of public access along PRoW Footpaths ZB48 and ZB49. These changes will be minimised through the schemes' CEMPs which will include measures to control lighting and the location of the Site compound while also protecting retained vegetation in and around the Site. Furthermore, the movement of materials between stockpiles will be limited so that they do not shift over time thereby adding to the sense of fragmentation and instability of the landscape.

6.8.4. These changes will create a new small, localised, temporary landscape of differing contrasting landscape character and elements with continual change and activity across the Sites. However, the key landscape features including the grassed flood defences and the banks of the Creek and some trees and foreshore of the Swale will be protected and retained. Furthermore, increases in movement and noise levels albeit temporary will generate a series of shifting patterns from different parts of the sites during construction. As these changes extend over the sites and as differing areas are completed the landscape character will change.

6.8.5. The changes will result in temporary cumulative impacts of medium magnitude on low sensitivity site features as well as landscape pattern/character which will result in temporary cumulative minor adverse effects.

6.8.6. In terms of the Project Landscape Character Areas, the key change will occur within LCA 1 – Queenborough & Rushenden Industrial Estate as all the sites are within this area. The detracting features of the construction activities and associated movement of the vehicles and plant will occur within a large proportion of this area which will be visible from Rushenden Road which passes through the middle of the sites. However, the construction activities are in keeping with the industrial activities in the rest of LCA 1. Therefore, there will be cumulative impacts of medium magnitude on low landscape sensitivity resulting in temporary moderate adverse effects.

6.8.7. The cumulative construction effects on LCA 2 – Rushenden and LCA 8 – Elmley Marshes will result in detracting features occurring close to the boundaries of these areas which will locally modify the setting of the character areas and views towards the construction activities. However, as there are other industrial and urban activities along the boundaries of the character areas, this will result in localised cumulative impacts of small magnitude which will result in temporary cumulative minor adverse to neutral effects.

6.8.8. The Saltings in the northern area of the Klondyke Site are within LCA 5 – Queenborough Conservation Area and therefore construction activities associated with this area in terms of site clearance and remediation will have a direct temporary effect on the landscape character. However, these activities in conjunction with the topography of the Klondyke Site will screen most of the construction activities associated with the other sites. Furthermore, they will occur in an area assessed to be in poor landscape conditions. Overall, there will be temporary cumulative impacts of medium magnitude resulting in temporary cumulative effects of moderate adverse significance.

Visual Context and Accessibility

6.8.9. There will be views of construction activities as well as the associated plant and vehicles movements on the sites from each of the viewpoints. Viewpoint 1 from PRoW ZB48 has open and full views from the whole length of the flood defences over all the sites. Due to the proximity of the viewpoint, the construction activities will be evident and prominent. However, the key viewing direction is towards the west over the Swale and away from the sites. The cumulative impacts will be medium resulting in temporary cumulative moderate adverse effects.

6.8.10. Viewpoint 2 from South Street in Queenborough will have views of the detracting construction activities associated with the Klondyke Site especially The Saltings, which is in poor condition, however, the Klondyke Site's topography also helps screen views beyond to the other sites. The cumulative impacts will be small resulting in temporary cumulative minor adverse effects.

6.8.11. Views from Rushenden Road at Viewpoint 3 will be affected by construction activities on all the sites which will dominate the views from the junction with Thomsett Way up to the bridge over the Creek. The cumulative impacts will be large resulting in temporary cumulative minor adverse effects.

6.8.12. Views from Frances Row at Viewpoint 4 will be dominated by the construction activities associated with the Twyford Site and the Site, which in turn will screen views of the Former

Steel Rolling Mill Site and the Klondyke Site. The views from this location are partial. The cumulative impacts will be medium resulting in temporary cumulative minor adverse effects.

Operation

6.8.13. During operation, the key effects will result from the proposed raising of ground levels within the Twyford, Klondyke and Former Steel Rolling Mill Site to create artificial development platforms, and the temporary reduction in built form on sites historically associated with extensive development. The changes at the Site will be insignificant compared to the creation of the surrounding development platforms. As the sites currently comprise derelict and cleared brownfield sites, the resulting site characteristics upon completion of the land raising process will not be significantly different to those currently present albeit the physical condition and quality of the sites will be improved slightly. The changes to the landscape features, pattern and character of the sites will result in cumulative long term impacts of small magnitude and minor beneficial significance. There will also be cumulative minor beneficial to neutral effects on the local Landscape Character Areas and the viewpoints.

6.9. Summary

6.9.1. The Site is characterised by previously developed land which has been cleared, remediated and then used to temporarily store topsoil. It is set within the wider Twyford Site which is subject to land raising to create a development platform which screens views of the Site from the north and east while the flood defences screen views from the west.

6.9.2. The Twyford Pumping Station on its own will have minor adverse to neutral effects on landscape and visual amenity during construction which will change to minor beneficial to neutral effects during operation as a result of the land use changes which will positively affect the landscape features, pattern and character of the Site and also views of the Site. There will also be no significant effects when considered cumulatively with the Twyford, Klondyke and Former Steel Rolling Mill Sites.

7.0 WATER ENVIRONMENT

7.1. Introduction

7.1.1. This chapter assesses the likely significant effects of the Twyford Pumping Station in terms of the water environment effects. It is supported by **Appendix 6**.

7.1.2. The chapter describes: the assessment methodology; the baseline conditions at the Site and in the surrounding area; the likely significant environmental effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; the likely residual effects after these measures have been employed.

7.2. Legislation and Planning Policy

7.2.1. The assessment has been undertaken within the context of relevant planning policies, guidance documents and legislative instruments. The key documents and policies are summarised below.

Legislation

7.2.2. Water resources are managed and protected under UK legislation and regulations consistent with European Community Directives. Where relevant, this assessment takes account of the legislative protection afforded to water resources. The main legislation affording protection to the water environment, relevant to this assessment are listed below:

- Flood and Water Management Act 2010[85];
- Flood Risk Regulations 2009[86];
- Water Act 2014[87];
- Water Industry Act 1991[88] (as amended by the Water Act 2003);
- Land Drainage Act 2010[89];
- Water Resources Act 1991[90];
- Environment Act 1995[91];
- Water Framework Directive (2000/60/EC)[92];
- Groundwater Daughter Directive (2006/118/EC) (GWDD)[93]; and
- Groundwater Directive (80/68/EEC) (GWD)[94].

[85] Flood and Water Management Act 2010
[86] The Flood Risk Regulations 2009 No. 3042
[87] Water Act 2014;
[88] Water Industry Act 1991
[89] Land Drainage Act 2010
[90] Water Resources Act 1991
[91] Environment Act 1995
[92] Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy
[93] Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration (Daughter to 2000/60/EC)
[94] Council Directive 80/68/EEC of 17 December 1979 on the protection of groundwater against pollution caused by certain dangerous substances.

Planning Policy Context

National Planning Policy

The National Planning Policy Framework (NPPF)[95]

7.2.3. The National Planning Policy Framework (NPPF) makes specific reference to flood risk and water supply in Section 14, where paragraphs 148 to 165 address the need to avoid inappropriate development in areas at risk from flooding. In particular, paragraph 150 of the NPPF compels Local Plans to:

'…avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures…'

7.2.4. Furthermore, paragraph 155 of the NPPF directs that:

'Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.'

7.2.5. Regarding water quality paragraph 170 e) states:

…'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'…

Planning Practice Guidance

7.2.6. Section 14 of the NPPF is supported by Planning Practice Guidance: Water supply, wastewater and water quality[96] which advises on how planning can ensure water quality and the delivery of adequate water and waste water infrastructure; and Planning Practice Guidance: Flood risk and coastal change[97] which advises on how planning can take account of the risks associated with flooding and coastal change in plan-making and the application process.

Local Planning Policy

Bearing Fruits 2031: The Swale Borough Local Plan 2017[98]

7.2.7. SBC adopted Bearing Fruits 2031: The Swale Borough Local Plan in 2017. It set out the vision and overall development strategy for the area and how it will be achieved for the period from 2014-2031. It identifies where development will take place and how the natural environment and built heritage of the Borough will be protected and enhanced. The policies relevant to this assessment are:

'Policy DM 21: Water, flooding and drainage

When considering the water-related, flooding and drainage implications of development, development proposals will:

[95] Ministry of Housing, Communities and Local Government (June 2019) National Planning Policy Framework
[96] Department for Communities and Local Government (July 2019) Planning Practice Guidance: Water supply, wastewater and water quality (ID:34)
[97] Department for Communities and Local Government (March 2014) Planning Practice Guidance: Flood risk and coastal change (ID: 7)
[98] Swale Borough Council (July 2017) Bearing Fruits 2031: The Swale Borough Local Plan

1. *Accord with national planning policy and planning practice guidance;*
2. *Avoid inappropriate development in areas at risk of flooding and where development would increase flood risk elsewhere;*
3. *Provide site specific flood risk assessments, as required, carried out to the satisfaction of the Environment Agency and, if relevant, the Internal Drainage Board. These will, where necessary, include details of new flood alleviation and flood defence measures to be installed and maintained by the developer;*
4. *Include, where possible, sustainable drainage systems to restrict runoff to an appropriate discharge rate, maintain or improve the quality of the receiving watercourse, to enhance biodiversity and amenity and increase the potential for grey water recycling. Drainage strategies (including surface water management schemes) for major developments should be carried out to the satisfaction of the Lead Local Flood Authority;*
5. *Integrate drainage measures within the planning and design of the project to ensure that the most sustainable option can be delivered, especially where, exceptionally, development is to be permitted in an area of flood risk;*
6. *Within areas at risk of flooding, submit a suitable flood warning and emergency plan that has been approved by the relevant emergency planning regime and, where appropriate, the emergency services; Bearing Fruits 2031: The Swale Borough Local Plan 2017 7 Development management policies;*
7. *Where necessary, demonstrate that adequate water supply and wastewater connection and treatment infrastructure is in place before construction commences and that these details have been approved by the appropriate water company and funded by the development where appropriate;*
8. *Ensure future unconstrained access to the existing and future sewerage and water supply infrastructure for maintenance and up-sizing purposes;*
9. *Make efficient use of water resources and protect the yield of local public water supplies. For new residential development, all homes to be designed to achieve a minimum water efficiency of 110 litres per person per day, in line with the Government's Housing Optional Technical Standard for water efficiency; and*
10. *Protect water quality, including safeguarding ground water source protection zones from pollution, to the satisfaction of the Environment Agency.'*

`Policy DM 22 The Coast

Planning permission will be granted for development proposals at or near the coast subject to:

1. *Maintaining or enhancing access to the coast where it can be appropriately managed;*
2. *The protection, enhancement or management as appropriate of biodiversity, landscape, seascape and coastal processes;*
3. *Enabling wildlife to adapt to the effects of climate change, contributing towards the Local Plan's Natural Assets and Green Infrastructure Plan provided by Policy CP 7;*
4. *No overriding conflict with the policies and proposals of the Shoreline Management Plans;*

5. *Proposals within the built up area boundaries as defined on the Proposals Maps, contributing to the rejuvenation of the developed coast, particularly where enhancing either existing industrial and maritime infrastructure, coastal heritage, tourism or environmental management;*

6. *Proposals at the undeveloped coast and its hinterland, supporting conservation and enhancement; and*

7. *Compliance with Policy DM 23 for the Coastal Change Management Area.'*

Swale Local Plan Review 2021[99]

7.2.8. Swale Borough Council is currently carrying out a Regulation 19 consultation between the 8th February and 30th April 2021. The consultation is in regards to a review which sets out the amount and location of new housing and employment and the planning policies to guide development in the borough for the period 2022 to 2038.

7.2.9. The emerging policy DM35 Water Quality and Water Resources states:

1. *'All development must make efficient use of water resources and protect the yield of public water supplies, groundwater and surface water and ensure long-term benefits to the local environment and habitats.*

    a. *For all minor residential development, all homes will achieve a minimum water efficiency of 110 litres per person per day, in line with the Government's Housing Optional Technical Standard for water efficiency; and*

    b. *For all major development, and for all minor development from 2025, higher water efficiency targets will be achieved, as set out in Policy DM 3, Mitigating and adapting to climate change through sustainable design and construction (using BREEAM and Home Quality Mark Assessment methods).*

2. *All development shall take a catchment-based approach to protect water quality, including surface water as well as safeguarding ground water source protection zones from pollution, to the satisfaction of the borough's Environmental Protection Team and the Environment Agency, as appropriate.*

    a. *Proposals for development within Groundwater Source Protection Zones will only be permitted if there is no risk of contamination to groundwater sources. If a risk is identified, development will only be permitted if adequate mitigation measures can be implemented.*

    b. *Proposals for piled foundations must take account of disturbance to ground and threats to water supply and prevent the creation of pathways from contaminated material to groundwater.*

3. *All development (except householder) must demonstrate that adequate water supply, drainage and wastewater connection and treatment infrastructure, to serve the whole development over its lifetime, is in place before construction commences and that these details have been approved by the appropriate water company and funded by the development where relevant. Details should include how works will be phased and ensure*

[99] Swale Borough Council (February 2021) Local Plan Review 2021. Pre-Submission Document (Regulation 19)

no occupation until all necessary works relating to water and wastewater have been carried out.

4. *All development must ensure connection to the sewerage system at the nearest point of capacity, following advice from the service provider. Proposals must demonstrate that future unconstrained access to the existing and future drainage, sewerage and water supply infrastructure for maintenance and up-sizing purposes has been allowed for.*

5. *Where it is likely that a proposal would have a significant adverse impact on water resources or water quality a detailed Water Quality Assessment will be required, as explained above and set out in Planning Practice Guidance, to the satisfaction of the borough's Environmental Protection Team and the Environment Agency, as appropriate.'*

7.2.10. The emerging policy DM36 Flood Risk states:

'Development proposals will:

1. Seek opportunities to provide multifunctional benefits, linking flood risk management with strategies for green and blue infrastructure, biodiversity net gain, improved health and wellbeing and mitigation and adaptation to climate change;

2. Avoid inappropriate development in areas at risk of flooding and where development would increase flood risk elsewhere;

3. Accord with national planning policy and planning practice guidance, in particular with regard to the application of the sequential and exception tests;

4. Provide site specific flood risk assessments, as required, carried out to the satisfaction of the Borough Council, the Environment Agency and, where relevant, the Lead Local Flood Authority and the Internal Drainage Board in accordance with the guidance set out in the Council's Strategic Flood Risk Assessment, addressing risks from all forms of flooding, cumulative and long term impacts, taking account of the most up to date and relevant data and guidance;

5. In accordance with Policy DM 37, use Drainage Strategies to demonstrate how surface water will be managed for major development, to the satisfaction of the Lead Local Flood Authority;

6. Provide, as necessary, details of how development will be made safe from flooding including details of what new flood mitigation, flood defences, resilience and resistance measures are to be installed and details of how these will be maintained and managed for the lifetime of the development, taking account of climate change;

7. Provide details of any necessary contributions to new flood defence or mitigation measures off site;

8. Provide, as necessary, details of the adoption arrangements secured with the relevant public authority or statutory undertaker;

9. Within areas at risk of flooding, submit a suitable flood warning and emergency plan that has been approved by the relevant emergency planning regime and, where appropriate, the emergency services.'

Strategic Flood Risk Assessment (SFRA)

7.2.11. JBA Consulting have prepared a Strategic Flood Risk Assessment (SFRA) for Swale Borough in 2020[100]. The report has been prepared to provide comprehensive and supporting evidence for the emerging Local Plan 2022 – 2038. The report provides flood risk evidence and long term strategy to support the management and planning of development, protect the environment, deliver infrastructure and promote sustainable communities within the Local Plan Area. It also supports the selection of site allocations in the emerging Local Plan and provides information and guidance to be used in the preparation of Flood Risk Assessments in support of site-specific planning applications.

7.2.12. The SFRA identifies the Site as being within Flood Zone 3a and at potentially at risk from tidal, fluvial and ground water sources.

7.3. Assessment Methodology and Significance Criteria

7.3.1. The methodology adopted in this assessment has focussed on the identification and evaluation of key sensitive receptors and then specifically on identifying impact 'types' and risks which potentially have beneficial or adverse effects on the key sensitive receptors.

7.3.2. The assessment of potential impacts and significant effects has been designed to be part of an iterative process where the results of the assessment process are inputted into the design of the Twyford Pumping Station and the development of the mitigation measures.

Study Area

7.3.3. The study area used for the basis of the assessment extends to at least 500m from the Site. Placing the Site within this wider context allows an enhanced appreciation of the character and importance of the water environment resource.

Data Sources

7.3.4. The desk top study reviewed the information provided by:

- British Geological Survey (BGS) website: www.bgs.ac.uk[101];
- Multi-Agency Geographical Information for the Countryside (MAGIC) website: www.magic.gov.uk[102]; and
- Environment Agency website and interactive maps: www.environment-agency.gov.uk[103].

Characterisation of Baseline Conditions

Surface Water

7.3.5. Baseline conditions have been determined using published data including Ordnance Survey mapping and site visits to identify nearby surface watercourses that could potentially be affected by the Twyford Pumping Station, and the Environment Agency General Quality Assessment (GQA)[104] and WIMS data[105] to establish the quality of those water bodies in and within the vicinity of the Site.

[100] JBA Consulting (February 2020) Swale Borough Council Level 1 Strategic Flood Risk Assessment
[101] www.bgs.ac.uk
[102] MAGIC Map Application http://magic.defra.gov.uk/MagicMap.aspx
[103] www.environment-agency.gov.uk
[104] Environment Agency (various dates) General Quality Assessment, www.environment-agency.gov.uk
[105] https://environment.data.gov.uk/water-quality/

Groundwater

7.3.6. Information on groundwater conditions in the vicinity of the Site has been compiled with reference to the Environment Agency Groundwater Vulnerability Map and other information held by the Environment Agency with respect to abstractions and Source Protection Zones (SPZs). There is no groundwater water quality data available on the Environment Agency's website.

Drainage Network

7.3.7. Assessment of the baseline rates and characteristics of surface water discharge from areas of impermeable surfaces within the Site has been undertaken with reference to the existing drainage system and the known drainage characteristics of the Site.

Flood Risk

7.3.8. Baseline information was derived from the Environment Agency's Flood Mapping for fluvial events and Updated Risk of Flooding from Surface Water (URoFSW) maps and the Flood Risk Assessment (FRA) provided in **Appendix 6.**

Limitations and Assumptions

7.3.9. Data used to compile this report consists of secondary information derived from a variety of sources. The assumption is made that this data, as well as that derived from other secondary sources, is reasonably accurate.

Impact Assessment and Significance Criteria

7.3.10. The assessment of potential effects to surface water has considered the change to the drainage of surface water as a result of the Twyford Pumping Station.

Groundwater

7.3.11. The assessment of the potential for construction and operation activities to affect groundwater has been undertaken by identifying potentially contaminative processes and operations resulting from the Twyford Pumping Station. The Site has already been remediated to remove pollutants associated with previous land uses and therefore these are not considered in this assessment.

Drainage Network

7.3.12. Assessment of the predicted indicative rate during construction and operation and predicted characteristics of surface water discharge from areas of impermeable surfaces has been undertaken with reference to the existing drainage system and the known drainage characteristics of the Site and Queenborough and Rushenden.

Flood Risk

7.3.13. The potential effect of the Twyford Pumping Station in terms of flooding was assessed by a review of the present and proposed site levels, surface water run-off flow regime and drainage strategy, in conjunction with predicted future river and flood levels, as supplied by the Environment Agency. The assessment was informed by the Flood Risk Assessment for the Link Road provided in **Appendix 6**.

Assessment of Sensitivity, Magnitude and Significance

7.3.14. **Table 7.1** sets out the scale of sensitivity used in the assessment.

Table 7.1: Scale of Sensitivity

Sensitivity	Description	
	Groundwater	Surface Water
Very High	Principle Aquifer with a Source Protection Zone	Surface watercourses with high ecological quality and good chemical quality. Surface, foul or combined drainage currently operating at, or exceeding design capacity.
High	Principle Aquifer with no Source Protection Zone	Surface watercourses with good ecological quality and good chemical quality. Watercourses within a SSSI/SPA/SAC/Ramsar. Surface, foul or combined drainage currently operating within 10% of design capacity.
Medium	Secondary A Aquifer with no Source Protection Zone but which is in continuity with a watercourse.	Surface watercourses with moderate ecological quality and good chemical quality. Watercourses of high amenity value. Surface, foul or combined drainage operating at between 70% and 90% of design capacity.
Low	Secondary B Aquifer with no Source Protection Zone and which is not in continuity with a watercourse.	Surface watercourses with poor ecological quality and failed chemical quality. Surface, foul or combined drainage operating at between 50% and 70% of design capacity.
Negligible	Unproductive Strata	Surface watercourses with bad ecological quality and failed chemical quality. Surface, foul or combined drainage operating at <50% of design capacity.

7.3.15. The magnitude of potential impacts is based on the scale set out in **Table 7.2.**

Table 7.2: Scale of Magnitude

Magnitude	Description	
	Groundwater	Surface Water
Very large	Extensive spatial distribution of contaminants with concentrations in excess of applicable thresholds (e.g. Soil Guideline Values (SGV)) and where a full pollutant linkage has been identified.	Substantial change in discharge rates that are in excess of watercourse capacity. This may lead to major changes in terms of flood risk, hydrology, form and/or characteristics. Substantial change in the quality of water being discharged. Any change in discharge rate that leads to exceedance of the design capacity of the surface, foul or combined drainage system.
Large	Concentrations of contaminants in excess of applicable thresholds (e.g. SGVs) and where a full pollutant linkage has been identified.	Substantial change in discharge rates that are not in excess of watercourse capacity. This may lead to major changes in terms of flood risk, hydrology, form and/or characteristics. Major change in the quality of water being discharged. Any change in discharge rate that leads to surface, foul or combined drainage systems operating at close to capacity.
Medium	Concentrations of contaminants are below applicable thresholds (e.g.	Slight to moderate change in discharge rates to watercourse. Slight or moderate changes to

Magnitude	Description	
	Groundwater	Surface Water
	SGVs) but a full pollutant linkage has been identified.	watercourse hydrology, form and/or characteristics. Moderate change in the quality of water being discharged from the site. Moderate change to discharge rate to the surface, foul or combined drainage systems. System operating well within capacity.
Small	Concentrations of contaminants in excess of applicable thresholds but where no pollutant linkage has been identified.	Slight change to the discharge rates. Might lead to very localised changes to form of the river, but not to flood risk. Slight change to discharge rate to the surface, foul or combined drainage systems. System operating well within capacity.
Negligible	Concentrations of contaminants are below applicable thresholds (e.g. SGVs) and no pollutant linkage has been identified.	No or very slight change in discharge rates or the quality of water released to watercourses. No or very slight change in discharge rates to the surface, foul or combined network.

7.3.16. The significance of effects is determined by considering the perceived sensitivity of the receptor in conjunction with the predicted magnitude of impact, as shown in **Table 7.3**.

Table 7.3: Methodology for Assessing Significance

Sensitivity/Value of Receptor	Magnitude of Effect				
	Very Large	Large	Medium	Small	Negligible/No Change
Very High	Substantial Significance	Substantial Significance	Moderate Significance	Moderate Significance	[1]
High	Substantial Significance	Moderate Significance	Moderate Significance	Minor Significance	[2]
Medium	Moderate Significance	Moderate Significance	Minor Significance	[2]	Neutral
Low	Moderate Significance	Minor Significance	[2]	Neutral	Neutral
Negligible	[1]	[2]	Neutral	Neutral	Neutral
[1] The choice between 'Moderate Significance', 'Minor Significance' and 'Neutral' will depend on the specifics of the effect and will rely upon professional judgement and reasoning.					
[2] The choice between 'Minor Significance' and 'Neutral' will depend on the specifics of the effect and will rely upon professional judgement and reasoning.					

Limitations and Assumptions

7.3.17. Data used to compile this report consists of secondary information derived from a variety of sources. The assumption is made that this data, as well as that derived from other secondary sources, is reasonably accurate.

7.4. Baseline Conditions

Topography

7.4.1. The topography of the Site and the study area is shown on **Figure 6.1**. The topography of the study area is that of a low lying, flat estuarine landscape with a range from -5m AOD up to 25m AOD.

7.4.2. There are no significant large scale natural terrestrial topographic features within the study area and the surrounding landscape. Areas of elevated land are restricted to three small hills. Rushenden Hill reaches a height of 15m AOD and is located to the south west of the Site immediately adjacent to the settlement of Rushenden. Doos Hill is barely distinguishable reaching a height of between only 5 and 10m AOD and is located to the north east of Queenborough. The highest of the three hills is Barrow Hill, which rises to approximately 25m AOD and is located approximately 1.25km to the east of the Site.

7.4.3. At the local scale, topographic features within the Site and its surroundings, take the form of manmade features including drainage ditches, flood defence bunds, railway embankments and land raised for development. The Site consists a flat area located at a level of between 0 m and 5m AOD, with temporary mounds of vegetated topsoil which rises to the west for the flood defence bund adjacent to the Swale.

7.4.4. The defining topography of the study area is therefore characterised by the low lying flat estuarine landscape, the Swale and River Medway with their associated tributary and creek systems, and the numerous local scale, linear earthworks and bund features, often associated with development.

7.4.5. The topography of the study area and surrounding landscape has played a significant role in establishing its overall landscape character and has in turn played an important role in influencing the nature and form of built development in the area.

Surface Water

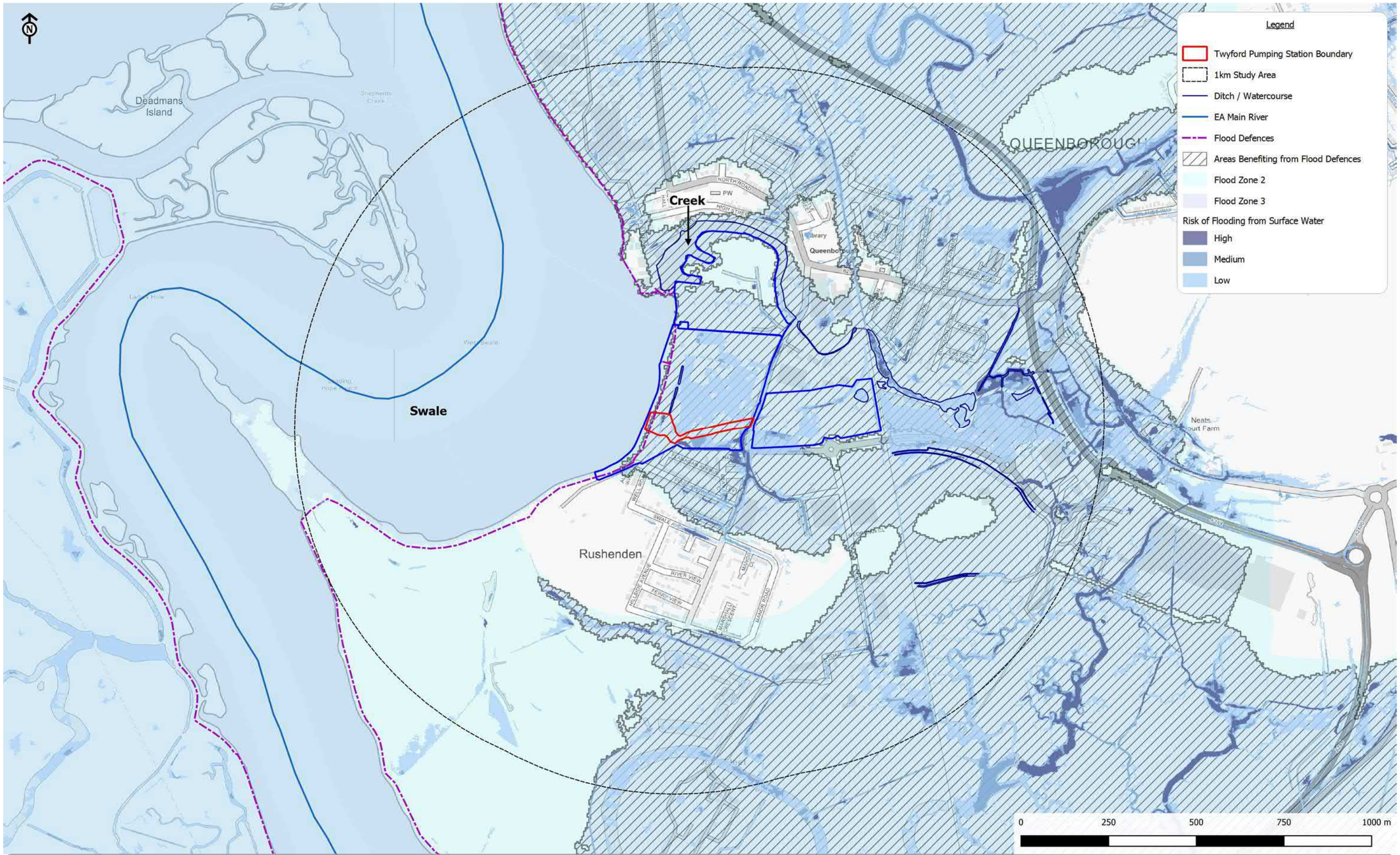
7.4.6. The tidal Swale is located on the western boundary of the Site separating the Isle of Sheppey from the mainland and Isle of Grain. The Swale is within the Medway Estuary and Marshes SPA, Ramsar and SSSI and is therefore of high sensitivity.

7.4.7. There is a ditch at the southern extent of the Site that crosses the wider Twyford Site north of Nelson's Vue, on a west-east alignment from Rushenden Road. The water from the ditch then enters a culvert to pass through the Site to a drainage ditch at the toe of the flood defences north of the Site, along the western boundary of the wider Twyford Site. The water quality within the ditch has not been monitored. However, as it is adjacent to and discharges into the Swale within the Medway Estuary and Marshes SPA, Ramsar and SSSI as shown in **Figure 7.1**, it is considered to be of high sensitivity.

Groundwater

7.4.8. The Site is located over alluvium in an impervious layer which is a secondary undifferentiated aquifer (www.magic.gov.uk). The alluvium is found over the London Clay Formation which is designated as Unproductive Strata.

7.4.9. The Site is not located within a Source Protection Zone. However, ground water levels across the Site are shallow with a groundwater gradient or flow direction in a westerly/north-westerly



Queenborough and Rushenden

Client: Homes England

Figure 7.1:
Surface Water Features and Flood Risk

Scale: 1:10000@A3

Job Number: 11465
Drawn by - Checked by: RP - MC
Drg No - Status/Revision: GIS256 - B
File location: N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\Environmental Report (pdf in Outputs)
Date (Revision History): 23/03/2021 (A, First Issue, 10/03/21, RP; B, Boundary Update, 23/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

direction towards the estuary. The groundwater is likely to be in hydraulic continuity with surface waters, including the drainage ditch within the Twyford Site.

7.4.10. The sensitivity of ground water is considered to be low as there is a secondary undifferentiated aquifer with potential continuity with the Swale.

Drainage Network

7.4.11. The ditch is part of the surface water sewer network for Queenborough and Rushenden including land being developed by the Applicant on the Twyford, Klondyke and Former Steel Rolling Mill Sites. The surface water from the impermeable surfaces within the settlements drains into pipes within the road network, which then ultimately flow down the pipe under Rushenden Road which feeds into the ditch that passes through the wider Twyford Site as described above before discharging into the Swale via the existing failing pumping station which is located at grid reference TQ908717 north of the Site. The current discharge rate from the existing pumping station is 240 l/s.

7.4.12. The sensitivity of the drainage network is considered to be low as the existing pumping station is failing but the network is working within capacity.

Flood Risk

7.4.13. The Site is shown on the Environment Agency's Flood Mapping to be in Flood Zone 3a as it benefits from the protection provided by the flood defence (**Figure 7.1**). This means that land within the Site would have a high probability of flooding without the local flood defences. These protect the area against a flood from the sea with a 0.5% chance of happening each year. The ground levels within the wider Twyford Site are currently being raised so that the land is outside of Flood Zone 3a. The majority of the Site is also at low risk from surface water flooding. There is a small area of medium risk surface water flooding at the eastern toe of the flood defences.

7.4.14. Therefore, the sensitivity of the Site to flood risk is high.

Assessment of Sensitivity

Table 7.4: Sensitivity of Surface Water, Groundwater, Drainage Network and Flood Risk

Receptor	Sensitivity	Qualifying Comments
Surface water: Swale	High	Watercourse within the Medway Estuary and Marshes SSSI, SPA and Ramsar
Surface water: Ditch within the Site	High	Lies adjacent and discharges into the Medway Estuary and Marshes SSSI, SPA and Ramsar
Groundwater	Low	Secondary Undifferentiated Aquifer potentially in continuity with the Swale.
Drainage Network	Low	Surface and foul drainage networks are within capacity but the existing pumping station is failing.
Flood Risk	high	Site lies within Flood Zone 3a and therefore has a high probability of flooding without the presence of the flood defences.

Future Baseline

7.4.15. In the absence of the Twyford Pump Station, the Klondyke and Twyford Sites would continue to be subject to construction activities associated with planning application SW/13/1550 until they are land raised. In due course if a separate planning application is successful and permission is granted then a mixed-use development will be built on both sites as discussed in Chapter 1. During the land raising and settlement periods for both sites, the vegetation will continue to be managed and the local topography of the Sites would be altered to create the development platforms. The land uses within the Site would be retained and management of the landscape will continue on a similar basis as the existing situation. The existing pumping station will continue to be at an increased risk of failing.

7.5. Assessment of Effects

7.5.1. The potential impacts, and the significance of the effect on the water environment, are characterised in the absence of mitigation measures, beyond those identified and described in Chapter 3 as embedded into the construction and/or operational phases of the Twyford Pumping Station. The following embedded mitigation measure is considered in this assessment:

- Implementation of the Construction Environmental Management Plan (CEMP) (**Appendix 1**) during construction; and
- Implementation of a temporary surface water drainage system while water in the ditch/culvert requires diverting from the existing culvert to facilitate construction.

7.5.2. Impacts may be direct or indirect. The effects during construction are anticipated to be of short term duration (temporary) while effects during operation are anticipated to be of long term duration (permanent) unless otherwise stated.

7.5.3. Impacts are only considered in detail when there is a reasonable likelihood of an effect on a feature of significance.

7.5.4. Further details on the Twyford Pumping Station and construction activities are provided in Chapter 3 and are therefore not reproduced in detail in this chapter.

Construction Effects

Surface Water

7.5.5. The majority of construction activities will be carried out off-line from the existing ditch and culvert to minimise effects to water quality in the Swale or the ditch as much as possible. While temporary short term works are carried out that directly affect the existing culvert prior to the completion of the new drainage network, a temporary water drainage system will be installed to ensure that construction activities will not directly affect the water quality in the Swale or the ditch. The temporary drainage system will involve the stopping up of the culvert under the Site and instead the water will be pumped through a pipe over the Site and into the ditch to the north of the Site where it can continue to flow to the existing pumping station and be discharged into the Swale. The culvert entrance to the ditch north of the Site will also be blocked up to avoid the Site flooding.

7.5.6. In addition, suspension of sediment and contaminants will be minimised through the effective implementation of the CEMP (**Appendix 1**), which includes a dust control plan and other measures that are in accordance with the best practice pollution prevention guidelines[106].

7.5.7. Overall, the impact on water quality within the Swale and ditch during construction will be of negligible magnitude, resulting in a temporary neutral effect.

Groundwater

7.5.8. There is a risk from leaks and spills associated with the storage of fuels, oils and other potentially hazardous materials used as part of the construction activities leaking into the soils. If there is a leak or spill, the potentially hazardous liquids could infiltrate through the soils causing a deterioration in groundwater quality.

7.5.9. These risks will be minimised through the effective implementation of the CEMP (**Appendix 1**) which specifies how to store fuels, oils and other potentially hazardous materials in accordance with best practice pollution prevention guidelines. The CEMP also includes details on how to mitigate for a leak or spill.

7.5.10. Overall, the impacts will be of negligible magnitude and will result in temporary neutral effects on groundwater quality.

Drainage Network

7.5.11. During construction, the existing pumping station will remain operational with the majority of the construction activities occurring off-line from the existing ditch and culvert. For the short period of time when the culvert is directly affected a temporary surface water drainage system will allow the existing surface water sewer network to continue to operate unimpeded during the construction activities. As such, the impact of the construction activities on the surface water sewer network will be of negligible magnitude resulting in a temporary neutral effect.

7.5.12. Significant volumes of foul water are unlikely to be generated during the construction phase. Any welfare facilities are likely to be of a temporary nature and foul water will be removed from the Site for disposal, via tanker. As such, the impact of construction activities on foul water drainage will be of negligible magnitude resulting in a temporary neutral effect.

Flood Risk

7.5.13. The construction activities will occur within Flood Zone 3a, but they will be protected by the flood defences. During the majority of the works, which will occur off-line from the existing ditch and culvert, there will be no effects on the flood risk. While works are carried out to the culvert, the temporary surface water drainage system that will be implemented will ensure that the water flowing through the ditches are not impeded by the construction activities. Therefore, there will be an impact of negligible magnitude to flood risk from the Swale and surface water resulting in a temporary neutral effect.

Operation

Surface Water

7.5.14. Once construction of the Twyford Pumping Station has been completed the existing pumping station will be decommissioned but left *in-situ* along with the ditch along the toe of the flood

[106] https://www.gov.uk/guidance/pollution-prevention-for-businesses

defences in place. Once operational the Twyford Pumping Station will discharge water to a location approximately 115m south of the existing outfall associated with the existing pumping station. The water quality will be either the same or better than the water discharged from the existing pumping station as the water will pass through a vegetated ditch/pond which will allow settlement of sediment and adsorption of nutrients including nitrogen and phosphorus to occur. This will improve the water quality being discharged into the Swale compared to the existing situation. The flow rate of the discharged water will be 50% greater than the existing flows at 400 l/s but it will remain low enough not to cause any likely significant effect on the habitats or qualifying species on the Medway Estuary and Marshes SPA, Ramsar and SSSI.

7.5.15. The magnitude of impact on surface water flow and quality will be negligible resulting in a permanent neutral effect.

Groundwater

7.5.16. During operation there will be no effects on groundwater as there will be little requirement for fuels, oils or other chemicals during operation that could leak or spill into the ground. Therefore, the magnitude of impact on ground water quality will be negligible resulting in a permanent neutral effect.

Drainage Network

7.5.17. Once the Twyford Pumping Station becomes operational, the existing pumping station will be decommissioned. The Twyford Pumping Station will provide an improvement to the existing storm and surface water drainage system by being more reliable and also the pond will increase the storage capacity in storm events prior to the water being discharged into the Swale. The discharge rate from the Twyford Pumping Station will be 50% greater than the existing pumping station with a discharge rate of 400 l/s. Therefore, the magnitude of impact on the drainage network will be small resulting in a permanent minor beneficial effect.

Flood Risk

7.5.18. Once operational, the Twyford Pumping Station, which is a water compatible development, will provide an improvement to the existing storm and surface water drainage system by being more reliable and also the pond will increase the storage capacity in storm events prior to the water being discharged into the Swale. It will therefore, help protect against localised surface water flooding after storm events and is water compatible in the event of flooding from the Swale. The magnitude of impact on flood risk will be negligible resulting in a permanent neutral effect.

7.6. Mitigation Measures

7.6.1. No additional mitigation measures beyond the embedded mitigation measures already considered are required as there are no significant adverse effects anticipated to occur.

7.7. Residual Effects

7.7.1. **Table 11.5** provides a summary of the residual effects resulting from the Proposed Development after effective implementation of the embedded and additional mitigation measures proposed above.

Table 11.5: Residual Water Environment Effects

Development Phase	Resource/Receptor affected	Residual Effect
Construction	Surface water	Temporary neutral effect
	Groundwater	Temporary neutral effect
	Drainage network	Temporary neutral effect
	Flood risk	Temporary neutral effect
Post-Construction	Surface water	Permanent neutral effect
	Groundwater	Permanent neutral effect
	Drainage network	Permanent minor beneficial effect
	Flood risk	Permanent neutral effect

7.8. Cumulative Effects

7.8.1. This section summarises the cumulative effects of the Twyford Pumping Station in combination with the construction and post-construction of development platforms on the Twyford Site, Klondyke Site and Former Steel Rolling Mill Site. All the schemes are anticipated to have an overlapping construction programme as well as be in operation at the same time. To this end, this section summarises the residual cumulative effects during construction followed by the cumulative effects post-construction or operation of the four developments.

7.8.2. If there is a requirement for additional mitigation measures to be implemented to minimise any potential significant adverse cumulative effects, these will be highlighted and considered in the assessment.

Construction

7.8.3. During construction of the Twyford, Klondyke and Former Steel Rolling Mill sites as well as the Site, there will be a reduction in area of hardstanding once it has been removed across the sites. It will be replaced by the creation of development platforms which will be surrounded by swales and contain drainage blankets which will collect the water and allow it to infiltrate into the ground or pass into the existing surface water bodies within or adjacent to the sites.

7.8.4. The land associated with the creation of the development platforms will be raised above the Flood Zone 3a reducing the risk of flooding in the sites and surrounding areas.

7.8.5. Furthermore, the construction effects for each development will be minimised through the implementation of the site specific CEMP. Therefore, the temporary cumulative impacts will be of negligible magnitude resulting in temporary cumulative neutral effects on surface and ground water, drainage network and flood risk.

Operation

7.8.6. The operation of the Twyford Pumping Station, with its increased capacity for pumping surface water from Queenborough and Rushenden surface water sewer network along with the raised land associated with the Twyford, Klondyke and Former Steel Rolling Mill Sites will have cumulative negligible impacts resulting in permanent neutral to minor beneficial effects on surface and ground water, drainage network and flood risk.

7.9. Summary

7.9.1. The closest surface water bodies to the Site are the ditch flowing through the Site which is partially culverted and the Swale within the Medway Estuary and Marshes SPA, Ramsar and SSSI to the west. The ditch forms part of the storm and surface water drainage network for Queenborough and Rushenden. The Site is also located over a secondary undifferentiated aquifer within the alluvium.

7.9.2. During construction, through the implementation of the CEMP and the installation of a temporary surface water drainage system in the form of a pipe connecting the two sections of open ditch either side of the Site together, there will be neutral effects on surface and ground water, the drainage network and flood risk. During operation, through the increased storage capacity provided by the pond and the operation of a reliable water pumping station, the water quality discharged into the Swale will be slightly improved and flood risk from surface water flooding reduced slightly. Overall, there will be neutral effects to the surface and ground water as well as flood risk and a minor beneficial effect on the drainage network.

7.9.3. There will also be no significant effects when considered cumulatively with the Twyford, Klondyke and Former Steel Rolling Mill Sites.

8.0 SUMMARY AND CONCLUSIONS

8.1. Introduction

8.1.1. This chapter provides a summary of the mitigation and monitoring identified by the specialist environmental studies along with a summary of the residual effects following implementation of the mitigation and monitoring measures. Full details of the assessments can be found in the respective technical chapters.

8.2. Mitigation and Monitoring Measures

8.2.1. **Table 8.1** provides a summary of the mitigation and monitoring measures required to minimise the effects of the construction and operation phases of the Twyford Pumping Station. The Applicant anticipates that, where appropriate, SBC will secure the mitigation and monitoring measures through planning conditions.

Table 8.1: Summary of Mitigation and Monitoring Measures

Topic	Development Phase	Effect	Measures
Biodiversity	Detailed Design	Effects on habitats and fauna within the Site	A detailed Ecology and Landscape Management Plan will be produced, based on **Appendix 2**, to provide a framework for the long-term management and enhancement of the semi-natural and natural habitats within the Site.
		Effects on reptiles	A detailed reptile mitigation strategy will be produced and agreed with Kent County Council Ecologists ahead of implementation.
	Construction	Effects from dust, noise and lighting on habitats and species within and near to the Site	Implementation of the CEMP (**Appendix 1**) during construction
		Effects on reptiles through loss of habitats and disturbance	Implementation of the reptile mitigation strategy.
		Effects on water voles through construction activities within 5m of the bank toe	A precautionary water vole field sign search of the ditch south of the Site will be carried out in advance of the works within 5m of the bank toe.
	Operation	Effects on habitats	Implementation of the Ecology and Landscape Management Plan (**Appendix 2**).
Landscape Effects	Detailed Design	Effects on landscape and visual amenity	A detailed Ecology and Landscape Management Plan will be produced, based on **Appendix 2**, to provide a framework for the long-term management and enhancement of the semi-natural and natural habitats within the Site.
	Construction	Effects on landscape features, character and visual amenity from local viewpoints	Implementation of the CEMP (**Appendix 1**) during construction.

Topic	Development Phase	Effect	Measures
	Operation	Effects on landscape features, character and visual amenity from local viewpoints	Implementation of the Ecology and Landscape Management Plan (**Appendix 2**).
Historic Environment	Construction	Effects on Queenborough Conservation Area and associated Listed Buildings	Implementation of the CEMP (**Appendix 1**) during construction.
Water Environment	Construction	Effects on surface water, groundwater and flood risk	Implementation of the CEMP (**Appendix 1**) during construction.
	Construction	Effects on surface water and drainage network during works to the existing culvert	Implementation of a temporary surface water drainage system while water in the ditch/culvert requires diverting from the existing culvert to facilitate construction.

8.3. Residual Effects

8.3.1. The residual effects of the Proposed Development following implementation of the above measures have been assessed. Although each technical chapter (4 to 7) contains detailed consideration of residual effects, **Table 8.2** summarises the residual effects of the Proposed Development.

Table 8.2: Significance Table of Residual Effects

Topic	Stage of Development	Residual Effects	Duration of Effect	Geographical Importance						Significance of Residual Effect
				I	UK	R	C	D	L	
Biodiversity	Construction	Effects on Statutory Designated Sites through dust, air, water pollution and visual disturbance	Temporary	*	*					Neutral
		Removal of habitats within the Site during site clearance	Temporary						*	Neutral to minor adverse
		Disturbance to wintering and passaging birds	Temporary	*						Neutral
		Disturbance to breeding birds	Temporary						*	Neutral
		Harm to reptiles	Temporary						*	Minor adverse
		Loss of habitat affecting terrestrial invertebrates	Temporary						*	Minor adverse
		Effects on Statutory Designated Sites through dust, air, water pollution and visual disturbance	Permanent	*	*					Neutral
		Creation of new grassland habitats on the banks of the pond and the flood defences within the Site	Permanent						*	Moderate beneficial
		Disturbance to wintering and passaging birds	Permanent	*						Neutral
		Disturbance to breeding birds	Permanent						*	Neutral
		Creation of new habitats for reptiles	Permanent						*	Minor beneficial
		Creation of new habitats for terrestrial invertebrates	Permanent						*	Minor beneficial
Historic Environment	Construction	Effects on archaeology	Permanent						*	Neutral
		Effects on settings of Queenborough Conservation Area and associated Listed Buildings	Temporary			*				Neutral
		Effects on the historic landscape character	Temporary						*	Neutral
	Operation	Effects on archaeology	Permanent						*	Neutral
		Effects on settings of Queenborough Conservation Area and associated Listed Buildings	Permanent			*				Neutral
		Effects on the historic landscape character	Permanent						*	Neutral
Landscape Effects	Construction	Change in site landscape features including removal of	Temporary						*	Minor adverse

Topic	Stage of Development	Residual Effects	Duration of Effect	Geographical Importance						Significance of Residual Effect
				I	UK	R	C	D	L	
		temporary stockpiles of topsoil and reprofiling of the site								
		Change in landscape pattern/character	Temporary						*	Minor adverse
		Direct effects on LCA 1 – Queenborough & Rushenden Industrial Area resulting from the change of features within the Site	Temporary						*	Neutral
		Effects on setting and views from LCA 1 – Rushenden resulting from the change of features within the Site	Temporary						*	Neutral
		Effects on setting and views from LCA 5 – Queenborough Conservation Area resulting from the change of features within the Site	Temporary						*	Neutral
		Effects on setting and views from LCA 8 – Elmley Marshes resulting from the change of features within the Site especially on the flood defences	Temporary						*	Minor adverse
		Change in view from PROW ZB 48 (Viewpoint 1) resulting from the presence of construction activities	Temporary						*	Minor adverse
		Change in views from South Street (Viewpoint 2) resulting from distant glimpsed views of construction activities	Temporary				*			Neutral
		Change in views from Rushenden Road (Viewpoint 3) resulting from partial views of construction activities	Temporary						*	Neutral
		Change in views from Frances Row (Viewpoint 4) resulting from partial views of construction activities	Temporary						*	Neutral
	Operation	Change in site landscape features with the introduction of the pond, access track and Pumping Station compound with the kiosk	Permanent						*	Minor beneficial
		Change in landscape pattern/character	Permanent						*	Minor beneficial
		Direct effects on LCA 1 – Queenborough & Rushenden Industrial Area resulting from the change of features within the Site	Permanent						*	Neutral
		Effects on setting and views from LCA 1 - Rushenden resulting from the change of features within the Site	Permanent						*	Neutral

Topic	Stage of Development	Residual Effects	Duration of Effect	Geographical Importance						Significance of Residual Effect
				I	UK	R	C	D	L	
		No effects on the setting and views from LCA 5 – Queenborough Conservation Area	Permanent						*	Neutral
		No effects on setting and views from LCA 8 – Elmley Marshes	Permanent						*	Neutral
		Change in view from PROW ZB 48 (Viewpoint 1) resulting from the presence of new site features	Permanent						*	Minor beneficial
		No change in views from South Street (Viewpoint 2)	Permanent				*			Neutral
		Change in views from Rushenden Road (Viewpoint 3) resulting from partial views of new site features	Permanent						*	Neutral
		Change in views from Frances Row (Viewpoint 4) resulting from partial views of new site features	Permanent						*	Neutral
Water Environment	Construction	Effects on water quality and flows of surface water	Temporary						*	Neutral
		Effects on water quality within the groundwater	Temporary						*	Neutral
		Effects on drainage network	Temporary						*	Neutral
		Effects on flood risk	Temporary						*	Neutral
	Operation	Effects on water quality and flows of surface water	Permanent						*	Neutral
		Effects on water quality within the groundwater	Permanent						*	Neutral
		Effects on drainage network	Permanent						*	Minor beneficial
		Effects on flood risk	Permanent						*	Neutral

8.4. Conclusions

8.4.1. In summary, the Twyford Pumping Station will replace the existing pumping station (which is beyond its working life) within the Twyford Site. The Twyford Pumping Station is designed to increase the efficiency and capacity of discharging surface water run-off from Queenborough and Rushenden into the Swale to help facilitate future development within Queenborough and Rushenden. The existing pumping station will be decommissioned and along with the drainage channels will be left in-situ.

8.4.2. The Twyford Pumping Station will result in the following beneficial effects:

- Creation of new grassland habitats with improved management as well as increased species diversity within the Site;
- Improved habitats for reptiles and terrestrial invertebrates;
- Creation of new permanent landscape features which will have beneficial effects on visual amenity and landscape character; and
- Improvements to the drainage network through enhanced capacity and efficiency.

8.4.3. The assessment has also identified adverse effects which will mainly occur during construction including:

- Potential for disturbance for species within the Medway Estuary and Marshes SPA, Ramsar and SSSI;
- Changes to views from Rushenden Road, Frances Row and Public Rights of Way ZB48 and ZB49;
- Local changes to landscape features and character; and
- Potential for mobilisation of contaminants resulting in the deterioration of surface and groundwater quality.

8.4.4. The implementation of the mitigation measures outlined within the CEMP during construction such as the use of lighting, dust and noise suppression measures and temporary drainage will result in many adverse effects being minimised or avoided.

Appendix 1: Construction Environmental Management Plan

CampbellReith
consulting engineers

Twyford Pumping Station
Queenborough & Rushenden

Outline Construction Environmental Management Plan

For

Homes England

Project Number:

11465

April 2021

Campbell Reith Hill LLP
Raven House
29 Linkfield Lane
Surrey
RH1 1SS

T: +44(0)1737 784500
E: surrey@campbellreith.com
W: www.campbellreith.com

Document History and Status

Revision	Date	Purpose/Status	Author	Check	Review
D1	21/07/2020	Draft	Marian Cameron	Grant Plain	Alan Poulton
D2	01/04/2021	Final	Marian Cameron	Grant Plain	Alan Poulton

Document Details

Last saved	21/07/2020 13:33
Path	11465 Twyford Pumping Station Outline CEMP 010421
Author	Marian Cameron
Project Partner	Alan Poulton
Project Number	11465
Project Name	Twyford Pumping Station, Queenborough & Rushenden

Contents

Appendices

Figures

1.0 INTRODUCTION

1.1. The Purpose of the Document

1.1.1. This document provides the outline Construction Environmental Management Plan (CEMP) for the Twyford Pumping Station on behalf of Homes England.

1.1.2. The CEMP focuses on the construction works to be undertaken for the Twyford Pumping Station and minimising potential environmental effects resulting from them.

1.1.3. The Twyford Pumping Station will replace the existing failing surface water pumping station within the Twyford Site. It is designed to increase the efficiency and capacity of discharging surface water run-off from Queenborough and Rushenden into the Swale to help facilitate future development within Queenborough and Rushenden. The existing surface water pumping station will be decommissioned and along with the drainage channels will be left in-situ[1].

1.1.4. The Twyford Pumping Station will be located west of Rushenden Road and north of First Avenue and Nelsons Vue between Queenborough and Rushenden on the Isle of Sheppey as shown in **Figure 1.1**. The National Ordnance Survey (OS) Grid Reference for the approximate centre of the Site at 590715, 171645. The Site will be located within the south-west area of the wider Twyford Site. The wider Twyford Site along with the Klondyke Site directly to the north was subject to planning permission (SW/13/1550) (henceforth referred to as the 'Approved Scheme' which was granted in March 2014 for:

'Site clearance, demolition of existing buildings, remediation, enhancement of the existing flood defences and land raising to form a development platform above a minimum height of 4.9m and below a maximum height of 5.4m above Ordnance Datum (AOD) on the Twyford and Klondyke Sites'.

1.1.5. The construction activities on the Twyford and Klondyke Sites are subject to CEMPs. The aim is for this CEMP to be consistent with the existing CEMPs to provide a coherent strategy for managing environmental effects across the sites.

1.2. The Twyford Pumping Station

1.2.1. The Twyford Pumping Station is shown in **Figure 1.2**. The outline design of the pumping station complex (excluding the actual pumps) and associated drainage ditches have been produced by CampbellReith in 2018. The design has been consented by the Lower Medway Internal Drainage Board (LMIDB). In summary the new pumping station will comprise:

- Pumping station complex with associated rising and gravity main discharging through an existing Environment Agency earth flood embankment to the Swale Estuary;
- New electrical connection to nearby below ground high-voltage cabling (11 kV) that will cross the proposed rising main;
- New drainage ditch/pond;
- Removal of existing 975mm culvert connecting the existing drainage ditches that are below the disused railway corridor and replacement with two offset 1,200 mm pipes with headwall and safety rail;

[1] The removal of the existing Pumping Station and infilling of the ditches to it will form part of a separate planning application and are therefore not considered further within this report.

- Landscaping of sloping drainage ditches/pond;
- Provision of 8m access strip around the pumping station and drainage ditch/pond to facilitate future maintenance, or which 4m will be grassed and 4m will be of granular surface; and
- Security/maintenance gates and fencing to prevent unauthorised access to pumping station and potentially security gates at the site boundary.

1.2.2. In the short to medium term the Lower Medway Internal Drainage Board (LMIDB) will be responsible for the pumping station, however, in the longer term the pumping station is proposed to be adopted by Southern Water as more residential development comes forward as part of the Queenborough and Rushenden regeneration.

1.2.3. The new surface water pumping station (henceforth referred to as the 'Twyford Pumping Station') will replace the existing failing surface water pumping station within the Twyford Site which has reached the end of its working life. The Twyford Pumping Station is designed to increase the efficiency and capacity of discharging surface water run-off from Queenborough and Rushenden into the Swale to help facilitate future development within Queenborough and Rushenden. The existing surface water pumping station will be decommissioned and along with the drainage channels will be left in-situ[2].

1.3. The CEMP

1.3.1. A CEMP forms the management framework required for the planning and implementation of construction activities in accordance with the environmental commitments identified as part of the environmental assessments undertaken in support of the planning application as well as any subsequent planning conditions or Section 106 legal agreements. Its purpose is to reduce the risk of adverse effects on environmental resources, local residents and businesses.

1.3.2. The document describes the checking, monitoring and audit processes that will be implemented to ensure works are being undertaken in accordance with these requirements, together with measures to enable appropriate corrective actions or mitigation measures to be taken.

1.3.3. The CEMP forms part of the overall project management during the construction phase and as such, activities described will be integrated with other Quality, Sustainability and Health and Safety Management processes set up by the Principal Contractor. It is a live document that will be regularly updated, subject to environmental audits to enable construction activities to be satisfactorily managed and mitigated.

1.3.4. Although the CEMP is a stand-alone document, it is supported by a range of associated documents required by planning conditions or existing agreements with regulatory authorities. The accompanying documents for the detailed CEMP will include the following:

- Safety, Health, Environment and Quality (SHEQ) Plan;
- Waste Management Strategy;
- Traffic Management Method Statement;
- Pollution Control and Contingency Plan;

[2] The removal of the existing Pumping Station and infilling of the ditches to it will form part of a separate planning application and are therefore not considered further within this report.

- Dust Control Plan;
- Noise Control Plan;
- Spillage Response Plan;
- Environmental Training Plan;
- Project Community Liaison Plan;
- Ecological Management Plan; and
- Materials Management Plan.

1.3.5. The construction methods described in this document represent the most likely means of carrying out the work. The actual methods and equipment may vary, but are not likely to result in any effects greater than those assessed in the Environmental Report supporting the Planning Application[3].

1.4. Anticipated Programme

1.4.1. The Proposed Development is due to commence in 2021 and finish in 2022. The key stages in the six month construction programme will comprise:

- Enabling works;
- Site preparation;
- Construction of the pumping station, pond and access track; and
- Landscaping.

1.5. Description of Works

Enabling Works and Site Preparation

1.5.1. Enabling works and site preparation will involve:

- Construction of a temporary construction compound which will contain temporary offices and welfare facilities for management and construction work;
- Construction of temporary access points for construction vehicles;
- Erection of site hoarding around the Site which will be a minimum height of 1.8m;
- Translocation of reptiles from the Site to Harty Marshes Reptile Receptor Site Extension (see **Appendix 3);** and
- Installation of temporary surface water management measures for construction.

1.5.2. The following environmental advance and enabling works will also be undertaken during this phase:

- An application for an Environmental Permit will be submitted to the Environment Agency prior to any works affecting the watercourse or the Swale flood defences;
- An application for temporary closure of the sections of public footpaths ZB48 and ZB49 where they pass through the Site under the Road Traffic Act;
- General vegetation clearance within the Site; and

[3] CampbellReith (March 2021) Twyford Pumping Station, Queenborough & Rushenden, Environmental Report.

- Removal of the topsoil which is being temporarily stored on the Site and re-profiling of the land to create the new ground levels associated with the pond and the surrounding access track.

Earthworks and Construction of the Pumping Station, Pond and Access Track

1.5.3. The construction of the pumping station, pond and access track will involve the following general sequence:

- Excavation of the flood bund to facilitate the construction of the rising main and gravity outfall and associated headwall with flap valve and access chamber on the crest of the flood bund. The flood bund will be reinstated in accordance with conditions of the Environmental Permit. This work should be completed during the summer months to minimise flood risk;
- Construction of the new pumping station compound with associated pumps, wet well, control kiosk and security fencing;
- Connection of the new pond (in part), pumping station with rising main/ gravity outfall and install the two new 1,200 mm diameter offset pipes and outfall headwall whilst still maintaining flow to the existing culvert, drainage ditch and pumping station. At this point the new pumping station will be live during the construction process such that if required it can pump water into the Swale Estuary;
- Excavation of the remaining pond area including the removal and blocking up of the ends of the existing pipe culvert. This work will require to be undertaken during the summer months when surface water levels in the drainage ditches are at their lowest to mitigate any potential surface water flood risk. Emergency pumps (size of which will need to be agreed with the Regulators including the Environment Agency) will require to be on standby in a heavy rainfall even such that water can be pumped into the Swale if required. A flood emergency plan will be required; and
- Completion of landscaping, construction of access/ maintenance track/ loop with security gates and fencing.

Landscaping

1.5.4. The main planting and landscaping works will occur during the first main planting season after construction of the pumping station, pond and access track.

1.6. Material and Resource Use

1.6.1. The pumping station will be constructed in part from concrete, while the access track will be 4m wide and made from compacted type 6F1 granular surface. The track edges will be blended into the surrounding ground by haunching surplus spoil.

1.6.2. Where practicable, materials and resources used during the construction of the Twyford Pumping Station will be sourced from the local area. In terms of material selection, 'A' rated materials from the Building Research Establishment's Green Guide to Specification[4] will be preferred.

[4] Building Research Establishment (2002) Green Guide to Specification

1.6.3. Any excess material from the Site will be removed and used locally as part of the land raise on the surrounding Twyford, Klondyke or Former Steel Rolling Mill Sites.

1.7. Plant and Equipment

1.7.1. Consideration has been given to the types of plant that are likely to be used during the construction works. The plant and equipment likely to be associated with each key element of the construction process include:

- Tracked/wheeled 360 degree excavators;
- Low noise/vibration piling equipment;
- Dumpers;
- Eight-wheeler trucks;
- Air compressors;
- Hand held tools including breakers (pneumatic and hydraulic);
- Power tools including percussion drills, cutting disks, pipe-threaders;
- Hand/power tools;
- Wheel washing plant;
- Delivery trucks; and
- Skips and skip trucks.

1.8. Hours of Work

1.8.1. It is anticipated that the working hours for construction activities audible at the Site boundary will be:

- 08:00-18:00 Monday to Friday; and
- 08:00 – 13:00 Saturday.

1.8.2. These hours will be agreed with Swale Borough Council (SBC) prior to construction commencing. All work outside these hours will be subject to prior agreement, and/or reasonable notice by SBC, who may impose certain restrictions and will have regard to planning conditions attached to any grant of permission. It is not envisaged that any work will be required during night time or bank holidays.

2.0 RELEVANT PARTIES AND KEY ROLES

2.1. Relevant Parties and Key Roles

2.1.1. The relevant parties and key roles are to be confirmed on appointment of the principal contractor:

Employer

Company: Homes England

Contact: Petra Clarke

Mobile: 07970 974440

Email: Petra.Clarke@homesengland.gov.uk

Contract Administrator

Company: CampbellReith

Contact: Grant Plain

Mobile: 07826 914291

Email: grantplain@campbellreith.com

Environmental Manager

Company: CampbellReith

Contact: Marian Cameron

Mobile: 07773319726

Email: marian@mariancameron.co.uk

Contractor's Operations Manager

Contact:

Mobile:

Email:

Site Manager

Contact:

Mobile:

Email:

Health and Safety Officer:

Contact:

Mobile:

Email:

Environmental Compliance Officer

Contact:

Mobile:

Email:

Ecological Clerk of Works

Contact:

Mobile:

Email:

2.2. Management Structure and Environmental Responsibilities

2.2.1. The management structure and environmental responsibilities including those of sub-contractors are summarised in **Table 2.1**. All personnel will be made aware of the requirements of this plan relevant to their work.

Table 2.1: Management Structure and Environmental Responsibilities

Title	Key Responsibilities
Contract Administrator	Employer's Agent who is responsible for administering the construction contract on behalf of the Employer.
Contractor's Operations Manager	Overall responsibility for the performance of the contract. Overall responsibility for the environmental performance of the contract and the safe construction of the project with particular responsibility for safeguarding the environment.
Site Manager	Responsible to the Operations Manager. Overall responsibility for the operation of the Application Site including safeguarding the environment as well as traffic and waste management issues arising from the project.
Environmental Manager/Liaison Officer	Responsible for: • Ensuring the works are carried out in accordance with UK environmental legislation, guidance and good practice; • The management of environmental issues as advised by the specialists (e.g. biodiversity and lighting); • Provide advice and liaise with construction teams to ensure that environmental risks are identified and that appropriate controls are developed and included within method statements and risk assessments; • Identify environmental competence requirements for all site personnel working on the project and ensure delivery of environmental training to personnel within the project team in accordance with the Environmental Training Plan; • Obtaining the necessary environmental consents; • Liaising with external third party organisations and individuals; • The production of the CEMP; • Regularly reviewing and updating of the CEMP and specialist procedures and identify any areas for improvements; • Maintenance of environmental records including those resulting from regular inspections; • Review method statements for environmental aspects and advise the Operations Manager as to their suitability; • Responsible for environmental monitoring (except water levels) and the maintenance of records; and • Act as a main point of contact between the Contractor, the Employer and Regulatory Authorities on environmental issues.
Foreman	Responsible to the Operations Manager with particular responsibility for construction and assisting with safeguarding the environment.

Title	Key Responsibilities
Environmental Specialists (including Environmental Compliance Officer and Ecological Clerk of Works)	To support the project as required and to provide mitigation measures described in the CEMP or in response to particular construction activities that may otherwise present an environmental risk. Their role will be to undertake the detailed mitigation design within their specialist field and oversee its implementation, maintenance and monitoring.

2.3. External Agencies

2.3.1. A list of key contacts from external agencies is provided below: [to be confirmed by Contractor once appointed]

Swale Borough Council

Environmental Health (air and noise)

Contact:

Address:

Landline:

Mobile:

Email:

Environmental Health (Ground Contamination)

Contact:

Address:

Landline:

Email:

Kent County Council

Traffic and Highways:

Contact:

Address:

Landline:

Mobile:

Email:

Conservation Officer:

Contact:

Address:

Landline:

Mobile:

Email:

Biodiversity Officer

Contact: Helen Forster

Address:

Landline:

Mobile:

Email: helen.forster@kent.gov.uk

Environment Agency

Contact:

Address:

Landline:

Mobile:

Email:

Natural England

Contact:

Address:

Landline:

Mobile:

Email:

3.0 ENVIRONMENTAL COMPLIANCE OF STAFF AND TRAINING RECORD ON CONSTRUCTION ENVIRONMENTAL MANAGEMENT

3.1.1. The raising of environmental awareness is viewed as a crucial element in the appreciation and implementation of the CEMP. As a consequence, all staff will undergo environmental awareness training, initially by way of the pre-start induction process. A project specific training plan that has identified the competency requirements for all personnel allocated with environmental responsibilities is available on the Site.

3.1.2. Training for all personnel identified in the training plan will be completed before commencement of the associated construction activities. Training will take the form of site inductions and toolbox talks. There will also be an environmental awareness course for all the principal contractor's project teams. Line managers and supervisors will ensure that all personnel engaged in activities that may have a detrimental effect on the environment are competent to carry out their duties or, where necessary, arrange for suitable training to be undertaken. All staff and contractors working on-site are to be made aware of the plan and should know their role if an incident occurs.

3.1.3. Exercises are to be carried out periodically to familiarise staff with the operation of the plant to test its effectiveness.

3.1.4. Training will include:

- Risk assessment procedures, requiring all personnel to be aware of and sign off the appropriate risk assessment/method statement for the task(s) in which they are engaged;
- Full health and safety induction with emphasis on use of the correct PPE which is to be provided by the Principal Contractor;
- Awareness of the potential for harm to both personnel and the environment from the materials held on-site;
- Awareness of the sensitivity of the environment surrounding the facility;
- Liaising with the Environment Agency if there is a risk of surface, groundwater or land contamination;
- Liaising with the Environment Agency if a discharge to the foul or combined sewer is involved;
- Clean-up, safe handling and legal disposal of contaminated materials and waste resulting from an incident (including arrangements for the use of specialist contractors and services);
- The appropriate clean up or legal disposal of contaminated PPE;
- Implementation of the provisions of the Environmental Incident Response Plan (see Chapter 9); and
- General public relations and the need for exemplary courtesy and behaviour of all site staff towards the general public.

4.0 ENVIRONMENTAL REQUIREMENTS AND LEGISLATION

4.1. The Employer's Requirements

4.1.1. Homes England is committed to best practice standards of working to ensure safe and secure implementation of the project with the minimum possible environmental harm.

4.1.2. Homes England will closely monitor the environmental, health and safety performance of any and all contractors subject to compliance with the present CEMP through all normal electronic and written media, telephone conversations and at least weekly visits.

4.1.3. Homes England will seek to remedy within the law any breach of the requirements of this document by any contractor.

4.2. Relevant Legislation and Guidance

4.2.1. All works will be carried out in accordance with current legislation and approved codes of practice and guidance, where applicable.

4.2.2. The Environmental Compliance Officer will prepare and maintain a register of all relevant environmental legislation and guidance. This will be agreed with the Environmental Manager prior to being communicated to all relevant site workers.

4.2.3. The following regulations/guidelines/codes of practice are considered relevant to the works covered by this CEMP:

- Air Quality (England) Standards Regulations 2010;
- Anti-Pollution Works Regulations 1999;
- BRE Report 456: Control of dust from demolition and construction activities 2003;
- British Standard BS 5228: 2009+A1: 2014: Code of practice for noise and vibration control on construction and open sites;
- British Standard BS 42020: 2013 Biodiversity – Code of practice for planning and development;
- Clean Air Act 1993;
- The Construction Plant and Equipment (Harmonisation of Noise Emission Standards) (Amendment) Regulations 1995;
- Contaminated Land (England) (Amendment) Regulations 2012;
- The Conservation of Habitats and Species Regulations 2017;
- Control of Pollution (Amendment) Act 1989;
- Controlled Waste (Carriers and Seizure of Vehicles) Regulations 1991;
- The Controlled Waste (England and Wales) Regulations 2012;
- Environment Act 1995;
- The Waste (England and Wales) Regulations 2011;
- Environmental Protection Act 1990;

- Hazardous Waste Regulations 2005;
- Hedgerows Regulations 2016;
- Landfill (England and Wales) (Amendment) Regulations 2016;
- Town and Country Planning Act 1990;
- Water Environment (Water Framework Directive) Regulations 2003;
- Environmental Permitting Regulations 2017;
- Water Resources Act 1991;
- Wildlife and Countryside Act 1981 (Amendment) (England and Wales) Regulations 2009; and
- Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy).

4.3. Method Statements

4.3.1. Method statements will be prepared by all contractors engaged to carry out works in consultation with: the engineers or other appropriate experienced personnel; on-site environmental staff; and, where necessary, environmental specialists. Their production will include a review of the environmental risks and commitments, so that appropriate control measures are developed and included within the construction process.

4.3.2. The Environmental Manager shall decide which of the works have environmental implications using the following criteria:

- The work may result in an adverse effect on the environment or human health;
- The work is adjacent to the Medway Estuary and Marshes SPA, Ramsar and SSSI;
- The work is adjacent to a surface water drain and/or water body.

4.3.3. Where the works have environmental implications, the method statements will be written or approved by the Environmental Compliance Officer in conjunction with any environmental specialists prior to work commencing. If the method of working is changed from the approved method statement, then work will cease. Any environmental changes deemed necessary will be approved in writing by the Environmental Manager and the relevant personnel informed before implementation. Where necessary, method statements will be submitted to the Regulators (Natural England, Environment Agency and Environmental Health Officer etc.) as appropriate. Method statements will contain at a minimum:

- Location of the activity and access/egress arrangements;
- Work to be undertaken and method of construction;
- Plant and materials to be used;
- Labour and supervision requirements;
- Health, safety and environmental considerations;
- Planning restrictions; and
- Any permit or consent requirements.

4.4. Risk Assessment

4.4.1. All activities undertaken within the Site will be subject to an environmental risk assessment. **Appendix 5** comprises an environmental risk register which summarises the key aspects and effects and their significance associated with the construction of the Twyford Pumping Station. The activities associated with the contract are identified, with individual tasks broken down into effects that could arise, or are likely to arise. The probability and importance of each effect is then determined.

4.4.2. The scoring applied to the effects is subjective according to knowledge of the task and the Site in addition to information available (1: minimal risk, 2: below average risk, 3: average risk, 4: above average risk, 5: high risk). Significance is a weighted score achieved by multiplication of the score applied to probability and importance. The risk register will be updated and revised regularly. More detail is inserted for control measures if the score is greater than 12 i.e. a high effect. These effects are reflected in the objectives and targets section.

4.4.3. Risk assessments will be undertaken by trained staff and agreed with the Environmental Manager (and an Ecological Clerk of Works where activities may affect the integrity of the Medway Estuary and Marshes SPA, Ramsar and SSSI or a protected species) following an approved procedure which will:

- Identify the significant environmental effects that can be anticipated;
- Assess the risks from these effects;
- Identify the control measures to be taken and re-calculate the risk; and
- Report where an inappropriate level of residual risk is identified so that actions can be taken through design changes, re-scheduling of work or alternative methods of working to reduce the risk to an acceptable level.

4.4.4. The residual risks are only considered acceptable if: the severity of outcome is reduced to the lowest practicable level; the number of risk exposures are minimised; all reasonably practicable mitigating measures have been taken; and the residual risk rating is minimised. The findings of the risk assessment, and in particular, the necessary controls will be agreed with the Environmental Manager and then explained to all operatives before the commencement of the relevant risks using the agreed instruction format.

4.5. Site Environmental Standards

4.5.1. The Site Environmental Standards will be agreed with the Environmental Manager and will detail the minimum measures that should be achieved for general operations which fall outside the risk assessment/method statement procedures designed to cover most construction activities. They will cover issues such as storage of materials, management of waste, water pollution, dust, noise and vibration and water pollution control. The standards will be printed on A3 posters, placed on site notice boards and used as a briefing tool on site. Routine toolbox talks will be conducted by suitably qualified persons.

5.0 HEALTH AND SAFETY AND GENERAL SITE MANAGEMENT

5.1.1. There is a legal requirement to protect project personnel and the general public from any significant adverse effect of implementing the construction works.

5.2. H&S – Project Personnel

5.2.1. Appropriate induction training should be given to all persons visiting and working on the Application Site. All persons will be provided with a copy of the Contractor's 'Environmental Site Induction' upon entering the Site for the first time (**Appendix 6**). The Contractor and their sub-contractors will fully comply with the site-specific rules contained in the 'Environmental Site Induction' and this CEMP.

5.2.2. It will be the responsibility of the Contractor to ensure that all site visitors and site operatives are given appropriate personal protective equipment (PPE) for the tasks being undertaken.

5.2.3. It will be the responsibility of the Contractor to ensure adherence to all standard safety procedures as laid down in the appropriate guidelines for the type of work and the pre-construction information.

5.3. H&S – General Public

5.3.1. It will be the responsibility of the Site Manager/Site Foreman to ensure that the Site and associated plant and machinery are secured during non-working hours.

5.3.2. It will be the responsibility of the Site Foreman to ensure that all heavy goods vehicles (HGVs) safely enter and exit the Site. All loading and unloading of HGVs will be undertaken within the worksite boundary.

5.4. General Site Management

5.4.1. The Contractor will keep records of all construction plant/machinery used on site, which will be maintained at weekly intervals.

5.4.2. The Contractor will ensure that all HGVs are routed from the A259 to the Site via Thomsett Way and Rushenden Road. No HGVs will be permitted to access or exit the Site via Queenborough.

5.4.3. Access and egress points onto the wider Twyford Site will be controlled by barriers and manned by a gateman during working hours and security personnel out of hours. However, the delivery of construction materials, plant and equipment will be restricted to approved working hours, unless in exceptional circumstances. To ensure safe access to the Site, signage will be used in advance and throughout the construction works.

5.4.4. During works on the flood defences, the Public Right of Way ZB48 will be closed.

5.4.5. The Contractor will determine appropriate intervals for the removal of waste from the Site and will ensure that this is disposed of at a suitably licensed facility.

5.4.6. The Contractor will be responsible for keeping detailed daily records of climatic conditions including rainfall, minimum and maximum temperatures and humidity.

5.4.7. On completion of construction works, the Contractor will clear away and remove all plant, surplus materials, rubbish and temporary works of every kind and leave the Site in a condition that satisfies SBC.

5.4.8. All necessary and reasonable measures will be taken to minimise fire risk and the Contractor will comply with the requirements of the local fire authority. Unauthorised open fires are prohibited at all times.

5.4.9. The Contractor will not allow any living accommodation on site except with prior written consent of the relevant local authority. Mess rooms, locker room, toilets and showers will be permitted.

5.4.10. If site security cameras are provided by the Contractor, these must be located in positions which will not cause offence to local residents or commercial business premises.

6.0 ENVIRONMENTAL CONSTRAINTS

6.1.1. The Site, as shown on **Figure 1.1**, is located adjacent to the Swale on the wider Twyford Site between Queenborough and Rushenden on the Isle of Sheppey.

6.1.2. The main environmental constraints for the Twyford Pumping Station are outlined below with the baseline survey results for ecology, water quality, air, noise and contamination within **Appendix 7**. The key sensitive receptors are shown on **Figure 6.1**.

6.2. Access

6.2.1. Located close to the A259, the Site is well connected to the national highways network. The A259 is predominately accessed from the Site via Rushenden Road and Thomsett Way.

6.2.2. There is one Public Right of Way ZB48 that passes through the western part of the Site along the top of the disused railway embankment and another, ZB49, which runs along the disused railway corridor through the Site.

6.2.3. Bus services in Queenborough and Rushenden are relatively limited with the following Arriva Kent and Surrey services:

- 334 Sheerness – Iwade – Sittingbourne – Detling Hill – Maidstone;
- 341 Sheerness – Iwade – Sittingbourne;
- 360 Leysdown – Eastchurch – Minster – Sheerness – West Minster; and
- 361 West Minster – Sheerness - Queenborough – Rushenden.

6.2.4. The nearest bus stops are located on Rushenden Road outside of the wider Twyford Site and opposite the Former Steel Rolling Mill Site. There is also a railway station in Queenborough adjacent to the B2207 Main Road which provides rail services to Sheerness and the mainland, although changes need to be made at Sittingbourne for other stations towards: London, Chatham and Rochester to the west; and Faversham, Canterbury and Dover to the east.

6.3. Landscape and Topography

6.3.1. The Site is not subject to any national landscape designations. It is located on a brownfield site in a historically industrial area between Queenborough and Rushenden. To the west is located the Swale with its open expanse of tidal estuary and mud flats that are exposed during low tide. The Isle of Grain is on the opposite bank of the Swale with low lying salt marshes. The wider area of Twyford Site is in the process of being land raised (planning reference: SW/13/1550) and therefore the ground level is undulating across the wider Twyford Site. The Site is at the original ground level (between 2.20m AOD and 2.87m AOD) which is lower than the land raised areas of the wider Twyford Site which once complete will be between 4.9m and 5.4m AOD. The Site has though been recently used to store topsoil which has created a slightly raised gently undulating ground level.

6.3.2. The area between Queenborough and Rushenden, where the Site is located, was generally flat and low lying behind the flood defences along the banks of the Swale until it was land raised in the Twyford Site. The Klondyke Site will be reprofiled 2020 to 2021.

6.4. Historic Environment

6.4.1. To the north of the Site, lies Queenborough which is a medieval town and port with a rich maritime history. It has strong connections to the Swale and Creek, as well as its wider marshland and estuarine setting. Queenborough is historically significant as a planned and laid out port settlement, planned by Royal Charter in 1368 between the west Swale and the Royal Castle. The Creek forms the boundary of the old town and its quayside. To the south of the Creek, the Saltings (the open grassland and saltmarsh in the Klondyke Site) provide an important landscape setting for the Conservation Area and is a key historic feature. In contrast Rushenden is a 20th century settlement with little cultural heritage significance.

6.4.2. The Site, although it is close to the areas of importance for prehistoric, roman, medieval or later archaeological remains, has a low potential for archaeological remains as the land has been previously developed which means that buried archaeological remains are likely to have been previously destroyed or truncated. In addition, the Site has been subject to archaeological intrusive investigations as part of the wider Twyford Site works.

6.5. Ecology and Nature Conservation

6.5.1. The Site is located outside of areas designated for ecology and nature conservation interest. However, the Medway Estuary and Marshes Ramsar, SPA and SSSI abut the flood defences forming the western boundary of the Site. The Medway Estuary and Marshes is designated for its internationally and nationally important wintering and breeding bird assemblages which use both the estuary and adjacent grazing marshes. It is also recognised for its assemblage of both aquatic and terrestrial macro-invertebrates including a number of Red Data Book species and the diversity of vegetation.

6.5.2. The habitats within the Site and in the area around the flood defences comprise made ground that has been subject to land raising as part of the wider Twyford Site with limited ecological interest. The grass flood defences along the western boundary of the Site support reptiles.

6.6. Water Resources and Flood Risk

6.6.1. The tidal Swale is located on the western boundary of the Site separating the Isle of Sheppey from the mainland and Isle of Grain. There are drainage ditches to the north along the western boundary of the wider Twyford Site and south of the Site crossing the wider Twyford Site north of the Keepmoat development, on a west-east alignment from Rushenden Road.

6.6.2. The Site and the wider Twyford Site was located within Flood Zone 3a where there was a 1 in 200 year or greater chance of flooding by the sea. The ground levels within wider Twyford Site are currently being raised so that the land is outside of Flood Zone 3a.

6.6.3. The Isle of Sheppey is located over alluvium in an impervious layer which is a secondary undifferentiated aquifer. The alluvium is found over the London Clay Formation which is designated as Unproductive Strata. The clays are located over deep chalk which comprises a mixture of secondary and primary aquifers.

6.6.4. The Site is not located within a Source Protection Zone. However, ground water levels across the Site are shallow with a groundwater gradient or flow direction in a westerly/north-westerly direction towards the estuary. The groundwater is likely to be in hydraulic continuity with surface waters, including the drainage ditch within the Twyford Site.

6.7. Ground Conditions and Contamination

6.7.1. The Site is underlain by Made Ground over Alluvium which is underlain by London Clay. The Site is in an area with a long history of industrial use, which has resulted in significant contamination of the soils and groundwater. The Site has been subject to remediation as part of the wider Twyford Site to remove and treat the contamination. No remediation has been carried out on the flood defences. The land within the Site, unlike the wider Twyford Site, has not been subject to land raising, although topsoil has been temporarily stockpiled on the Site.

6.8. Air Quality

6.8.1. There are no Air Quality Management Areas or Clean Air Zones on the Isle of Sheppey. The nearest AQMAs are in Sittingbourne on the mainland.

6.9. Sensitive Receptors

6.9.1. The receptors which are considered potentially sensitive to the construction of the Twyford Pumping Station have been identified and are summarised in **Table 6.1**.

Table 6.1: Potential Sensitive Receptors

Category	Sensitive Receptor/Land Use
Residential	• The residential properties in Nelsons Vue and along First Avenue on the northern edge of Rushenden.
Transport and Infrastructure	• Local highway network including Rushenden Road, Thomsett Way and A259; and • Public Right of Way ZB48.
Landscape and Views	• Views from the existing urban area of Queenborough and Rushenden; • Views from the Swale; and • Views from Queenborough Conservation Area.
Ecological Features and Habitats	• Medway Estuary and Marshes Ramsar, SPA and SSSI; and • Flora and fauna along the flood defences and the rest of the Site.
Historic Environment	• Queenborough Conservation Area; • Listed Buildings within Queenborough; and • Potential archaeological remains within the Site.
Water Resources	• The Swale • The drainage ditches within the wider Twyford Site to the north and south.

7.0 MITIGATION OF POTENTIAL EFFECTS DURING CONSTRUCTION

7.1. Introduction

7.1.1. This section sets out the measures to mitigate for adverse effects resulting from the construction of the Twyford Pumping Station. This section will be developed in more detail with the Contractor once appointed, to best reflect the actual methods of working and programming of construction activities. Construction teams will use the measures outlined below, whilst completing risk assessment and method statements which will in turn provide the appropriate mechanism for implementation on site.

7.2. General Mitigation

7.2.1. The following are general mitigation measures relevant to the construction activities:

- Construction works will be managed and controlled under the Construction (Design and Management) (CDM) Regulations 2007 which control health and safety and define responsibilities for appropriate project stakeholders;
- The Contractor will provide appropriate induction training for all site workers, including providing key workers with a copy of the CEMP and COSSH data sheets;
- The Contractor will provide and ensure use of appropriate PPE for all on site works, including (where necessary) overalls, dust masks, gloves and protective eye wear;
- Records are to be kept of all plant and machinery used on site, which are to be maintained at weekly intervals (see **Appendix 6**);
- All plant will be properly maintained (greased, blown silencers replaced, saws kept sharpened, teeth set and blades flat, worn bearing replaced) and not left running when not directly in use;
- Vehicle speeds on unpaved surfaces will be limited to 20 mph;
- The Site will be securely fenced prior to the commencement of any site works. The site fencing will be a minimum of 1.8m in height and of such a standard so as to deter trespassers onto the Site;
- Contractor's compound, plant and material stockpiles will be located away from nearby sensitive receptors including water bodies and surface drains and at a convenient distance to services to ensure clean water for welfare facilities where practicable;
- The Contractor will ensure best practice in accordance with pollution prevention guidelines is used at all times;
- Unauthorised fires will be prohibited within the site;
- Any hot works will be planned and managed under the control of a Hots Works Permit issued by the project team. Hot Work Permits will be issued when required and the Contractor will ensure that all hot works are compliant with the permits. The Contractor will ensure that all hot works are stopped 1 hour prior to the end of each day/shift and are inspected by the project team;

- The designated route for construction vehicles using the haul routes will be implemented and used within and around the Site;
- The designated route for construction vehicles to access the Site entrances on Rushenden Road via Thomsett Way and the A259 will be implemented;
- Deviations from approved method statements will be permitted only with prior approval from the Principal Contractor and other relevant parties;
- Records of daily weather conditions will be kept;
- Contractors will be prohibited from climbing onto the flood defences unless authorised; and
- Warning signs will be provided along the access route and at points where footpaths cross through the Site. The signs shall be retained in place and maintained through the construction and period. The signs will include: ones that warn Contractors '*Public in road ahead proceed with care*' within the Site 45m before any footpath interaction; and ones that warn pedestrians '*Warning construction site cross with care*' located on the footpaths 45m before any construction site interaction.

7.3. Control of Landscape and Lighting Effects

7.3.1. The following are landscape and lighting mitigation measures relevant to the construction activities:

- Where possible construction works will be restricted to daylight hours to avoid the potential for disturbance to people and fauna associated with mobile lighting;
- Specified working hours, uses of lighting and the location of temporary floodlights will be agreed with SBC;
- Lighting usage will be minimised and switched off when not required unless specifically needed for construction activities or for health and safety requirements. The Contractor will ensure that any task lighting that may be required during the winter months will be switched off outside of the Site;
- Light fittings will comply with the specifications and the requirements of CIE 150 (2003) and Institute of Lighting Engineer's Guidance Notes for the Reduction of Obtrusive Light. Security and site lighting which is required on a temporary or permanent basis through the night for security and safety reasons will be of a type with downward directional luminaries, low lighting columns (4-5m high) and low wattage luminaries to reduce light spillage and upward and outward light pollution. The light will also not be of a flashing or intermittent nature;
- The lights will be directed away from the flood defences, Swale and the houses to the south at Nelsons Vue and will be substantially confined to the object(s) intended to be illuminated;
- Lighting will be located and directed in such a manner that it does not cause unnecessary distraction to road users on First Avenue and Rushenden Road;

- All retained vegetation in and around the Site will be protected by fencing installed prior to construction and in compliance with BS 5837 (2012) – Trees in Relation to Design, Demolition and Construction - Recommendations[5]; and
- Movement of materials between stockpiles will be limited so that they do not shift over time thereby adding to the sense of fragmentation and instability of the landscape.

7.4. Protection of Species and Habitats

7.4.1. The following are measures to minimise effects on species and habitats relevant to the construction activities:

- Undertake site clearance between August and March where possible to avoid disturbance to breeding birds;
- If clearance operations are required during the breeding season, an ecologist will undertake a thorough inspection of all vegetation within a period of up to two days prior to removal to ensure that no nests are destroyed or disturbed;
- Weekly checks will be carried out by the Ecological Clerk of Works between March and August for breeding birds. If an active nest is found, ground clearance, vegetation clearance or construction activities around the nest (including a buffer area determined by the Ecological Clerk of Works), shall not be permitted until the breeding attempt has ended as confirmed by the Ecological Clerk of Works in writing to the Local Planning Authority;
- Daily inspections will be carried out to ensure mammals are not trapped in excavations etc. RSPCA assistance to remove all found trapped;
- All site operatives will be educated in the importance of the surrounding habitats and why the fencing has been erected;
- Reptiles will be translocated from the Site by a trapping and translocation exercise and moved to Harty Marshes Reptile Receptor Site in agreement with the Employer's team. Reptile fencing will be installed and maintained around the perimeter of the Site to prevent reptiles returning during construction. This will be carried out in line with recommended guidelines (HGBI, 1998).
- Habitats will be stripped using an excavator with low ground pressure and a toothed buck during reptile active season (March to October) under supervision of the Ecological Clerk of Works to capture and release any animals found;
- Site excavations will be covered during night time where practicable to prevent animals from falling and becoming trapped. If the excavations are unable to be covered then a board should be placed within the hole overnight to ensure animals have a safe escape route;
- If any reptiles are discovered during the construction activities, they will be captured and released within the receptor site by the Ecological Clerk Works. This will be carried out in

[5] British Standards Institute (2012) British Standards (BS) 5837: Trees in Relation to Design, Demolition and Construction - Recommendations

accordance with recommended guidelines (HGBI, 1998)[6] with the time between capture and release minimised with four hours as a maximum;

- Defined work areas will be clearly delineated using Heras fencing. No unauthorised construction works, machinery, workers or storage of materials will be allowed outside of these areas or in the woodland unless agreed with the relevant authorities. All site operatives will be educated in the importance of the surrounding habitats and why the fencing has been erected; and
- No herbicide will be used unless specifically authorised. The Contractor will ensure that there is strict adherence to the application method guidelines on wind conditions and type of herbicide.

7.5. Transport and Access

7.5.1. The following are transport and access measures relevant to the construction activities:

- Construction traffic will be managed through the Construction Traffic Management Plan (**Appendix 2**), which sets out measures to control construction vehicle movements and visitors to site. The Construction Traffic Management Plan will be displayed within the site welfare area and at all site entrances in prominent locations;
- All construction vehicles and plant will be fitted with flashing amber beacons, highways maintenance stickers and chevrons;
- The delivery of goods will be managed to ensure that arrival times occur outside of any sensitive periods. No deliveries will be accepted outside of the normal site working hours and vehicles will not be allowed to wait outside the Site on the public highway;
- Identified routes for all demolition, remediation and construction traffic to be implemented as described in **Appendix 2**. This will reduce the likelihood that vehicles will pass along sensitive roads (i.e. residential roads, congested roads, via unsuitable junctions);
- Large-scale vehicle movements will be timed to avoid peak hours on the local road network as far as reasonably practicable;
- On-site movements and plant will be restricted to well within the Site and not near the perimeter or existing sensitive receptors, wherever possible;
- All vehicle movements on site will be confined to designated haul roads and a one-way system will be in operation, vehicles shall not exceed the site speed limit of 10 miles per hour;
- Vehicles will be kept to hard standing and roadways at all times. All hard standing and roadways used for vehicles entering, parking or leaving the Site will be kept clean and in a maintained state. This will also include the site compound area and its associated car park;
- All persons working on or visiting the Site will park in the designated areas associated with the relevant development phase and sufficient space will be provided;

[6] Herpetofauna Groups of Britain and Ireland (1998) Evaluating local mitigation/translocation programmes: Maintaining Best Practice and lawful standards. HGBI advisory notes for Amphibians and Reptile Groups (ARGs). HGBI, c/o Froglife, Halesworth. Unpubl.

- Designated pedestrian walkways will be set up and signed around the compound area and where required around site. They will be segregated from all site hazards; and
- Plant will be located, where possible, well within the Site, away from the Site perimeter and existing sensitive locations.

7.6. Control of Dust

7.6.1. The following are dust control measures relevant to the construction activities:

- A Dust Control Plan will be produced and implemented which will include monitoring and mitigation measures (see **Appendix 4**);
- Liaison with SBC will be maintained throughout the construction phase and any incidents which lead to excessive elevation of dust deposition and/or PM_{10} concentrations at neighbouring sensitive receptors will be reported to the Environmental Health Department. In addition, nearby residents will be notified that dust emergence is being controlled on site. Any complaints received will be documented in a diary or log held on site by the Site Manager or Construction Liaison Officer;
- Visual checks for windblown dust will be undertaken and dust control measures implemented as required;
- Limit the area(s) of working during construction so that vehicles are confined within an area that can be subjected to appropriate dust control;
- Use of appropriately designed vehicles for material handling;
- Material stockpiles will be enclosed at all times and dusty materials will be dampened using water sprays and/or sheeted during dry weather;
- Stockpiles will be appropriately located within the Site as far as possible from sensitive properties and ecological receptors, taking account of the prevailing wind direction;
- Hard surface site haul roads will be maintained to minimise mud and dust build up. Surfaced and un-surfaced site access roads should be watered as necessary using a water bowser and surfaces kept in order. There will be regular inspections of local highways and boundaries of the Site to check for dust deposits (evident by soiling and marking) on vegetation, cars and other objects;
- Dust control will be applied during cutting or grinding of material on site to minimise or mitigate dust in accordance with the Dust Control Plan (**Appendix 4**);
- Before concrete is poured, the form work will be vacuumed rather than blown out;
- Vehicles carrying loose aggregate, fill materials or contaminated materials to and from the Site should be sheeted at all times;
- Smoke emissions or fumes from site plant or stored fuel will be limited;
- Vehicles should be kept clean using wheel washers as appropriate, particularly on departure from the Site onto the public highway;
- Screening of earthworks and perimeter landscaping, where appropriate should be completed to provide a physical barrier between the Site and the surroundings;

- A tractor/bowser will be operated during periods of dry weather to keep site roads damped down to prevent dust being blown into the air by wind or passing vehicles;
- Observation of wind speed and direction will be undertaken prior to conducting dust-generating activities to determine the potential for dust nuisance to occur. Potentially dust-generating activities will be avoided when wind direction may carry dust into sensitive areas and dust-generating operations will be avoided during periods of high or gusty winds or by erecting barriers adjacent to sensitive receptors;
- Surface areas of stockpiles (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) will be kept at a minimum to reduce the surface area exposed to wind pick-up. Dampening of exposed soils and stockpile materials will be carried out as and when appropriate using hoses and/or sprinklers. If longer term exposure is anticipated, then these areas will be re-vegetated;
- Completed earthworks will be covered or vegetated as soon as practicable;
- On-site aggregate handling will be carried out in enclosed areas and transfer will be completed in a way that minimises the requirements to deposit materials from height; and
- When loading materials into vehicles or using transfer chutes and skips, drop heights will be kept to a minimum and enclosed wherever possible.

7.7. Control of Noise and Vibration

7.7.1. The following are noise and vibration control measures relevant to the construction activities:

- Noise levels will be monitored prior to construction commencing and at regular intervals during the works. In addition, nearby residents will be notified that noise and vibration are being controlled on site;
- A Noise Control Plan will be implemented to ensure construction is undertaken in accordance with BS5228 (Parts 1 and 2)[7]. Noise complaints will be reported to the Principal Contractor and immediately investigated;
- The proposed working hours for construction works will be strictly adhered to throughout, unless in an emergency. Plant and machinery will only be operated within the permitted hours of operation where construction activities are audible from the boundary of any noise sensitive receptor;
- Drop heights are to be minimised and chutes are to be used where possible;
- Silencers or mufflers as appropriate will be fitted to plant and machinery;
- Plant known to emit noise strongly in one direction shall, where possible be orientated so that the noise is directed away from Swale and residential dwellings to the south;
- Consideration will be given to temporary screening or enclosures for static noisy plant and equipment to reduce noise emissions and plant should be certified to meet any relevant EC Directive standards;

[7] British Standards Institute (2009 and 2014) BS 5228 – 1:2009+A1:2014 Code of Practice for noise and vibration control on construction sites. Noise

- The quietest possible plant that can reasonably and practicably be obtained will be used for each construction task. Where possible, electrically driven equipment will be selected in preference to internal combustion powered or hydraulic powered equipment;
- Use of radios, other sound systems or tannoys will not be permitted on the Site;
- Cutting tools will be well maintained and kept sharp to reduce frictional noise;
- All necessary lubrication will be carried out in a timely fashion to reduce noise;
- Loading and unloading of vehicles, dismantling of equipment such as scaffolding or moving equipment or materials around the Site will be conducted in such a manner as to minimise noise generation; and
- The contractor will control vibration levels using best practicable means to reduce vibration levels at source such as the use of low noise/vibration piling techniques. Where necessary, consideration will be given to the implementation of specific mitigation measures to control vibration (e.g. with the use of appropriate plant and techniques) and where it is not practicable to work to the target, criteria provisions will be set out to reduce, monitor and control any adverse effects.

7.8. Control of Emissions to Water

7.8.1. The following are emissions to water control measures relevant to the construction activities:

- Construction activities will be carried out in accordance with guidance contained within best practice pollution prevention guidelines;
- The water quality within the Swale and the ditches within the wider Twyford Site will be monitored prior to and at regular intervals during construction to ensure that the quality is not affected;
- All necessary agreements or consents for the discharge of water from the Site will be obtained;
- Heras fencing would be installed at the edge of the 3m stand-off from each bank of the ditches within the wider Twyford Site to prevent vehicular movement and material storage on the banks;
- The Environment Agency and/or Internal Drainage Board will be consulted prior to any temporary or permanent works that may interfere with the bed, banks or floodplains of the Swale or ditches within the wider Twyford Site;
- Prior to pumping from excavations, permits to operate pumps will be issued to the pump operator, indicating the point of discharge and all other necessary control procedures;
- There will be no pumping to controlled waters or surface water drains/ditches without a Discharge Consent obtained from the Environment Agency;
- Before any discharge of water is made from the Site, adequate provision will be made to ensure that it is not polluting. Appropriate silt settlement techniques will be incorporated into the watercourses within and surrounding the Site;
- A Spillage Response Plan will be developed and implemented with all spills, regardless of size, reported to project management;

- Fuel, oil or chemical storage required will be stored on impervious bases with bunds to prevent spills or leaks of 110% and will be located away from watercourses in accordance with the COSHH Regulations 2002 and the Control of Pollution (Oil Storage) Regulations 2004;
- Where practicable, drainage from storage compounds will be passed through oil interceptors prior to discharge;
- Leaking and empty drums will be removed from the Site and disposed of appropriately;
- Any refuelling of mobile plant and machinery will be undertaken in a designated area away from watercourses and surface drains, and supplied with appropriate spill kits and bunded bowsers;
- All mobile plant will have drip trays or the equivalent under them to prevent any leaks getting to the ground;
- The handling and storage of potentially hazardous liquids on site e.g. fuels and chemicals will be controlled and best practice guidance from the Environment Agency will be applied;
- Biodegradable hydraulic oil will be used for machinery/plant where possible;
- Operational outlets to public sewers will be protected from debris and filters/screens/sumps will be employed;
- All drum and barrels will be fitted with flow control taps and will be properly labelled;
- Portable toilets (for initial site set up works) and good quality temporary toilet facilities will be provided for construction worker use to prevent water pollution resulting from worker-generated sewage effluents. The waste water from these facilities will be tankered off site and disposed of appropriately;
- The placing of any wet concrete or cement in or close to any water body including culverts will be controlled through temporarily bunding the area of works to separate the wet concrete or cement and water to prevent leaks into the water body;
- No concrete wash outs will be permitted on site. Contractors using concrete wagons must employ the use of a concrete sock for each wagon. Manholes and catch pits will be covered to prevent concrete/cement ingress;
- Haul roads and hard standing on the Site and approaches to the ditches will be regularly cleaned using water bowsers and/or road sweepers to prevent the build-up of mud, oil and dirt that may be washed into a stream or drain during heavy rainfall;
- The use of water sprays to reduce dust or wash down within construction areas will be carefully regulated to avoid washing substantial quantities of silt etc., into surface water drains; and
- Spill kits will be located near to the ditches within the wider Twyford Site, within the works compounds and at any location where fuel, oil or other chemicals are in use.

7.9. Contamination

7.9.1. The following are contamination measures in addition to those relating to emissions to water relevant to construction activities:

- Environmental protection during construction will be achieved by compliance with industry standard codes of practice such as CL:AIRE code of practice for the treatment of natural and made ground and implementation of construction environmental management procedures including: providing a decontamination unit for personnel working in the contaminated zones; only authorised personnel will be allowed access to the contaminated zones; and Environmental Permits will be sought as appropriate to control the environmental effects of the relevant permitted activity;
- A discovery strategy will be prepared in consultation with the Local Planning Authority and Environment Agency detailing the procedure to follow if unforeseen contamination is identified;
- Asbestos removal will be undertaken in accordance with current legislation and guidance, if identified;
- Hardstanding will not be removed until absolutely necessary to do so, as the hardstanding will mitigated the effects of dust and direct contact with potentially contaminated materials and prevent the infiltration of rainwater to the underlying wastes. Once removed pile matting or geotextile membranes will be installed as soon as possible;
- Where possible any stockpiles of soil should be stored on hardstanding or other appropriate impermeable surfaces to minimise the potential for mobilisation of contamination to the underlying groundwater and should be covered to prevent wind-blow of dust;
- Contaminated soils arising from excavation will be transported to a designated containment area prior to waste classification and subsequent treatment or disposal to prevent cross-contamination;
- Discharge arrangements for surface water will be agreed with the appropriate water company prior to implementation. Temporary management of surface water will follow the basic principle that surface water should be managed to prevent the mobilisation of contamination to the underlying groundwater;
- All gases and fuels will be stored in accordance with the current regulations. The locations of fuel storage will be on the Fire and Emergency Plan;
- Leaking and empty drums will be removed from the Site and disposed of appropriately;
- All mobile plant will have drip trays or the equivalent under them to prevent any leaks getting to the ground;
- Biodegradable hydraulic oil will be used for machinery/plant where possible;
- Operational outlets to public sewers will be protected from debris and filters/screens/sumps will be employed; and
- All drums and barrels will be fitted with flow control taps and will be properly labelled.

7.10. Control of Littering and Waste

7.10.1. The following are littering and waste measures relevant to the construction activities:

- The waste hierarchy will be adhered to throughout construction. The Principal Contractor will establish key performance indicators specifically for waste management which will be agreed with the Local Planning Authorities prior to construction commencing;
- Stockpiles will be sorted by type of material to enable recycling/reuse. The stockpiles will be in allocated areas away from the boundary of the Site and sensitive receptors and will be enclosed or securely sheeted;
- The Site Waste Management Plan (**Appendix 8**) which provides details about the transportation and management of waste within and outside the Site will be implemented;
- Any waste material arising from the enabling works and site preparation activities suitable for reuse will be retained and stockpiled where possible to incorporate such materials into the subsequent construction process;
- The Contractor will undertake improved procurement and consultation with selected suppliers regarding commitments to waste minimisation, recycling and the emphasis on continual improvement in environmental performance;
- Highways and footpaths on and in the vicinity of the Site will be kept free of debris and litter;
- All topsoil and subsoil will be handled and stored carefully to minimise the potential for damage to the soil structure. A detailed method statement will be produced that clearly identifies correct stripping, soil handling, storage and placement and programming requirements to avoid compaction and moving the material in suitable weather conditions;
- Where practicable, construction arisings will be reused within the Site. Detailed procedures and guidance will be developed and implemented through the construction process to minimise the import of non-sustainable raw materials and for identifying opportunities for reusing and recycling waste; and
- Site office waste will be collected in separate containers to maximise the opportunities for recycling.

8.0 ENVIRONMENTAL INCIDENTS AND AUDITING

8.1.1. An 'environmental incident' is any incident that, by its scale or nature, will have a negative effect on the environment. Such an effect is likely to result in a breach of environmental law, either by pollution to the environment or by endangering wildlife. As there are no restrictions on what constitutes an environmental incident, the system in place must remain flexible. In this case an emergency pollution response plan is to be implemented on the Site.

8.1.2. The Environmental Manager will be informed of any environmental incidents by the appropriate site supervisor. All environmental incidents, dangerous occurrences or near misses will be recorded by the Contractor on an Accident/Incident Report form. Once the incident is reported and recorded, actions will be identified to avoid a recurrence and the site procedures will be updated accordingly.

8.1.3. In the event of a serious pollution incident the person in charge of the operation will immediately notify the relevant Director of the Contractor. All serious environmental incidents, dangerous occurrences and/or near misses will be thoroughly investigated by the relevant managers, assisted by the Environmental Manager, to establish the facts, the reasons for the incident and make recommendations to prevent recurrence. The Contractor will co-operate with all accident/incident investigation and enquiries as required by the Employer. A report including photographs and witness statements will be forwarded to the Contract Administrator.

8.1.4. All accidents/incidents, dangerous occurrences and near misses will be reviewed by the Environmental Manager and where necessary changes to working practices/procedures will be implemented.

8.1.5. The following list details some of the incidents which it is anticipated may potentially occur, but the list is not intended to be exclusive:

- Leaking or poorly maintained machinery with no drip tray;
- Improper storage of chemicals;
- Incident leading to pollution of land, air or water;
- Incorrectly labelled or unlabelled waste, which may potentially be special (i.e. dangerous) waste;
- Waste left in an unsuitable and unsafe place;
- Disturbance to nesting birds; and
- Disturbance to wintering birds within the Medway Estuary and Marshes SPA, Ramsar and SSSI.

8.2. Pollution Control and Contingency Plan

8.2.1. A Pollution Control and Contingency Plan is to be implemented. This will include (amongst others) the following provisions:

- Contact list;
- Site drainage plan;
- Site chemical, product and waste inventory; and

- Emergency procedures.

8.3. Monitoring and Audits

8.3.1. The Contractor will undertake monitoring and auditing as necessary to implement the described mitigation. Records of any monitoring undertaken, e.g. noise, vibration, dust, water quality and wildlife fencing will be forwarded to the Environmental Manager.

8.3.2. Additional ad-hoc monitoring may be undertaken by the Employer.

Monitoring of Effects on the Interest Species within the Medway Estuary and Marshes

8.3.3. In addition to the general monitoring and auditing of the construction activities described above, special attention will be paid to the effects on the interest species within the Medway Estuary and Marshes SPA, Ramsar and SSSI during the winter months.

8.3.4. Noise monitoring will be undertaken along the western boundary of the Site and an experienced bird ecologist will regularly monitor bird activity within the Medway Estuary and Marshes SPA, Ramsar and SSSI during the period from October through to March (inclusive). If the monitoring shows that disturbance is happening (despite the control measures being implemented) then works will cease until further measures are agreed (with SBC in liaison with Natural England) and implemented.

8.3.5. The monitoring will record differing levels of response by the birds from heightened awareness to taking flight over significant distances and relate these to the activities being undertaken on the Site. Regular reports of the bird disturbance monitoring will be provided to Natural England and SBC as part of a mechanism to inform all parties immediately if disturbance events are happening.

8.4. Control of Non-Conformance

8.4.1. Non-conforming products or processes will initiate a Non-Conformance Report, which will identify the nature of the problem, the proposed corrective action taken to prevent recurrence of the problem and verification that the agreed actions have been carried out. The corrective actions will be agreed between the Contractor and the Employer before being implemented and will be subsequently monitored during their implementation.

9.0 COMMUNICATION AND CO-ORDINATION

9.1.1. This section describes the main methods of communication and co-ordination of day to day activities on the Site during construction. Informal methods of communication and co-ordination should be undertaken as appropriate in addition to those highlighted below.

9.2. Internal Communication

9.2.1. Internal project communications will be via two processes:

- Regular environmental meetings; and
- Informal on-site communication.

9.3. Regular Environmental Meetings

9.3.1. Regular environmental meetings, either weekly or fortnightly as appropriate, chaired by the Environmental Manager will be held with the Site Manager, Site Foreman and Environmental Specialists to review performance and coordinate short term planning of forthcoming activities. The Contract Administrator may also attend these meetings as appropriate.

9.3.2. Environmental management representatives will use these meetings to report on the findings of their inspections together with any systematic or recurring issues. Actions from these meetings will be recorded via minutes and reviewed by the Contract Manager, Environmental Manager and Contract Administrator.

9.4. Informal On-Site Communication

9.4.1. Daily briefing/updates should be informally discussed between the Environmental Manager, Site Manager and Site Foreman to discuss changes in programme, issues with activities and potential risk to the environment.

9.5. Communications with the Public

9.5.1. A Project Community Liaison Plan will be established to provide a framework for managing communications with local residents and interested parties. This will be the responsibility of the Construction Liaison Officer.

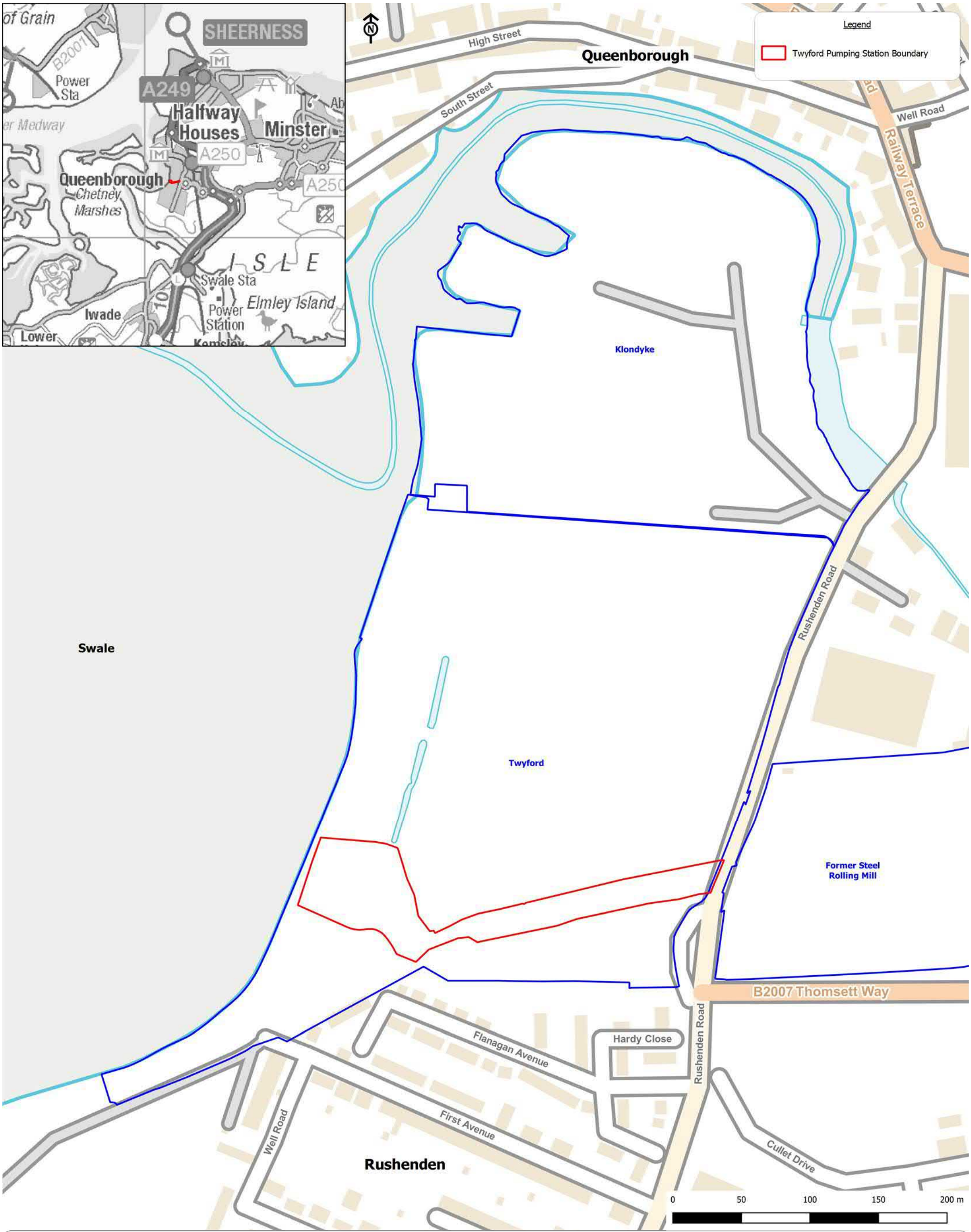
9.5.2. In the event of unusual activities or events that can be anticipated, SBC and the relevant property owners, occupiers and neighbours will be notified wherever possible, at least 14 days in advance of the activity especially where the activity may cause a loss of amenity. The relevant activities will be determined by agreement with SBC once the detailed programme of construction is defined and will include:

- Commencement of construction in certain areas closet to neighbouring properties;
- Any necessary night time working (although none is currently envisaged);
- Weekend or evening working (outside core areas) of a type which may affect properties;
- Road or footpath closures/diversions and movement of wide loads; and
- Work on roads affecting land used by others.

9.5.3. Any complaints will be logged on-site and, where necessary, reported to the relevant individual within SBC as soon as practicable. The required actions to remedy the situation will be different

in each specific case, depending on the operation, equipment or location or application of additional controls.

Figures



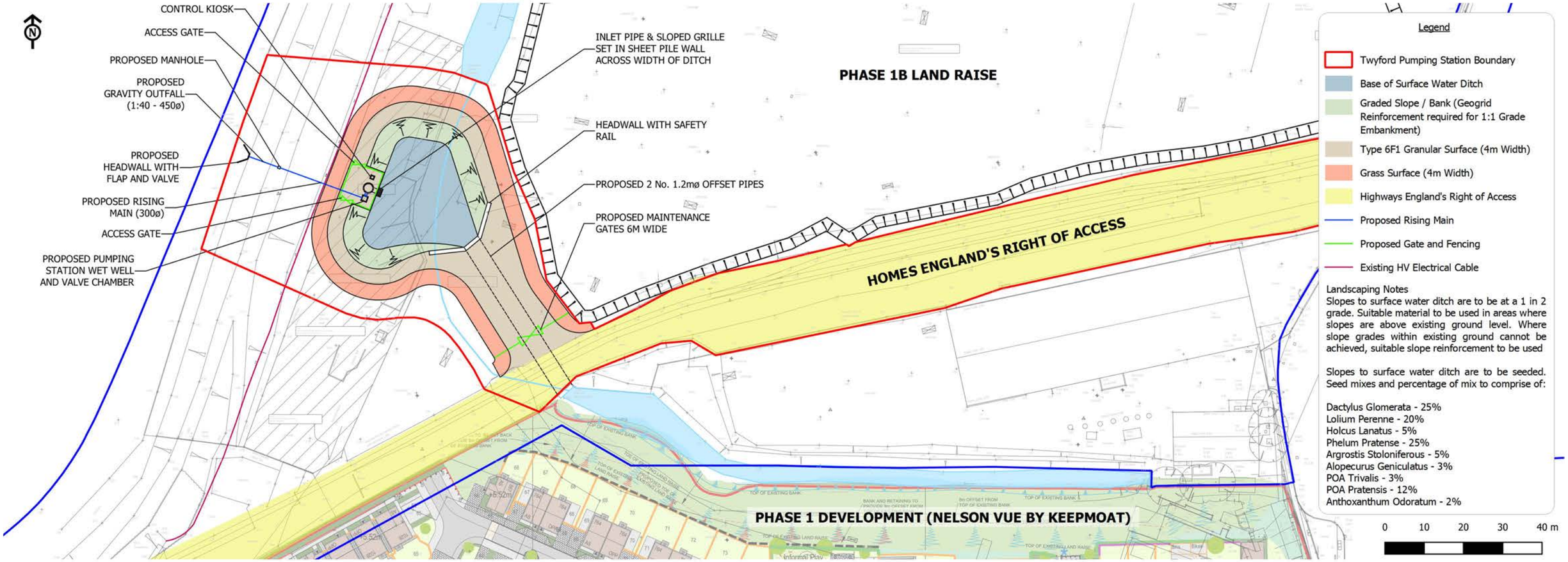
Queenborough and Rushenden

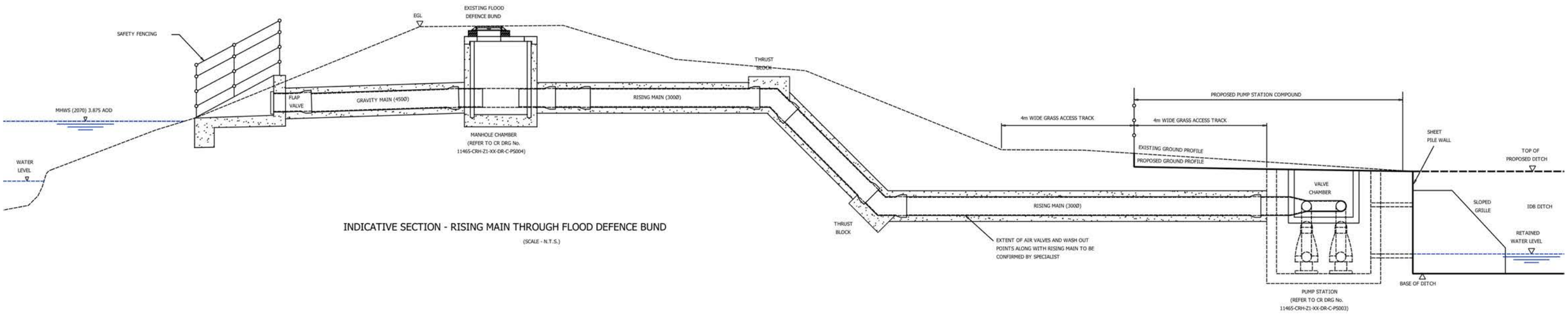
Client: Homes England

Figure 1.1:
Site Location Plan

Scale:	1:2500@A3; Overview 1:100000@A3
CampbellReith OS Copyright:	© Crown copyright. All rights reserved. Licence number 100020027
Contains Ordnance Survey data	© Crown copyright and database right 2021.
Job Number:	11465
Drawn by - Checked by:	RP - MC
Drg No - Status/Revision:	GIS270 - A
File location:	N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\CEMP (pdf in Outputs)
Date (Revision History):	26/03/2021 (A, First Issue, 26/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com





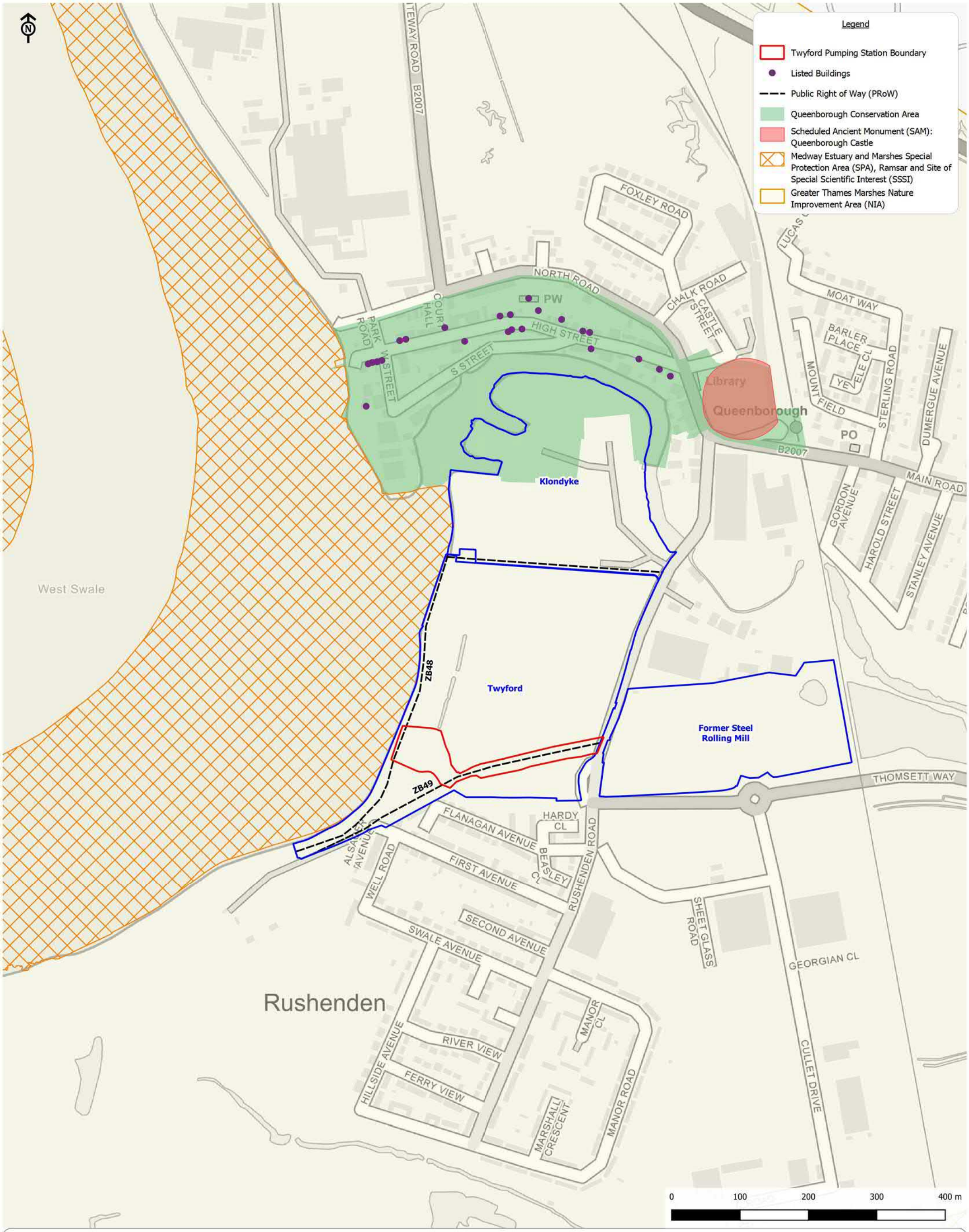
Queenborough and Rushenden

Client: Homes England

Figure 2.1:
Twyford Pumping Station

Scale:	1:1000@A3
CampbellReith OS Copyright: © Crown copyright. All rights reserved. Licence number 100020027	
11465-CRH-Z1-XX-DR-C-PS001_S4_P1 (May 2019)	
Job Number:	11465
Drawn by - Checked by:	RP - MC
Drg No - Status/Revision:	GIS271 - A
File location:	N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\CEMP (pdf in Outputs)
Date (Revision History):	26/03/2021 (A, First Issue, 26/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com



Queenborough and Rushenden

Client: Homes England

Figure 6.1:
Environmental Constraints

Scale:	1:5000@A3
CampbellReith OS Copyright:	© Crown copyright. All rights reserved. Licence number 100020027
Contains Ordnance Survey data	© Crown copyright and database right 2021.
Job Number:	11465
Drawn by - Checked by:	RP - MC
Drg No - Status/Revision:	GIS272 - A
File location:	N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\CEMP (pdf in Outputs)
Date (Revision History):	26/03/2021 (A, First Issue, 26/03/21, RP)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

Appendix 1: Project Consents and Planning Conditions

(to be completed onsite by the Contractor)

Appendix 2: Traffic Management Method Statement

(to be completed onsite by the Contractor)

Appendix 3: Construction Programme

(to be completed onsite by the Contractor)

Appendix 4: Dust Control Plan

(to be completed onsite by the Contractor)

CampbellReith
consulting engineers

Twyford Pumping Station
Queenborough & Rushenden

Outline Dust Control Plan

For

Homes England

Project Number:

11465

April 2021

Campbell Reith Hill LLP
Raven House
29 Linkfield Lane
Surrey
RH1 1SS

T: +44(0)1737 784500
E: surrey@campbellreith.com
W: www.campbellreith.com

Document History and Status

Revision	Date	Purpose/Status	Author	Check	Review
0	25/03/2021	Draft	Marian Cameron	Grant Plain	Alan Poulton
1	01/04/2021	Final	Marian Cameron	Grant Plain	Alan Poulton

Document Details

Last saved	31/03/2021 10:22
Path	11465 Twyford Pumping Station Dust Control Plan 010421
Author	Marian Cameron
Project Partner	Alan Poulton
Project Number	11465
Project Name	Twyford Pumping Station, Queenborough & Rushenden

Contents

Appendices

1.0 INTRODUCTION

1.1. Background

1.1.1. This document provides the outline Dust Control Plan to protect nearby residents, businesses surface water features, as well as flora and fauna during the creation of the Twyford Pumping Station. The Twyford Pumping Station will replace the existing failing surface water pumping station within the Twyford Site. The Twyford Pumping Station is designed to increase the efficiency and capacity of discharging surface water run-off from Queenborough and Rushenden into the Swale to help facilitate future development within Queenborough and Rushenden. The existing surface water pumping station will be decommissioned and along with the drainage channels will be left in-situ[1].

1.1.2. The location and boundaries of the Site (hereafter referred to as the 'Site') are shown in **Appendix 1**. The Site is approximately 0.94 hectares (ha) and is situated on previously developed land between Queenborough and Rushenden on the Isle of Sheppey.

1.1.3. The Twyford Pumping Station will be located west of Rushenden Road and north of First Avenue and Nelsons Vue between Queenborough and Rushenden on the Isle of Sheppey as shown in **Appendix 1**. The National Ordnance Survey (OS) Grid Reference for the approximate centre of the Site at 590715, 171645. The Site will be located within the south-west area of the wider Twyford Site. The wider Twyford Site along with the Klondyke Site directly to the north was subject to planning permission (SW/13/1550) (henceforth referred to as the 'Approved Scheme' which was granted in March 2014 for:

'Site clearance, demolition of existing buildings, remediation, enhancement of the existing flood defences and land raising to form a development platform above a minimum height of 4.9m and below a maximum height of 5.4m above Ordnance Datum (AOD) on the Twyford and Klondyke Sites'.

1.2. The Dust Control Plan

1.2.1. The Dust Control Plan forms an integral part of the Construction Environmental Management Plan (CEMP) and will be finalised by the Contractor, once appointed, prior to works commencing. Through implementation of the CEMP and the Dust Control Plan, the Principal Contractor will ensure that monitoring, control and protection measures associated with dust are designed to incorporate current industry guidance and discussions with the relevant statutory authorities. The works and monitoring will demonstrate:

- PM_{10} particulate levels remain below agreed action levels and do not exceed the level of 0.15 mg/m^3 (10 minute mean) at the site boundary at the top of the hoarding/fencing. This is to provide reassurance that dust is not migrating into adjacent areas for which there are no clear ambient standards; and
- Total Inhalable Dust (TID) remains below 10 mg/m^3 over an 8 hr Time Weighted Average to demonstrate compliance for workers.

1.2.2. The effective implementation of the Dust Control Plan will also ensure that odour and/or airborne emissions from the works have no adverse effects on members of the public or

[1] The removal of the existing Pumping Station and infilling of the ditches to it will form part of a separate planning application and are therefore not considered further within this report.

adjacent neighbours and demonstrate that no exceedances against Workplace Exposure Limits occur based on Time Weighted Averages. If such exceedances do occur, the Contractor shall notify the Project Manager.

1.2.3. The Dust Control Plan includes the following:

- Summary of work to be carried out;
- Description of site layout and access – including proposed haul routes;
- Location of site equipment including supply of water for damping down, source of water (wherever possible from dewatering or extraction), drainage and enclosed areas;
- Inventory and timetable of all dust generating activities;
- List of all dust and emission control methods to be used;
- Details of any fuel stored on site;
- Identification of an authorised responsible person on-site for air quality. Ideally this person needs to have knowledge of pollution control and vehicle emissions;
- Summary of monitoring protocols and agreed procedure of notification to the local authority nominated person(s); and
- A site log book to record details and actions taken in response to exceptional incidents or dust causing episodes. It should also be used to record the results of routine site inspections.

1.3. Definitions of Dust

1.3.1. The following definitions have been used in this specification:

- Dust is defined as all particulate matter up to 7 microns in diameter (according to BS6069) and comprising both suspended and deposited dust;
- PM_{10} – a mass fraction of airborne particles with an aerodynamic diameter of 10 microns or less. It is comprised of coarse particles (2.5-10 microns in diameter), which are primarily from non-combustion sources and fine particles (less than 2.5 microns), which includes combustion processes or are formed in the atmosphere through the chemical reaction of primary emissions of gases; and
- Particulate matter includes a wide range of sizes and types of particles and will vary in composition from place to place and time to time.

2.0 THE SITE AND PROPOSED DEVELOPMENT

2.1. The Site

2.1.1. The Site comprises an irregular parcel of land of approximately 0.94 ha located within the wider Twyford Site between Queenborough and Rushenden to the west of Rushenden Road and just over 3km to the south of Sheerness on the Isle of Sheppey as shown in **Appendix 1**. National Ordnance Survey (OS) Grid Reference for the approximate centre of the Site is 590715, 171645.

2.1.2. The Site is derelict, with the previous industrial and commercial warehouses and structures demolished to ground level in 2016/17. The main area of the Site will be located within the south-west area of the wider Twyford Site. The wider Twyford Site along with the Klondyke Site directly to the north was subject to planning permission (SW/13/1550) (henceforth referred to as the 'Approved Scheme' which was granted in March 2014 for:

'Site clearance, demolition of existing buildings, remediation, enhancement of the existing flood defences and land raising to form a development platform above a minimum height of 4.9m and below a maximum height of 5.4m above Ordnance Datum (AOD) on the Twyford and Klondyke Sites'.

2.1.3. The Site at its original ground level was between 2.20m AOD and 2.87m AOD, but it is currently being used as a temporary store of approximately 8,000 sqm of topsoil associated with the former surcharge materials from the Nelson Vue, Keepmoat development to the south-east of Site. There is a ditch passing through the Site.

2.1.4. The Site is bordered to the north, east and south by the wider Twyford Site and west by the flood defences and beyond the Swale within the Medway Estuary and Marshes SPA, Ramsar and SSSI. Further to the south beyond the southern boundary of the wider Twyford Site is Nelsons Vue residential development with Rushenden beyond.

2.2. The Twyford Pumping Station and Construction Programme

2.2.1. The purpose of the proposed works is to replace the existing failing water pumping station within the Twyford Site. The Twyford Pumping Station is designed to increase the efficiency and capacity of discharging surface water run-off from Queenborough and Rushenden into the Swale to help facilitate future development within Queenborough and Rushenden. The existing pumping station will be decommissioned and along with the drainage channels will be left in-situ. The design of the Twyford Pumping Station is illustrated in **Appendix 1**.

2.2.2. Construction of the Twyford Pumping Station is programmed to commence in summer 2021 and take approximately 6 months to complete.

2.2.3. Once appointed the Contractor will produce a more detailed construction programme prior to works commencing.

Enabling Works and Site Preparation

2.2.4. Enabling works and site preparation will involve:

- Construction of a temporary construction compound which will contain temporary offices and welfare facilities for management and construction work;
- Construction of temporary access points for construction vehicles;

- Erection of site hoarding around the Site which will be a minimum height of 1.8m;
- Translocation of reptiles from the Site to Harty Marshes Reptile Receptor Site Extension; and
- Installation of temporary surface water management measures for construction.

2.2.5. The following environmental advance and enabling works will also be undertaken during this phase:

- An application for an Environmental Permit will be submitted to the Environment Agency prior to any works affecting the watercourse or the Swale flood defences;
- An application for temporary closure of the sections of public footpaths ZB48 and ZB49 where they pass through the Site under the Road Traffic Act;
- General vegetation clearance within the Site; and
- Removal of the topsoil which is being temporarily stored on the Site and re-profiling of the land to create the new ground levels associated with the pond and the surrounding access track.

Earthworks and Construction of the Pumping Station, Pond and Access Track

2.2.6. The construction of the pumping station, pond and access track will involve the following general sequence:

- Excavation of the flood bund to facilitate the construction of the rising main and gravity outfall and associated headwall with flap valve and access chamber on the crest of the flood bund. The flood bund will be reinstated in accordance with conditions of the Environmental Permit. This work should be completed during the summer months to minimise flood risk;
- Construction of the new pumping station compound with associated pumps, wet well, control kiosk and security fencing;
- Connection of the new pond (in part), pumping station with rising main/ gravity outfall and install the two new 1,200 mm diameter offset pipes and outfall headwall whilst still maintaining flow to the existing culvert, drainage ditch and pumping station. At this point the new pumping station will be live during the construction process such that if required it can pump water into the Swale Estuary;
- Excavation of the remaining pond area including the removal and blocking up of the ends of the existing pipe culvert. This work will require to be undertaken during the summer months when surface water levels in the drainage ditches are at their lowest to mitigate any potential surface water flood risk. Emergency pumps (size of which will need to be agreed with the Regulators including the Environment Agency) will require to be on standby in a heavy rainfall even such that water can be pumped into the Swale if required. A flood emergency plan will be required; and
- Completion of landscaping, construction of access/ maintenance track/ loop with security gates and fencing.

Landscaping

2.2.7. The main planting and landscaping works will occur during the first main planting season after construction of the pumping station, pond and access track.

3.0 RISK ASSESSMENT

3.1. Initial Screening

3.1.1. There are existing residential dwellings within 100m of the Site with residential dwellings within Nelsons Vue to the south being the closest. There is also an active industrial estate with tenants working close to the Rushenden Road on the eastern boundary of the wider Twyford Site. Furthermore, the Swale is adjacent to the western boundary of the Site.

3.1.2. The dominant wind direction is from the south-west. Therefore, all the properties within 200m north-east of the Site such as the industrial units east of Rushenden Road have the potential to be adversely affected by construction dust, along with to a lesser extent the residential dwellings to the south and the Swale to the west, due to their close proximity.

3.2. Assessed Risk of Dust Emission Magnitude

3.2.1. Following the Institute of Air Quality Management (IAQM) guidance, the planned site activities have been assessed and given a classification of risk to the human receptors identified above.

Demolition

3.2.2. There are no buildings or structures to be demolished or removal of ground slabs as they have already been done as part of the wider Twyford Site works and therefore demolition is not discussed further in this document.

Enabling Works and Site Preparation

3.2.3. The site clearance will include the removal of stored topsoil and the creation of a compound area, erection of site hoarding as well as the removal of vegetation. The compound area will include offices and welfare facilities for the management team and construction workers.

3.2.4. The potential dust emission magnitude for this activity is categorised as large.

Earthworks and Construction of the Pumping Station, Pond and Access Track

3.2.5. The Site covers an area of approximately 0.94 ha and will involve the movement of significant volumes of material to create the pond and to connect the pumping station through the flood defences with the Swale.

3.2.6. There will be several temporary stockpiles on the Site during the works. Their locations will be defined by the Contractor once appointed.

3.2.7. The construction works undertaken below existing ground level (including the removal of obstructions) are not anticipated to generate dust.

3.2.8. The potential dust emission magnitude for this activity is categorised as large.

Trackout

3.2.9. All excavated and site-won material will be transported off the Site to the other nearby development sites including the wider Twyford Site, Klondyke Site or Former Steel Rolling Mill Site as required. Any material to create the Twyford Pumping Station will also be brought to the Site via the A259, Thomsett Way and Rushenden Road.

3.2.10. The majority of trafficked routes on the Site will have a crushed stone surface or tarmac.

3.2.11. The potential dust emission magnitude for this activity is categorised as medium.

Summary

3.2.12. The summary of potential dust emission magnitude is presented in **Table 3.1**.

Table 3.1: Summary of Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	None
Enabling Works and Site Preparation	Large
Earthworks and Construction of the Pumping Station, Pond and Access Track	Large
Trackout	Large

3.3. Assessment of Sensitivity of the Area

3.3.1. It is likely that the residential properties at Nelsons Vue to the south of the Site will be affected by airborne dust generated on site, for at least the duration of the works during operational hours (8:00-18:00 Monday to Friday and Saturday 8:00-13:00). These are categorised as a High Sensitivity Receptor for both dust soiling and human health.

3.3.2. It is likely that the workers at the industrial units along Rushenden Road to the east of the Site will be affected by airborne dust generated on site, for at least the duration of the works during operational hours. These are categorised as a Medium Sensitivity Receptor for both dust soiling and human health.

3.3.3. The Swale is adjacent to the western boundary of the Site. The Swale forms part of the Medway Estuary and Marshes Special Protection Area (SPA), Ramsar and Site of Special Scientific Interest (SSSI). Works this close to the SPA, Ramsar and SSSI will be monitored carefully for dust generation. However, as the prevailing wind is south-westerly, it is unlikely dust generated as a result of these activities will migrate to this receptor. As such the risk to any ecological receptor is likely to be low. Should activities lead to unacceptable amounts of dust generation (from site inspection), immediate dust management activities will commence for the duration of the works.

3.4. Deriving Overall Risk of Impacts

3.4.1. Deriving the risk of impacts is calculated by combining both the unmitigated potential magnitude of dust with the sensitivity of the receptors. As the Site has a large potential for dust emission magnitude and is close to high sensitivity receptors, the Site is deemed to have a high risk of impacts, and control measures are required to control the detrimental effect of the construction works on local receptors.

4.0 GENERAL AIR QUALITY MONITORING REQUIREMENTS

4.1. Introduction

4.1.1. A programme of air quality monitoring (dust, vapour, odour and asbestos) will be carried out for the duration of the project by the Contractor. The monitoring data will constitute the basis for enhancement of hazard control, upgrading of safety measures and amendments to methods of working as deemed necessary.

4.1.2. The Contractor will implement continuous and real-time dust monitoring using visual checks and automatic particulate monitors to measure PM_{10} particulate levels. The final arrangement of the monitoring will be determined by the Contractor, once appointed, to the satisfaction of the Local Planning Authority and the Project Manager. The Contractor will ensure that monthly dust monitoring reports are submitted to the Project Manager showing the monitoring results and will be included within the Validation Report.

4.1.3. The Contractor will supply suitably qualified specialist environmental staff to carry out the monitoring works. The Contractor will submit a monthly report to the Project Manager to demonstrate that the monitoring is being carried out to an appropriate standard and that the measured levels are in accordance with statutory authority requirements.

4.2. Background Monitoring

4.2.1. Prior to works commencing, a base reading of the existing dust level will be taken from all the monitoring locations using a hand-held monitoring device. The monitoring locations will be chosen by the Contractor, once appointed, as per IAQM guidance with a '*minimum of two sampling sites, one upwind and one downwind*'. For the Site, there will be four monitoring locations with two downwind and two upwind which take into consideration the location of the sensitive receptors surrounding the Site.

4.2.2. Following this, an agreed level will be determined which, if exceeded when follow-up readings are taken, works will cease and alternative protection measures implemented.

4.3. The Monitoring Programme

4.3.1. The monitoring programme will incorporate four main elements:

- Worker personal exposure monitoring;
- Work zone monitoring;
- Boundary monitoring; and
- Other monitoring required to take account of any unplanned nuisance or odour event or of changing weather or any other factors that may alter the risks presented by the Site (dynamic monitoring).

4.3.2. All site staff will proactively monitor dust emissions as a matter of their daily responsibilities.

4.3.3. All analytical work will use methodologies with minimum detection limits at least one order of magnitude lower than site criteria or provide an explanation of non-compliance. All results will be recorded as part of the on-site health and safety requirement. Any real-time monitoring of the air quality including that for organic substances will be undertaken using equipment of sufficient sensitivity to allow direct comparison with the relevant air quality standards.

4.3.4. All field and laboratory analytical results will be reported to the Project Manager for review and subsequent inclusion within the Contractor's Validation Report.

4.3.5. Principal parameters to be monitored will include volatile organic compounds (VOCs), hydrogen sulphide, NO_x, dust (inhalable dust (PM_{10})) and asbestos. In addition, provision will be made for monitoring flammability, methane, oxygen and carbon dioxide levels, as necessary in relation to excavations.

4.3.6. Fixed monitoring stations, fitted with DustScan deposition pads (or the equivalent), will be located around the area of any site excavations or demolition of buildings at locations determined by the Contractor, once appointed, and agreed with the Project Manager. As a minimum the stations will measure dust, vapours and include reporting on odour concentrations.

4.4. Odour/Vapour Monitoring

4.4.1. Vapour monitoring will be undertaken for the detection of VOCs, particularly benzene, toluene, ethylbenzene and xylenes (BTEX).

4.4.2. The odour/vapour monitoring protocol will include the following:

- Detail on the position of odour/vapour monitors;
- Trigger and action levels;
- The portable photoionisation detectors (PID) will be calibrated for a response to 100ppm Isobutylene;
- Concentrations will be recorded at pre-designated points around the site boundary to ensure than sensitive receptors are sufficiently covered;
- An on-site log will be maintained by a site chemist to record prevailing weather conditions, particularly wind direction, alongside the records of daily total VOC (TVOC) readings on three occasions throughout the day; and
- Working areas within the Site will be monitored to ensure that operatives are not exposed to harmful concentrations of hydrocarbons. The frequency of monitoring will depend on the variability of ground conditions and initial olfactory assessment.

4.4.3. The Contractor will ensure that on-site testing equipment to monitor for vapours will include portable photoionisation detectors (PID), portable gas chromatographs and Gastec detection tubes as well as fixed monitoring stations in areas down-wind and the results provided to the Project Manager. These will be supplemented by more detailed off-site analysis by an approved laboratory.

4.4.4. The Contractor will demonstrate that levels do not exceed an appropriate site action level to prevent impacts upon local sensitive receptors. The site action level will be agreed with the relevant statutory authorities.

4.4.5. A dynamic odour assessment will also be carried out during the remedial works. The dynamic approach is based around consideration of the work activities and weather conditions, and making a judgement on a daily basis as to where the odour assessment work will be undertaken.

4.4.6. The Contractor will ensure that a record is kept on-site to log VOC levels and exceedances of the action level and the implementation of best practice control measures and monthly odour/vapour monitoring reports will be submitted to the Project Manager showing the results.

4.4.7. Where odours are registered, odour suppression systems will be utilised and/or excavation contact sprays will be used to minimise odour generation at the work interface. The Contractor will ensure that all construction work and dust control measures are carried out in accordance with the agreed CEMP and be cognisant of the requirements of the Environmental Permitting Regulations.

4.5. Monitoring of Airborne Asbestos Fibres

4.5.1. Monitoring of airborne fibres shall be undertaken at the sites of removal works and at locations on the site boundary to be agreed with the Project Manager and the relevant statutory authorities throughout the duration of the works.

4.5.2. The Employer may employ an independent Specialist Consultant to monitor any asbestos removal works.

5.0 GENERAL DUST SUPPRESSION TECHNIQUES

5.1. Introduction

5.1.1. This chapter provides a summary of the general best practice dust suppression techniques that will be employed at the Site throughout the construction phase. The Contractor will have robust perimeter suppression systems in place as well as any other working area measures and implement these control measures to prevent adverse environmental effects and nuisance issues on the surrounding area.

5.2. Community Liaison Officer

5.2.1. A community liaison officer will be appointed by the Contractor, who will be based on the Site for the duration of the construction of the Twyford Pumping Station. The community liaison officer will be proactive in communicating with residents and presenting the Dust Control Plan as an integral part of the CEMP and the commitments to them.

5.2.2. The community liaison officer will also receive any complaints or other correspondence from the local residents, and will act swiftly to relay the information to the site team for immediate action to be taken. All correspondence will be logged for review purposes and will be available at all times to the Local Authority.

5.2.3. The community liaison officer will also be responsible for maintaining liaison with the Local Planning Authority throughout the construction phase. Any incidents which lead to excessive elevation of dust deposition and/or PM_{10} concentrations at neighbouring sensitive receptors will be reported to the Environmental Health Department.

5.3. General Measures

5.3.1. The following dust control measures will be implemented throughout the construction phase:

- Daily weather conditions will be taken into account and works stopped or re-allocated on any days where winds are unusually high;
- Senior site staff will record all and any exceptional instances and act in a timely fashion to mitigate any detrimental effects;
- Regular liaison meetings will be held with the Contractors carrying out construction works on the wider Twyford Site, Klondyke Site and Former Steel Rolling Mill Site as appropriate, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes;
- Limit the area(s) of working during construction so that vehicles are confined within an area that can be subjected to appropriate dust control;
- Use of appropriately designed vehicles for material handling;
- Material stockpiles will be enclosed at all times and dusty materials will be dampened using water sprays and/or sheeted during dry weather;
- Stockpiles will be located as far as possible from the north and eastern site boundaries;

- All cutting and grinding equipment will be fitted with dust suppression bottles. Where they do not come with an attached bottle, a second man will be deployed with a water spray. Cutting and grinding without water suppression is contrary to site RAMS;
- The roads and haul roads will be monitored at appropriate intervals and maintained to minimise mud and dust build up. Surfaced and un-surfaced site access roads will be watered as necessary at least daily using a water bowser or mechanical road sweepers and surfaces kept in order;
- A bowser will be operated during periods of dry weather to keep site haul roads damped down to prevent dust being blown into the air by wind or passing vehicles;
- Vehicles carrying loose aggregate, fill materials or contaminated materials to and from the Site should be sheeted at all times;
- Where used, skips will be covered;
- Smoke emissions or fumes from site plant or stored fuel will be limited;
- Vehicles should be kept clean through the use of wheel washers, particularly on departure from the plats onto the public highway. However, no transport or delivery vehicle will need to track onto the soft earth, therefore it is not necessary to implement a wheel wash for delivery vehicles leaving the Site;
- Screening of earthworks and perimeter landscaping, using 1.8m high debris netting, will occur along the western, southern and eastern boundaries to provide a physical barrier between the Site and the surrounding. The debris netting and site fencing will be cleaned and mended as required;
- All screeners and crushers will be fitted with fine water sprays;
- Material deposited from dumpers will be done slowly and carefully to minimise dust generation. Wetting down will be deployed where necessary; and
- No bonfires will be lit on the Site. Burning of waste materials is strictly prohibited.

Appendix 1: Drawings

CONTROL KIOSK
ACCESS GATE
PROPOSED MANHOLE
PROPOSED GRAVITY OUTFALL (1:40 - 450ø)
PROPOSED HEADWALL WITH FLAP AND VALVE
PROPOSED RISING MAIN (300ø)
ACCESS GATE
PROPOSED PUMPING STATION WET WELL AND VALVE CHAMBER
INLET PIPE & SLOPED GRILLE SET IN SHEET PILE WALL ACROSS WIDTH OF DITCH
HEADWALL WITH SAFETY RAIL
PROPOSED 2 No. 1.2mø OFFSET PIPES
PROPOSED MAINTENANCE GATES 6M WIDE

PHASE 1B LAND RAISE

HOMES ENGLAND'S RIGHT OF ACCESS

PHASE 1 DEVELOPMENT (NELSON VUE BY KEEPMOAT)

Legend

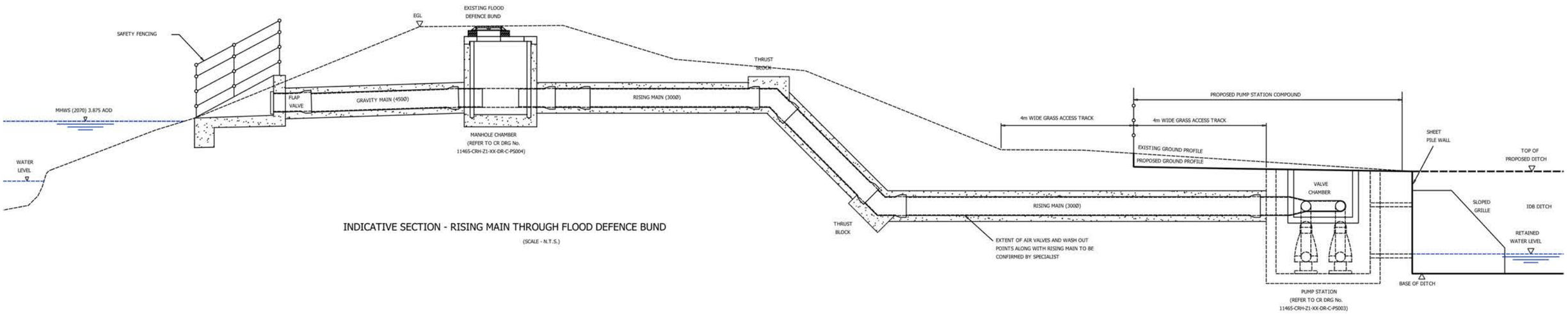
- Twyford Pumping Station Boundary
- Base of Surface Water Ditch
- Graded Slope / Bank (Geogrid Reinforcement required for 1:1 Grade Embankment)
- Type 6F1 Granular Surface (4m Width)
- Grass Surface (4m Width)
- Highways England's Right of Access
- Proposed Rising Main
- Proposed Gate and Fencing
- Existing HV Electrical Cable

Landscaping Notes
Slopes to surface water ditch are to be at a 1 in 2 grade. Suitable material to be used in areas where slopes are above existing ground level. Where slope grades within existing ground cannot be achieved, suitable slope reinforcement to be used

Slopes to surface water ditch are to be seeded. Seed mixes and percentage of mix to comprise of:

Dactylus Glomerata - 25%
Lolium Perenne - 20%
Holcus Lanatus - 5%
Phelum Pratense - 25%
Argrostis Stoloniferous - 5%
Alopecurus Geniculatus - 3%
POA Trivalis - 3%
POA Pratensis - 12%
Anthoxanthum Odoratum - 2%

0 10 20 30 40 m



INDICATIVE SECTION - RISING MAIN THROUGH FLOOD DEFENCE BUND

(SCALE - N.T.S.)

Queenborough and Rushenden

Client: Homes England

Figure 3.1:
Twyford Pumping Station

Scale: 1:1000@A3

11465-CRH-Z1-XX-DR-C-PS001_S4_P1 (May 2019)
Job Number: 11465
Drawn by - Checked by: RP - MC
Drg No - Status/Revision: GIS250 - B
File location: N:\11250 - 11499\11465 R - Queenborough and Rushenden Land Raising\Workspaces\Twyford Pumping Station\Environmental Report (pdf in Outputs)
Date (Revision History): 23/03/2021 (A, First Issue, 01/03/21, RP; B, Boundary Update, 23/03/21)

CampbellReith
consulting engineers
LONDON 020 7340 1700 ☐ ☐ MANCHESTER 0161 819 3060
REDHILL 01737 784 500 ☒ ☐ BIRMINGHAM 01675 467 484
BRISTOL 0117 916 1066 ☐ ☐ DUBAI 00 971 4453 4735
www.campbellreith.com

London

15 Bermondsey Square
London
SE1 3UN

T: +44 (0)20 7340 1700
E: london@campbellreith.com

Birmingham

Chantry House
High Street, Coleshill
Birmingham B46 3BP

T: +44 (0)1675 467 484
E: birmingham@campbellreith.com

Surrey

Raven House
29 Linkfield Lane, Redhill
Surrey RH1 1SS

T: +44 (0)1737 784 500
E: surrey@campbellreith.com

Manchester

No. 1 Marsden Street
Manchester
M2 1HW

T: +44 (0)161 819 3060
E: manchester@campbellreith.com

Bristol

Wessex House
Pixash Lane, Keynsham
Bristol BS31 1TP

T: +44 (0)117 916 1066
E: bristol@campbellreith.com

Appendix 5: Risk Assessment

(to be completed onsite by the Contractor)

Appendix 6: Record Proformas

(to be completed onsite by the Contractor)

- Permissions and Consents for Site Works
- Environmental Site Induction
- Project Environmental Training
- Method Statements
- Noise and Vibration Monitoring and Compliance Record
- Dust Monitoring and Compliance Record
- Site Aqueous Discharge Monitoring and Compliance Record
- On-site Bird Monitoring Record
- On-site Bat Monitoring Record
- Energy/Fuel Consumption Records
- Environmental Incident Reports and Record of Follow-Up

Appendix 7: Environmental Baseline Survey Results

- Biodiversity
- Water Quality
- Air Quality and Dust
- Noise and Vibration
- Contamination
- Biodiversity
- Water Quality
- Air Quality and Dust
- Noise and Vibration
- Contamination
- Biodiversity
- Water Quality
- Air Quality and Dust
- Noise and Vibration
- Contamination

Appendix 8: Site Waste Management Plan

(to be completed onsite by the Contractor)

London

15 Bermondsey Square
London
SE1 3UN

T: +44 (0)20 7340 1700
E: london@campbellreith.com

Birmingham

Chantry House
High Street, Coleshill
Birmingham B46 3BP

T: +44 (0)1675 467 484
E: birmingham@campbellreith.com

Surrey

Raven House
29 Linkfield Lane, Redhill
Surrey RH1 1SS

T: +44 (0)1737 784 500
E: surrey@campbellreith.com

Manchester

No. 1 Marsden Street
Manchester
M2 1HW

T: +44 (0)161 819 3060
E: manchester@campbellreith.com

Bristol

Wessex House
Pixash Lane, Keynsham
Bristol BS31 1TP

T: +44 (0)117 916 1066
E: bristol@campbellreith.com

Appendix 2: Ecology and Landscape Management Plan

CampbellReith
consulting engineers

Twyford Pumping Station
Queenborough & Rushenden

Ecology and Landscape Management Plan

For

Homes England

Project Number:

11465

April 2021

Campbell Reith Hill LLP
Raven House
29 Linkfield Lane
Surrey
RH1 1SS

T: +44(0)1737 784500
E: surrey@campbellreith.com
W: www.campbellreith.com

Document History and Status

Revision	Date	Purpose/Status	Author	Check	Review
D1	25/03/21	Draft	Marian Cameron	Grant Plain	Alan Poulton
F1	01/04/21	Final	Marian Cameron	Grant Plain	Alan Poulton

Document Details

Last saved	31/03/2021 10:21
Path	11465 Twyford Pumping Station ELMP 010421
Author	Marian Cameron
Project Partner	Alan Poulton
Project Number	11465
Project Name	Twyford Pumping Station, Queenborough & Rushenden

Contents

Appendices

1.0 INTRODUCTION

1.1. Context and Site Location

1.1.1. This document provides the Ecology and Landscape Management Plan for a new surface water pumping station (henceforth referred to as the 'Twyford Pumping Station') which will replace the existing failing surface water pumping station within the Twyford Site. The Twyford Pumping Station is designed to increase the efficiency and capacity of discharging surface water run-off from Queenborough and Rushenden into the Swale to help facilitate future development within Queenborough and Rushenden. The existing surface water pumping station will be decommissioned and along with the drainage channels will be left in-situ[1].

1.1.2. The Twyford Pumping Station will be located west of Rushenden Road and north of First Avenue and Nelsons Vue between Queenborough and Rushenden on the Isle of Sheppey. The National Ordnance Survey (OS) Grid Reference for the approximate centre of the Site at 590715, 171645. The Site will be located within the south-west area of the wider Twyford Site. The wider Twyford Site along with the Klondyke Site directly to the north was subject to planning permission (SW/13/1550) (henceforth referred to as the 'Approved Scheme' which was granted in March 2014 for:

'Site clearance, demolition of existing buildings, remediation, enhancement of the existing flood defences and land raising to form a development platform above a minimum height of 4.9m and below a maximum height of 5.4m above Ordnance Datum (AOD) on the Twyford and Klondyke Sites'.

1.1.3. Aims of the Report

1.1.4. This report sets out the necessary prescriptions for the management of new and existing planting within the area of soft landscaping on the Site and the management of the Site between construction of the Twyford Pumping Station and future development on the wider Twyford Site. If this period is longer than five years, this report should be reviewed and revised accordingly.

1.1.5. When the future development on the Twyford Site occurs, it is envisaged that the management of the area of soft landscaping will be integrated into the ongoing management of the wider Twyford Site with further details on the management of the Twyford Pumping Station and development on Twyford Site as a whole, provided within documents to support the future planning application.

1.1.6. Maintenance prescriptions have been formulated to maintain healthy plant growth, keep the Site free from weeds/litter and ensure the plant stock remains free from disease. This plan deals with the maintenance of the following areas:

- Maintenance of the proposed grassland planting and existing grassland;
- Maintenance of the aquatic planting; and
- Maintenance of the hardstanding.

[1] The removal of the existing Pumping Station and infilling of the ditches to it will form part of a separate planning application and are therefore not considered further within this report.

1.1.7. Following initial development of the Site, the first 12 months of planting maintenance will be the responsibility of the landscape sub-contractor as appointed by the Employer. Following this period, Homes England alongside The Lower Medway Internal Drainage Board will manage the Site until the Twyford Site is further developed.

1.2. Implementation of the Works

1.2.1. All works shall be installed in accordance with the details and specification set out in this report.

1.2.2. All planting shall take place in the first available planting season following construction of the Twyford Pumping Station. **Figure 1.1** provides details on the planting strategy in the area of soft landscaping.

1.2.3. No trees shall be planted as part of the Twyford Pumping Station works. Therefore, they are not considered further in this document.

2.0 GENERAL MAINTENANCE ITEMS

2.1.1. Maintenance of the landscape areas shall be undertaken by a competent Landscape Contractor, preferably registered with the British Association of Landscape Industries (BALI).

2.1.2. Maintenance visits shall be undertaken at monthly intervals (min. 12 visits per year). At each visit the following operations shall be undertaken:

- Regular litter pick entire site to ensure that all planting and the Site are kept free from litter;
- Rake-up any leaf litter and remove from Site;
- Ensure that all adjacent areas affected by maintenance operations are protected using boards or tarpaulins. Do not place excavated or imported materials directly onto grass/hard surfaces;
- Undertake weeding of planted areas;
- Undertake watering as required to ensure healthy growth/establishment of plant stock especially during the summer months (May to August) or during periods of prolonged drought when more frequent visits may be required;
- Sweep all hard surfaces to ensure they are kept free from litter and leaves; and
- Undertake the landscape maintenance outlined in the following chapters.

2.1.3. All soft landscape areas to be maintained to BS 7370-4:1993[2].

2.1.4. Cutting of vegetation shall be undertaken outside of breeding bird season (March-August inclusive) but before the potential of winter frosts set in. In general shrubs shall be cut back if necessary in late winter (but before March).

2.1.5. The Contractor shall physically maintain the whole Site in accordance with the schedules and specification included within this document. The landscape maintenance shall be carried out to a high standard at all times.

2.1.6. A record or log of all maintenance visits shall be undertaken by the appointed Contractor and these shall be collated on a six monthly basis and submitted to Homes England or their agent for review.

2.1.7. The Contractor shall ensure that any chemical application is undertaken by trained personnel/operatives who have the appropriate NPTC certificates and in accordance with the manufacturer's recommendations. The 'Code of Practice for the Safe Use of Pesticides for Non-Agricultural Purposes' shall be observed where applicable. The use of any chemicals shall be noted on the record sheets as outlined above.

2.1.8. The Contractor shall programme and vary their agreed time of visits to coincide with appropriate weather conditions for carrying out operations, with particular regard for the use of chemicals and the mowing of grass. The mowing of grass during excessively wet weather or following periods of extended rain is strictly prohibited.

[2] British Standards Institute (1993) BS 7370-4:1993 Grounds Maintenance. Recommendations for maintenance of soft landscape (other than amenity turf)

2.1.9. The Contractor shall notify Homes England and/or their agent of any significant pest or disease problem affecting the planted stock and shall provide a suitable strategy for treatment to be agreed with Homes England.

2.1.10. The Contractor shall advise Homes England and/or their agent of all plants found to be dead, dying, vandalised or suffering significantly from the current growing conditions. All failed defective plants identified within the first 12 months of installation shall be replaced by the contractor at the soonest available planting season to ensure a continued coverage of growth. Replacement plants shall be of the same species and specification as the failed specimens.

2.1.11. Chipping and shredding is not permitted on site without prior consent from Homes England.

2.1.12. Should mammalian pests become a significant problem on site, then proposals for their control/eradication shall be submitted to Homes England and/or their agent for approval.

2.1.13. Ensure that a suitable water supply is available to carry-out the operations detailed in this document. In the event of water restrictions (e.g. drought), the contractor shall be responsible for submitting proposals to the management company for an alternative source of water e.g. use of a trailer mounted bowser.

3.0 MAINTENANCE OF GRASSLAND PLANTING

3.1. Objectives

3.1.1. To ensure new grassland areas are suitably managed to maintain an attract area to maximise biodiversity.

3.2. Prescriptions

3.2.1. The slopes to the surface water ditch and pond shall be seeded with the following mix:

- Cock's-foot *Dactylus glomerata* (25%);
- Perennial ryegrass *Lolium perenne* (20%);
- Yorkshire fog *Holcus lanatus* (5%);
- Timothy-grass *Phelum pratense* (25%);
- Creeping bent grass *Agrostis stoloniferous* (5%);
- Marsh foxtail *Alopecurus geniculatus* (3%);
- Rough blue grass *Poa trivalis* (3%);
- Blue grass *Poa pratensis* (12%); and
- Sweet vernal grass *Anthoxanthum odoratum* (2%).

3.2.2. In the first few years of establishment grassland plantings require regularly mowing to keep the growth of vigorous grasses in check, and to allow flowering species to establish. During the first year after sowing cut to a height of approximately 3-5cm, four times during the year.

3.2.3. A single early-spring cut may be desirable if coarse grasses and weeds exhibit excessive growth.

3.2.4. Once established cut the grassland annually in November once all plants have flowered and released their seeds. Rake up and remove all arisings.

3.2.5. Remove all litter including fallen leaves prior to mowing. Strim around any obstructions e.g. street furniture.

3.2.6. Where the grassland areas have become worn or have failed to establish, areas are to be re-turfed at the soonest available planting season.

3.2.7. Remove aggressive weed species, such as thistles, nettles, Buddliea and saplings as required to maintain the integrity of the Site and to prevent the area developing with low biodiversity. Hand weed or spot-treat with a glyphosate based weed killer.

3.2.8. Following initial seeding, provide appropriate signage to discourage entrance for a minimum of one month or until the grass sward is suitably established to withstand footfall.

3.2.9. No fertiliser shall be applied to the area.

4.0 MAINTENANCE OF THE POND

4.1. Objectives

4.1.1. To ensure the pond and its new aquatic and marginal planting is suitably cared for to enable its successful establishment, and to promote healthy growth and attractive form.

4.2. Prescriptions

4.2.1. Bankside vegetation of the pond shall be managed through cutting back 1/3 of vegetation on a three year rotation to control vigorous plants. Cutting shall be undertaken at a time to avoid disturbance to wildlife, with an optimal period between November and February.

4.2.2. During the first two years of the pond's enhancement, blanket weed shall be thinned to 1/3 coverage. Care shall be taken when clearing out algae to ensure no disturbance to wildlife inhabiting or breeding within the plant mass. Algae shall be removed by hand or using a pitchfork and shall be left on the pond edge for 48 hours to allow any animals to re-colonise the pond, before it is taken away for disposal.

4.2.3. Waterbodies can become clogged with plants or sediment over time, this will reduce their effectiveness as SUDS and wildlife ponds. Where sediment and aquatic vegetation is removed, no more than a quarter of the waterbody area shall be cleared in any one year. Material shall be left on the bank for at least 48 hours to allow wildlife time to re-enter the water, before being removed and composted or disposed of properly. Dredging shall be carried out annually after a two-year rest period following construction activities, if there has been an accumulation of sediment.

4.2.4. Monitoring shall be carried out for the presence of invasive alien species. If found to be present, they shall be managed by removing fish humanely. No fertiliser or herbicides shall be used within the waterbody.

5.0 MAITENANCE OF HARDSTANDING

5.1. Objectives

5.1.1. To keep the areas of hardstanding including the access track clear of vegetation.

5.2. Prescriptions

5.2.1. Vegetation growing on the development platform shall be cut once a month between March and October each year to prevent plants from establishing. All arisings shall be removed from the Site.

6.0 MAINTENANCE SCHEDULES

6.1. General Maintenance Operations

Maintenance Operations	Year 1	Year 2	Year 3	Year 4	Year 5
Undertake watering as required to ensure healthy establishment of all plant stock	Mar-Nov As required	Mar-Nov As required	Mar-Nov As required	Mar-Nov As required	Mar-Nov As required
Remove all arisings from maintenance operations	As required	As required	As required	As required	As required
Ensure all planted areas are kept weed free; no weed cover to exceed greater than 5% in area or 300mm in height	As required	As required	As required	As required	As required
Re-instate any failed plant stock to specification as agreed with Homes England; include for top dressing with slow release fertiliser @50g/m^2	As required	As required	-	-	-
Ensure all hard surfaces are kept free from litter/leaves and sweep as required	As required	As required	As required	As required	As required
Apply folia acting/residual herbicide to hard surfaces to prevent ingress of weed and algae growth	Sept-Oct As required	Sept-Oct As required	Sept-Oct As required	Sept-Oct As required	Sept-Oct As required
Rake up fallen leaf litter; remove from site	Sept-Dec As required	Sept-Dec As required	Sept-Dec As required	Sept-Dec As required	Sept-Dec As required

6.2. New Grassland Maintenance Schedule

Maintenance Operations	Year 1	Year 2	Year 3	Year 4	Year 5
Remove any protective fencing after 12 months	Once	N/A	N/A	N/A	N/A
Tidy up all grassland areas removing rubbish, litter	Each visit	Each visit	Each visit	Each visit	Each visit

Maintenance Operations	Year 1	Year 2	Year 3	Year 4	Year 5
Cut grassland to a height of 30-50mm, rake and remove all arisings from site, trim/re-form edges	Jan/March/Sep/Nov	March/Nov	Annually Nov	Annually Nov	Annually Nov
Remove fallen leaved from grassed areas as required	Sept/Nov	Sept/Nov	Sept/Nov	Sept/Nov	Sept/Nov
Remove weeds from grassland planting area	Each visit	Each visit	Each visit	Each visit	Each visit
Re-turf or re-seed patchy areas; as required	Annually Sept/Oct	Annually Sept/Oct	Annually Sept/Oct	Annually Sept/Oct	Annually Sept/Oct

6.3. Pond Maintenance Schedule

Maintenance Operations	Year 1	Year 2	Year 3	Year 4	Year 5
1/3 of bankside vegetation to be cut on three-year rotation	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb
Thin blanket weed to 1/3 coverage	Oct-Mar	Oct-Mar			
Remove sediment and aquatic vegetation. No more than ¼ of water body area to be cleared in any one year			Oct-Mar		Oct-Mar
Monitor for the presence of invasive alien species	Each visit	Each visit	Each visit	Each visit	Each visit

6.4. Hardstanding Maintenance Schedule

Maintenance Operations	Year 1	Year 2	Year 3	Year 4	Year 5
Cut vegetation on hardstanding once a month	Mar-Oct	Mar-Oct	Mar-Oct	Mar-Oct	Mar-Oct

Appendix 1: Landscape Strategy Plan