

Lower Thames Crossing

9.89 Responses to the Examining Authority's ExQ1 Appendix G – 11. Biodiversity (Part 4 of 6)

Infrastructure Planning (Examination
Procedure) Rules 2010

Volume 9

DATE: September 2023
DEADLINE: 4

Planning Inspectorate Scheme Ref: TR010032
Examination Document Ref: TR010032/EXAM/9.89

VERSION: 1.0

Lower Thames Crossing

9.89 Responses to the Examining Authority's ExQ1 Appendix G – 11. Biodiversity (Part 4 of 6)

List of contents

	Page number
1 Introduction	1
1.1 Introduction.....	1
2 Responses to the Examining Authority's ExQ1 11	2
Glossary	3
Annexes.....	6
Annex A - Coalhouse Point Mitigation Water Supply Structure	
Annex B - LTC technical note considerations of in combination development within traffic modelling	
Annex C - Coalhouse Point e-mail update 24 February 2023	
Annex D - Underwater noise e-mail update 24 April 2023	
Annex E1 - Air Quality Methodology briefing note	
Annex E2 - Feedback received by email from Natural England	
Annex F1 - Methodology for the assessment of in-combination effects	
Annex F2 - Feedback received from Natural England	
Annex H - HRA and EIA Evidence Technical Note Rev1 Air Quality from vehicle emissions	
Annex I - Technical note on the methodology for assessing speed limits	
Annex J - Note on Modelling Approach for Designated Sites	
Annex K - Technical Note Ramsar Advanced Grouting Tunnel and Main Tunnels Numerical Model	
Annex L - Advanced Grout Tunnel Technical Note	
Annex M1 - Disturbance – noise and visual methodology briefing note	
Annex M2 - 02 April 2020 Feedback received from Natural England	
Annex N1 - 18 March 2020 Groundwater Assessment Methodology briefing note	
Annex N2 - 02 April 2020 Feedback received from Natural England	
Annex O1 - 08 April 2020 Epping Forest detailed botanical survey briefing note	
Annex O2 - 30 April 2020 Feedback received from Natural England	
Annex O3 - 12 May 2020 Feedback received from Natural England	

- Annex P1 - 06 May 2020 HRA Briefing Note Defining functionally linked land**
- Annex P2 - 18 May 2020 Feedback received from Natural England**
- Annex Q1 - 04 June 2020 Technical Note North Portal drainage discharge options**
- Annex Q2 - 25 June 2020 Feedback received from Natural England**
- Annex R - 18 May 2020 Epping Forest detailed botanical survey briefing note –
Revision 1**
- Annex S1 - 04 June 2020 Jetty Refurbishment Use and Decommissioning Paper**
- Annex S2 - 26 June 2020 Feedback received from Natural England)**
- Annex T1 - 04 June 2020 Technical Note North Portal Discharge Construction**
- Annex T2 - 25 June 2020 Feedback received from Natural England**
- Annex U - 18 May 2020 HRA Briefing Note Ornithology baseline**
- Annex V - 18 May 2020 Figures detailing European site locations in relation to ARN**
- Annex W - 22 May 2020 Figure showing land take in relation to European sites and
functionally linked land**
- Annex X - 22 May 2020 Approach to climate change assessment**
- Annex Y - 10 June 2020 Land take methodology**
- Annex Z - 02 June 2020 Construction traffic modelling and AQ effects briefing**
- Annex AA1 - Technical Note Ramsar Advanced Grouting Tunnel and Main Tunnels
Numerical Model (R1)**
- Annex AA2 - Technical Note Baseline Water Balance for the Ramsar site (Filborough
Marshes)**
- Annex BB - 22 July 2020 Stage 1 Screening Figure 31 – Predicted change in
nitrogen deposition at European sites**
- Annex CC - 10 September 2020 DCO1.0 Stage 1 Screening – Appendix H – LA 105
NEA001 Comparison**
- Annex DD1 - 28 January 2021 Technical Note: Recreational disturbance - Additional
analysis to support HRA screening**
- Annex DD2 - 24 June 2021 Feedback received from Natural England**
- Annex EE - 12 February 2021 Technical Note - Habitat enhancement to maintain
baseline functionality of functionally linked land**
- Annex FF - 23 February 2021 Technical Note - Habitat enhancement to maintain
baseline functionality of functionally linked land (Revision 1)**
- Annex GG - 09 March 2021 Technical Note – Dust measures**
- Annex HH - 09 March 2021 Technical Note - Operational Noise & Visual Disturbance**

Annex II - 09 March 2021 Technical Note - No LSE from Lighting Construction and Operation

Annex JJ - 13 April 2021 Technical Note - Construction Noise and Mitigation

Annex KK - 13 April 2021 Technical Note - Ramsar Surface Water Ecology Baseline (Construction surface water discharge)

Annex LL1 - 22 April 2021 Technical Note - Habitat enhancement to maintain baseline functionality of functionally linked land (Revision 2)

Annex LL2 - 28 July 2021 Feedback (partial) received from Natural England

Annex MM - 22 April 2021 Technical note - Iteration of the extent of functionally linked land

Annex NN - 12 May 2021 Technical Note - Ramsar Surface Water Ecology Baseline (Construction surface water discharge) Revision 1

Annex OO - 12 May 2021 Revised Technical Note - Dust measures (Revision 1)

Annex PP - 12 May 2021 Technical Note - No LSE from Lighting Construction and Operation

Annex QQ1 - 11 August 2021 HRA Evidence Technical Note Rev 0: Air Quality from vehicle emissions

Annex QQ2 - 03 December 2021 Feedback received from Natural England

**Annex G not used*

Annex II 09 March 2021 Technical Note - No LSE from Lighting Construction and Operation

HRA Technical Note: No LSE from Lighting in Construction and Operation

Introduction

Following discussion within meeting 3/2/2021 and email from Natural England dated 23/2/2021, this technical note provides extracts from the screening report to illustrate how the assessment of the effects of lighting in construction and operation relies on good practice and embedded measures to conclude no LSE on any European site – to facilitate agreement on the conclusion in the SoCG prior to Natural England seeing the final resubmission draft of the Screening report.

Proposed text in the Screening Report

Zone of influence

The zone of influence for changes in lighting is described in Table 4.3 as follows:

- Changes in light levels – construction: Within Order Limits, primarily construction compounds and work areas, where lighting is used such as construction compounds CA5, CA3A and CA3B.
- Changes in light levels – operation: Highway lighting is associated with the main line and junctions across the Project and within the tunnel. The Zol is limited to the area immediately either side of the highway.

Sites identified with potential LSE

Section 5.2 describes the European sites that could be affected by changes in lighting (without any measures in place) and these are:

1. Thames Estuary and Marshes Ramsar
 - a. during construction lighting within compounds CA3A and CA3B.
2. Functionally linked land associated with Benfleet and Southend SPA/Ramsar, Thames Estuary and Marshes SPA/Ramsar, Medway Estuary and Marshes SPA/Ramsar and The Swale SPA/Ramsar
 - a. during construction lighting within compounds CA3A, CA3B and CA5.
 - b. during operation lighting (5 pairs of columns) along the highway approaching/exiting the north portal

Measures that reduce/avoid

The measures that are relied upon in the screening report are set out within Section 4.5 Assumptions, Project design and environmental measures. The construction measures are a mix of good practice and embedded measures and the operational measures are all embedded within the engineering design.

The measures are described in the screening report as follows.

"Changes in lighting construction and operation

Construction

4.5.27 Construction compounds and worksites (which includes compounds CA5, CA3A and CA3B) would be lit for safety, security and working requirements, with a lux (lighting) level appropriate to the task and in line with industry best practice.

4.5.28 As required by the CoCP (Application Document 7.11), the Contractors would assess the required lux level to ensure visual intrusion and light spillage are kept to a minimum, particularly in close proximity to residential properties and busy roads where it may cause nuisance or distraction. Where necessary, the Contractors would provide lighting to site boundaries to ensure the safety of passing pedestrians.

4.5.29 Specific measures such as vertical lighting would be employed near or on the River Thames to mitigate potential impacts on wildlife and marine traffic.

4.5.30 Temporary lighting would be designed to minimise disturbance to the local areas typically by using inward-facing lighting equipment, minimising the height, and screening the worksite where possible. The control measures are detailed within the CoCP (Application Document 7.11).

4.5.31 Prior to the commencement of works below mean high water springs, proposals for lighting of marine construction works subject to the Deemed Marine Licence that require 24 hour working will be developed and submitted to the MMO. This would include an assessment of the effects of measures such as directional lighting and controls on lux levels to mitigate effects on waterfowl during 24-hour operations [REAC commitment - MB003].

Operation

4.5.32 The lighting columns include the following measures that would reduce the effect of light spill on the surrounding habitat:

- a. Column heights have been kept as low as practicable while still providing a compliant lighting design.
- b. Luminaires have been selected which emit no light above the horizontal to reduce skyglow and ensure light is only projected to where it is needed.
- c. Light-emitting diode (LED) light sources have been used to reduce energy consumption and offer a more readily recyclable product at the end of life, compared to traditional light source lamps and luminaires.
- d. Lighting levels would be linked to the live traffic flow, so that during quiet periods the lighting is dimmed to reduce energy consumption.
- e. The lighting columns would be placed in the verges projecting towards the central reserve wherever practicable to reduce light spill into adjacent areas."

Assessment of no LSE

The assessment of LSE is carried out in Section 6.2 and relevant extracts provided below.

Efficacy of good practice measures

Whilst no studies of the efficacy of the good practice and embedded measures are available in the literature to specifically demonstrate their effectiveness in preventing significant effects on nearby receptors, the measures have been developed over many years by the industry and there is very high confidence in their efficacy. The construction industry standards have been in place for many years and there has been no call or need for updating it in recent years, suggesting that they represent a mature and successful set of guidelines. There is no reason to suppose that measures that have proved successful on multiple projects in the past; protecting multiple habitat types and people without significant complaint; would not be equally successful at mitigating dust effects on European site habitats.

Changes in light levels - construction

The effect on Thames Estuary and Marshes Ramsar

"The Project is committed to a number of integral measures with regard to lighting on the construction site (see Section 4.5.10 to 4.5.13 (this refers measures listed above)) such that the land adjacent to construction compounds CA3A and CA3B would not be affected to the extent that significant effects are likely because the measures reduce and avoid light emissions at source, disrupting any pathway to effect. Also, the existence of lighting associated with the various ports and other developments along this part of the River Thames also means any construction lighting for this Project would not materially change overall light levels, as shown in the Landscape and Visual Figure 7.18 (Application document reference 6.2), viewpoint S38a and N04 (See copy of figure provided with this briefing note) which clearly illustrate the "night-time glow" associated with the river. Therefore, any residual light spill from the construction compounds would not be expected to result in any disturbance to the birds feeding and roosting in these parts of the Ramsar. The visual disturbance associated with construction lighting is considered to be a *de minimis* change and a conclusion of no LSE reached."

The effect on functionally linked land

"The Project is committed to a number of integral measures with regard to lighting on the construction site (see Section 4.5.10 to 4.5.13 (this refers measures listed above)) such that (noting some land will be lost) the remaining functionally linked land adjacent to construction compounds CA3A, CA3B and CA5 would not be affected to the extent that significant effects are likely because the measures reduce and avoid light emissions at source, disrupting any pathway to effect. Also, the existence of lighting associated with the various ports and other developments along this part of the River Thames also means any construction lighting for this Project would not materially change overall light levels, as shown in the Landscape and Visual Figure 7.18 (Application document reference 6.2), viewpoint S38a and N04 (See copy of figure provided with this briefing note) which clearly illustrate the "night-time glow" associated with the river. Therefore, would not be expected to result in any disturbance to the birds feeding and roosting in these parts of the functionally linked land. The visual disturbance associated with construction lighting is considered to be a *de minimis* change and a conclusion of no LSE reached."

Changes in light levels - operation

The effect on functionally linked land

"The road is in tunnel under the majority of the functionally linked land and is only lit within the tunnel and within the cutting at the north portal where five pairs of lighting columns are proposed on approach to/exit from the tunnel (see Volume 2. General Arrangement Sheet 17 of 47 (Application Document Reference 2.5)).

The Project is committed to a number of design principles relating to the lighting design (see measures listed above) which will reduce the light emissions at source. The lighting columns at the north portal are also within a cutting which will further reduce the effects of any residual light spill. Also, the existence of lighting associated with the various ports and other developments along this part of the River Thames also means that the road lighting at the north portal would not materially change overall light levels, as shown in the Landscape and Visual Figure 7.18 (Application document reference 6.2), viewpoint S38a and N04 which clearly illustrate the "night-time glow" associated with the existing river developments. Therefore, the changes in light levels would not be expected to result in any disturbance to the birds feeding and roosting in these parts of the functionally linked land. The visual disturbance associated with road lighting during operation is considered to be *de minimis* and a conclusion of no LSE reached."

In combination effects for changes in lighting construction and operation

"The pathway to effect for the Project alone is *de minimis* and so could not contribute to any in combination effects.

Therefore, a conclusion is reached of no LSE on the on the Thames Estuary and Marshes Ramsar, and the functionally linked land associated with the following European sites due to changes in light levels during construction and operation as a result of the Project alone or in-combination with other plans and projects, namely:

- a. Benfleet and Southend Marshes SPA and Ramsar
- b. Medway Estuary and Marshes SPA and Ramsar
- c. Thames Estuary and Marshes SPA and Ramsar
- d. The Swale SPA and Ramsar "

Annex JJ 13 April 2021 Technical Note - Construction Noise and Mitigation

HRA Technical Note: Construction noise and mitigation measures

Introduction

At the SoCG meeting with Natural England 9th December 2020 LTC team took an action to provide a short brief note on the potential effect of mitigating the change in noise through the construction period. Earlier draft assessments of the zone of influence of noise and visual disturbance identified through modelling showed an unacceptable impact on the qualifying features of the SPA/Ramsar and further mitigation was required to support a conclusion of no adverse effects. The proposed mitigation package included a twin-track approach of minimising the zone of influence of disturbance (the subject of this note) together with habitat enhancement measures to maintain the functionality of functionally linked land associated with the SPA/Ramsar (presented in *LTC HRA technical note: Habitat enhancement to maintain baseline functionality of functionally linked land*), which is designed to mitigate any residual impacts after the disturbance zone of influence has been minimised (together with mitigating effects of land take).

Following a discussion with LTC noise specialists on 9th December 2020 the most practicable option appears to be to surround construction work areas with an acoustic barrier (fences/bund). By mitigating construction noise via the use of barriers the potential effects on visual disturbance from the construction compounds will also be avoided.

Since then further iterations have occurred with noise model verification to determine the most effective, practical options to minimise noise within the Thames Estuary and Marshes Ramsar/SPA and associated functionally linked land.

The measures and subsequent effect on the area affected by construction noise related to the HRA conclusion rows within the SoCG tracker shown in Table 1.

Table 1: SoCG rows relating to construction noise and visual disturbance affected by the provision of noise barriers.

Item number	Relating to	Site	Impact	Pathway	Conclusion	Agreed?
HRA 62	Conclusions of HRA Stage 2 Appropriate Assessment	Thames Estuary and Marshes SPA & Ramsar	Disturbance to species	Changes in noise & vibration - construction works and vehicles	No AEol	Under discussion
HRA 64	Conclusions of HRA Stage 2 Appropriate Assessment	Thames Estuary and Marshes SPA & Ramsar	Disturbance to species	Changes in visual disturbance - people/vehicles in eyeline - construction	No AEol	Under discussion

Noise attenuation measures proposed

Figures 1-3 illustrate the noise attenuation measures within each of the compounds that has been incorporated into the noise model and reflected in the results (see contours and graphs in following sections). The areas of suitable habitat (worst case) where the noise levels are greater than 55dB or where there is a >3dB change have been reduced from approximately 328.7ha at DCO 1.0 to 106.6 ha at DCO 2.0. This represents the minimum area to be affected that is feasible to construct the scheme.

Figure 1: Noise attenuation measures at Compound CA3A

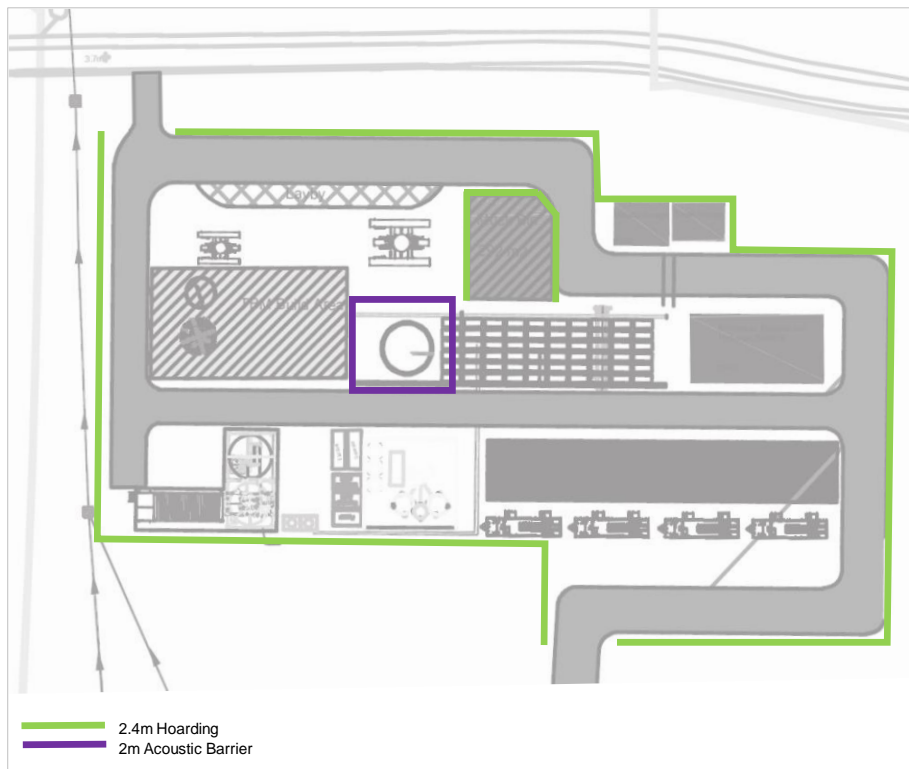


Figure 2: Noise attenuation measures at Compound CA3B

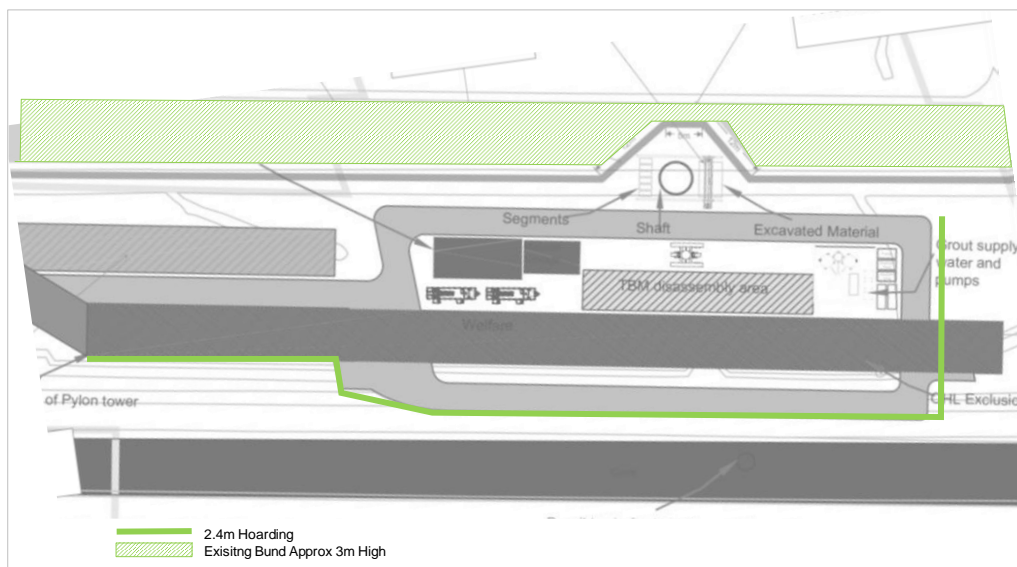
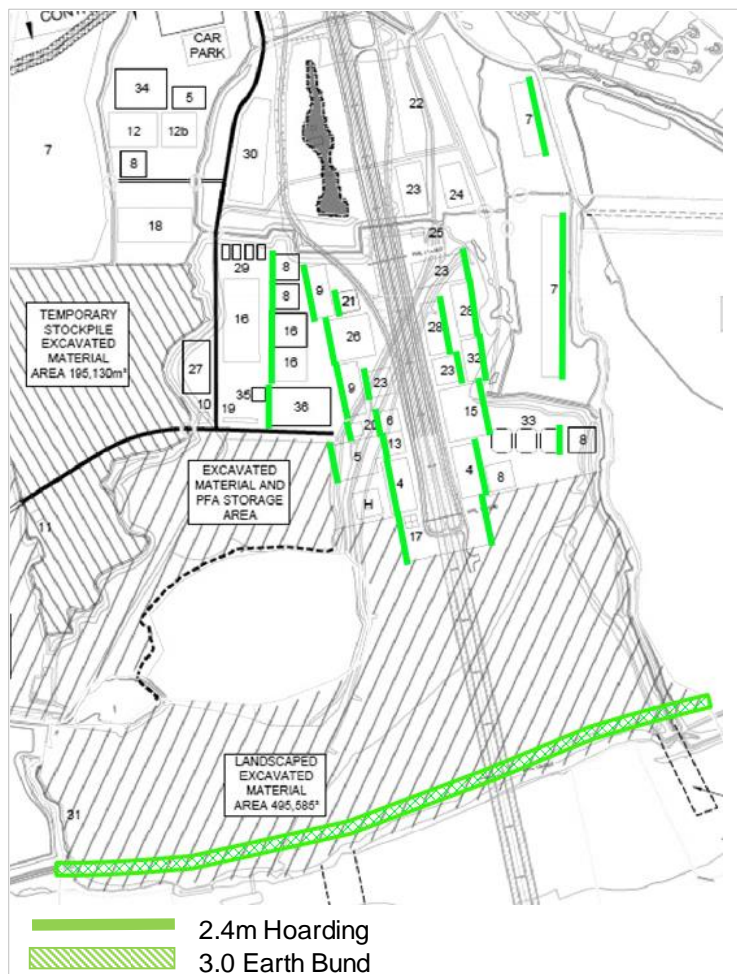


Figure 3: Noise attenuation measures at Compound CA5



The REAC secures the noise attenuation measures through the following commitments:

HR004: Noise attenuation measures shall be incorporated within Compounds CA5, CA3a and CA3b as shown on HRA Figure XX¹ (Application Document Ref 6.5) (noting HR005 & HR006) to ensure that the construction activities do not result in noise levels within the Thames Estuary and Marshes SPA/Ramsar or any land functionally linked to it (as shown in Figure XX² (Application Document Ref 6.5) that would cause disturbance to the wintering bird qualifying interests. The measures shall be in place prior to the operation of those compounds (or areas of compounds) and shall remain until the end of the compound operation.

HR005: The compound CA5 earthworks area immediately north of the River Thames shall be no closer than 75m to the existing field boundary and all soil reprofiling shall occur behind a 3m high bund that will delimit the extent of the works from functionally linked land associated with the Thames Estuary and Marshes SPA/Ramsar. Construction of the 3m high bund will be substantially started during April, May, June and July only to avoid disturbance

¹ This will be a figure in the HRA and is fig 1-2 in this note

² This will be a figure in the HRA illustrating the location of FLL

of birds in the passage and winter period from completion of construction of the bund and subsequent works behind it.

HR006: Erection of noise attenuation measures at the compound boundaries will be carried out in April, May, June and July only to avoid disturbance of birds in the passage and winter period.

NV001: Noise and vibration levels would be controlled in accordance with BS5228, the Code of practice for noise and vibration control on construction and open sites, to reduce disturbance to the environment and communities in the vicinity of the construction works, including the Thames Estuary and Marshes SPA/Ramsar and associated functionally linked land.

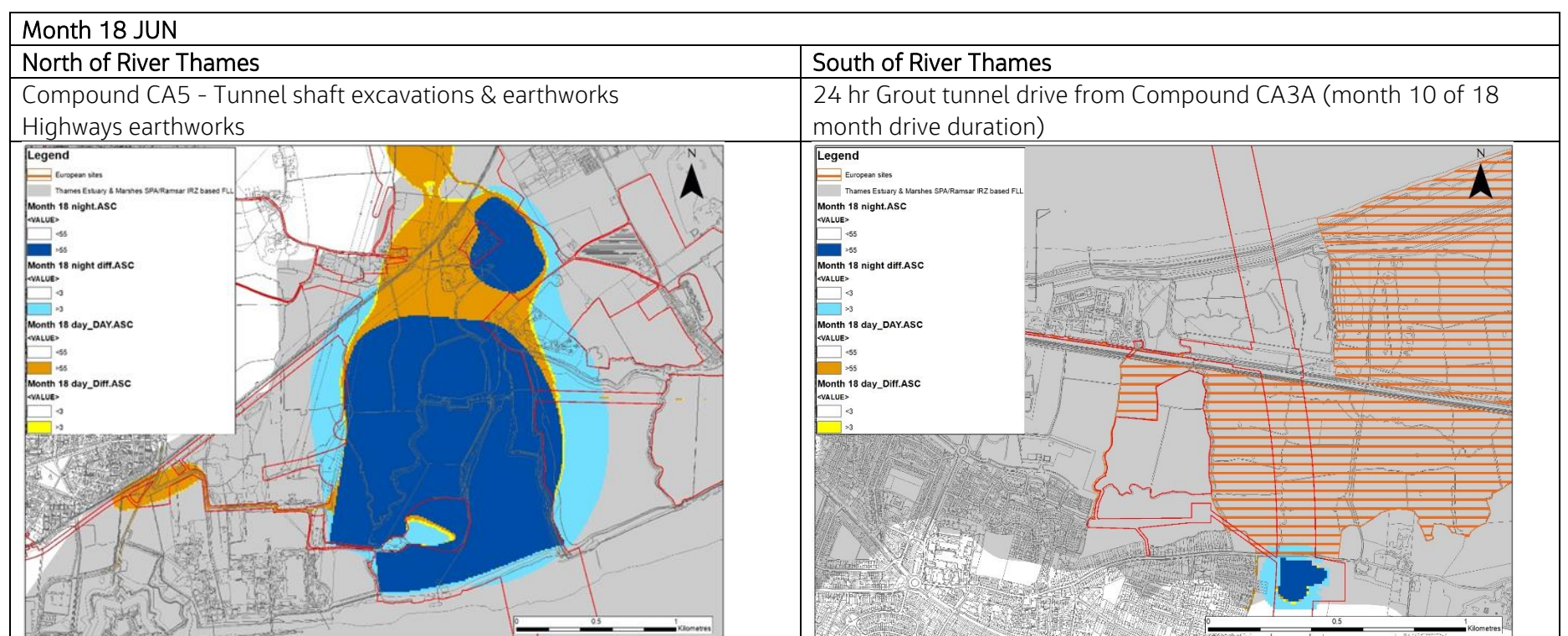
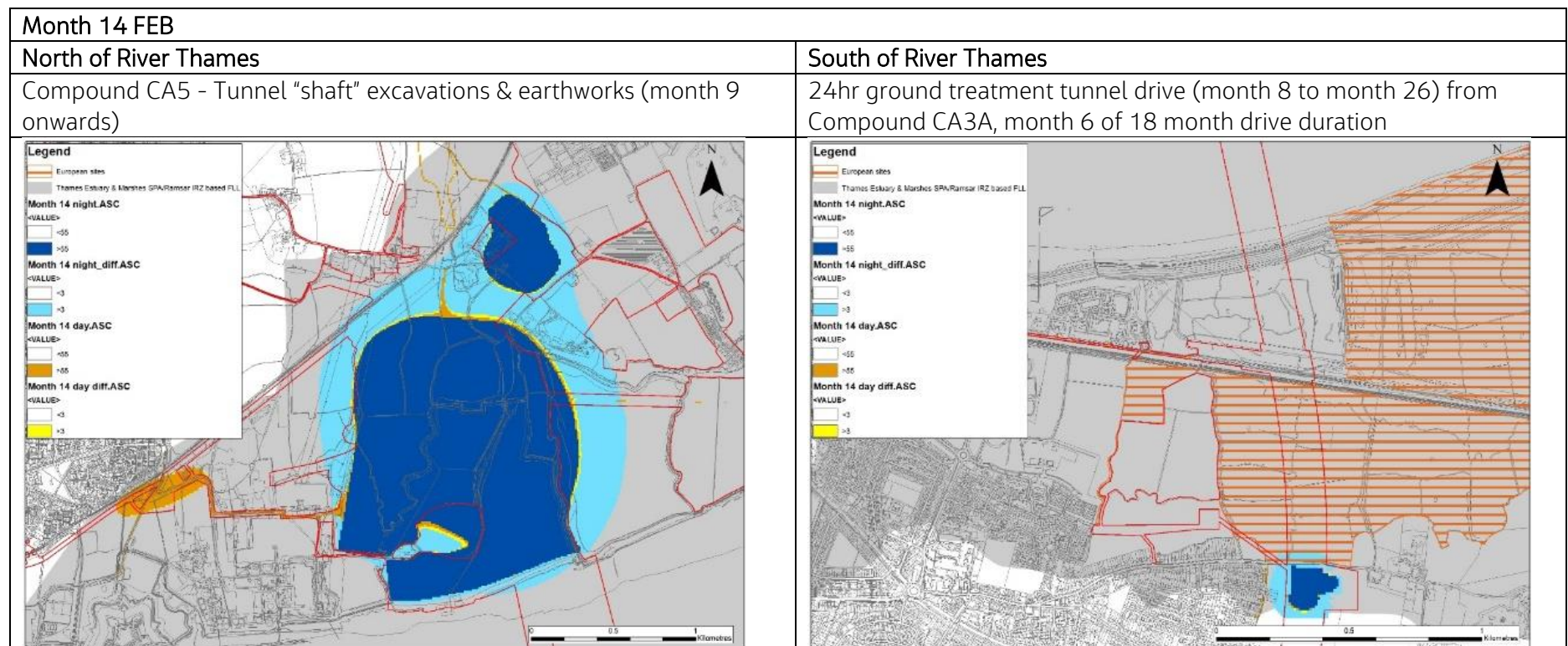
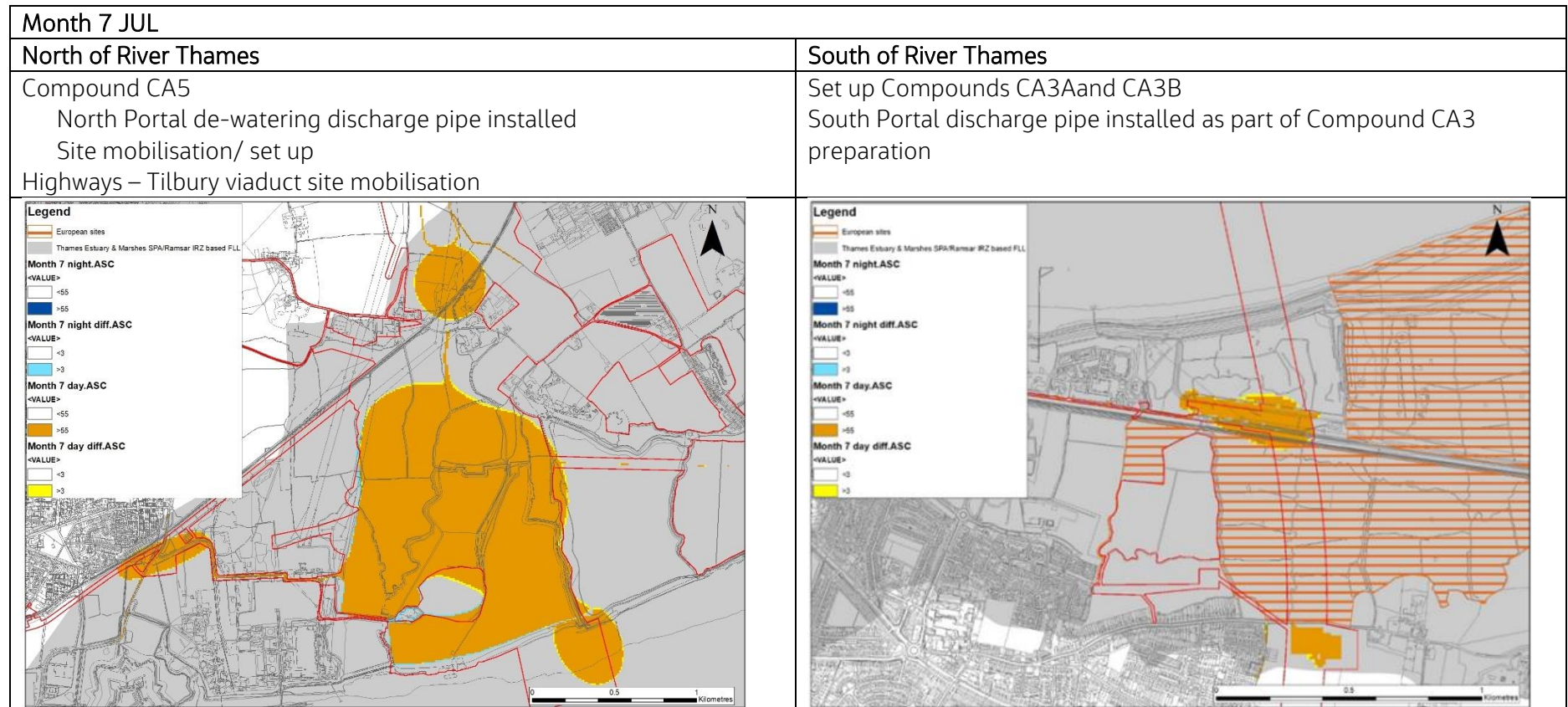
NV007: Best Practicable Means (BPM) as defined under Section 72 of the Control of Pollution Act 1974 would be employed during the construction phase to reduce noise nuisance. These would include measures such as:

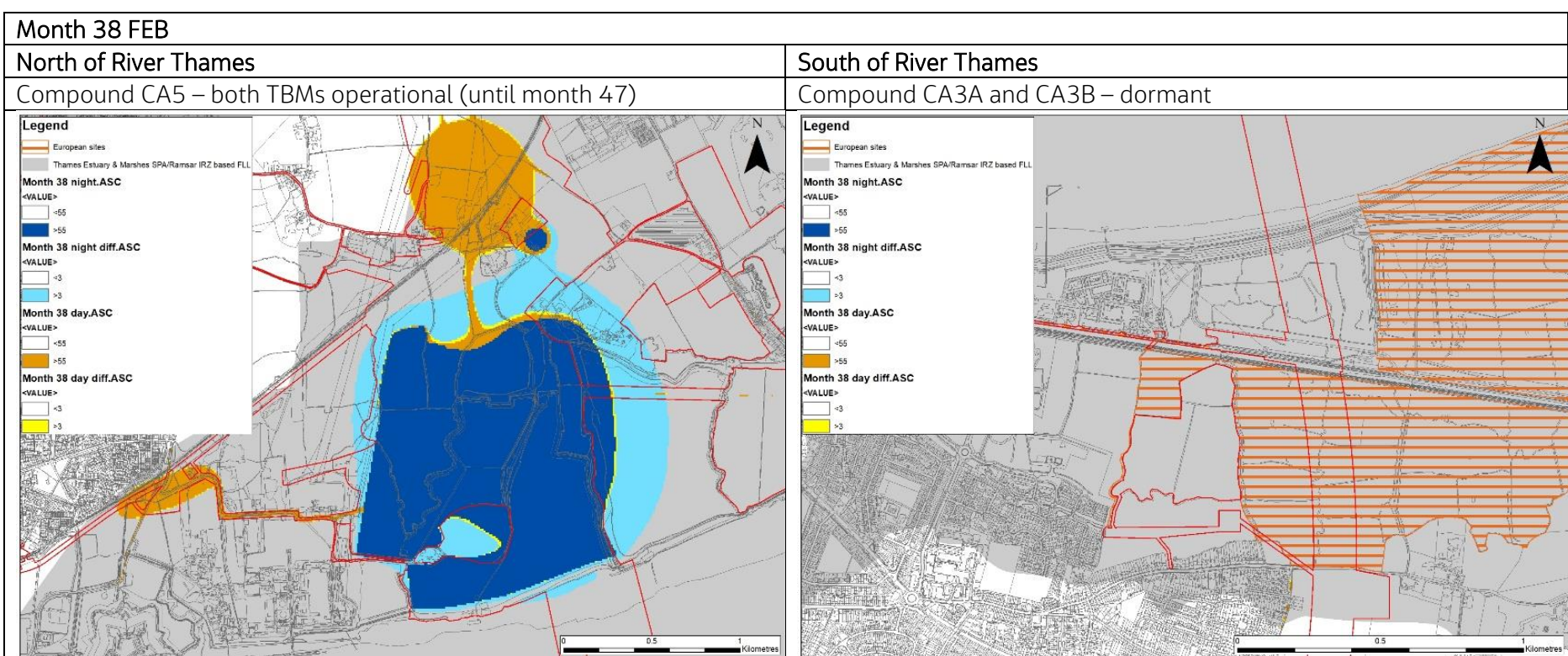
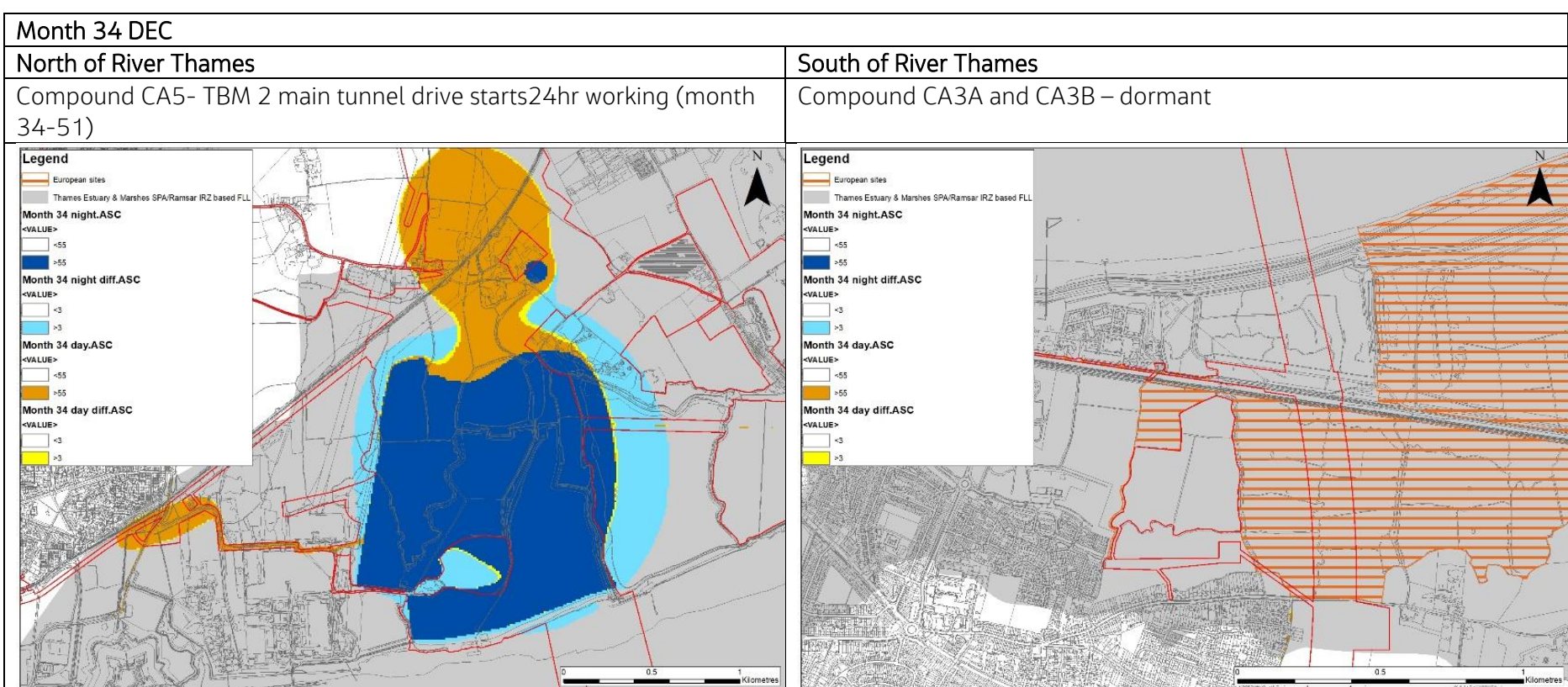
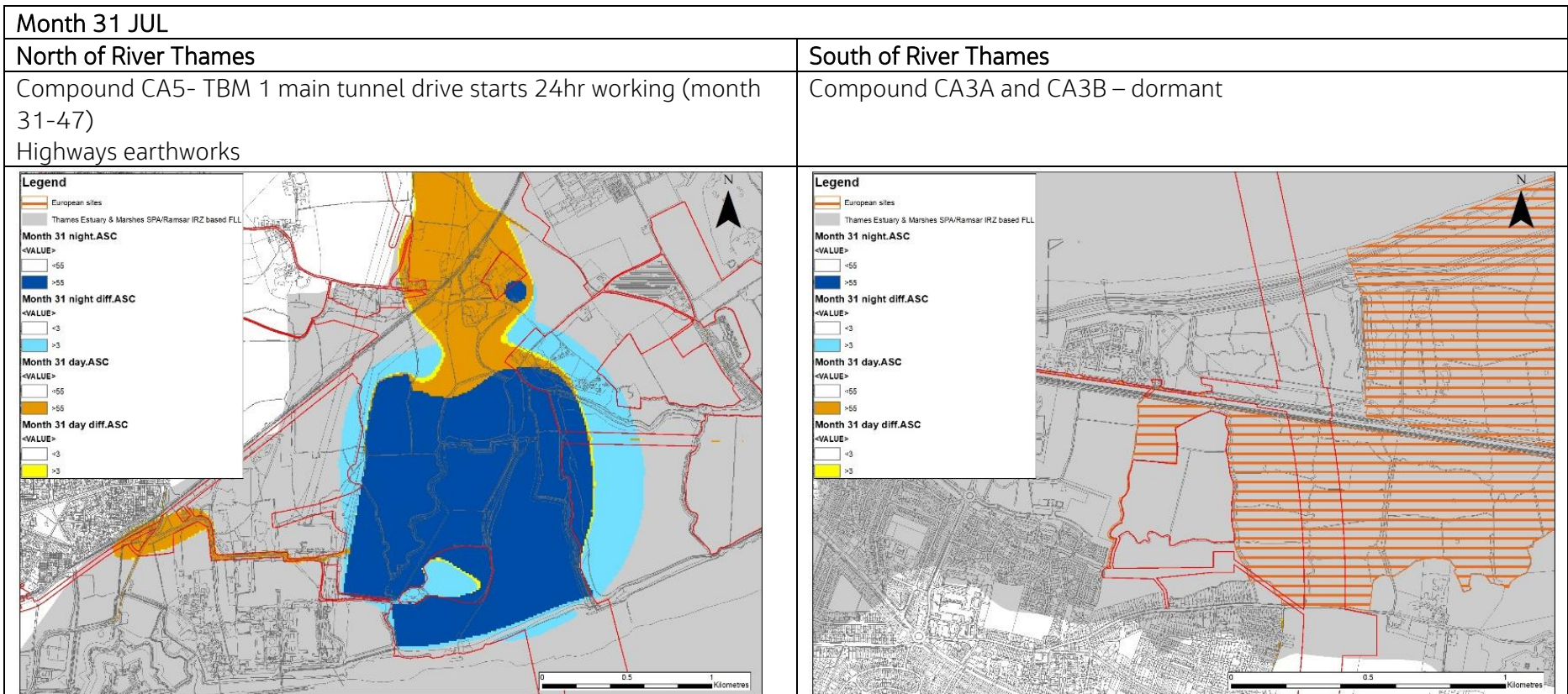
- installing and maintaining hoarding around the construction areas likely to generate noise
- keeping site access routes in good condition with condition assessments on site to inspect for defects such as potholes
- turning off plant machinery when not in use
- maintaining all vehicles and mobile plant such that loose body fittings or exhausts do not rattle or vibrate
- using silenced equipment where available, in particular silenced power generators and pumps
- no music or radios would be played for entertainment purposes outdoors on-site
- plan site layout to ensure that reversing is kept to a practicable minimum. Reversing manoeuvres, that are required would be managed by a trained banksman / vehicle marshal to ensure they are conducted safely and concluded quickly
- non-percussive demolition techniques would be adopted where reasonably practicable to reduce noise and vibration impact

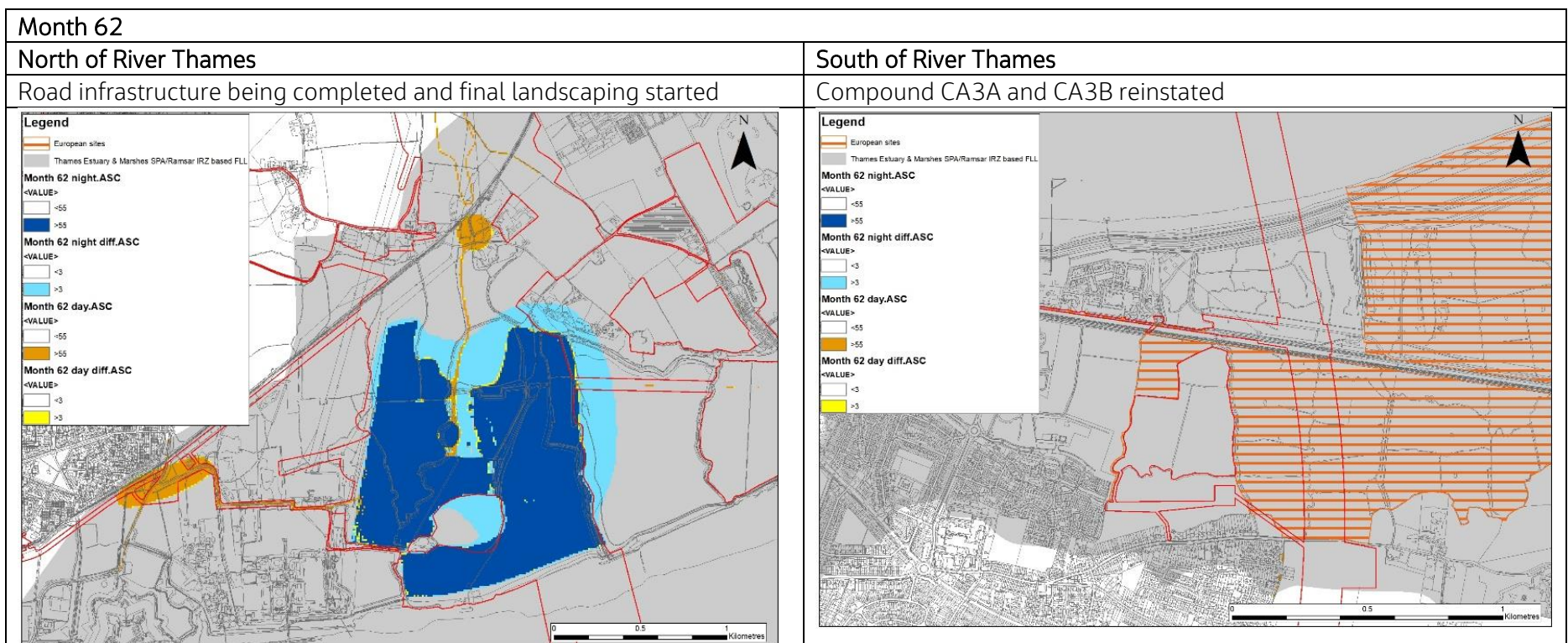
Predicted noise levels during construction

Construction phases

The sources of construction noise are from Compounds CA3A, CA3B and CA5 and the following timeline provides a summary of the key points of the construction programme that are considered likely to result in disturbing noise levels. The current assumption is month 1 of the noise model equates to January. The modelled contours shown include the noise attenuation measures described in the previous section.





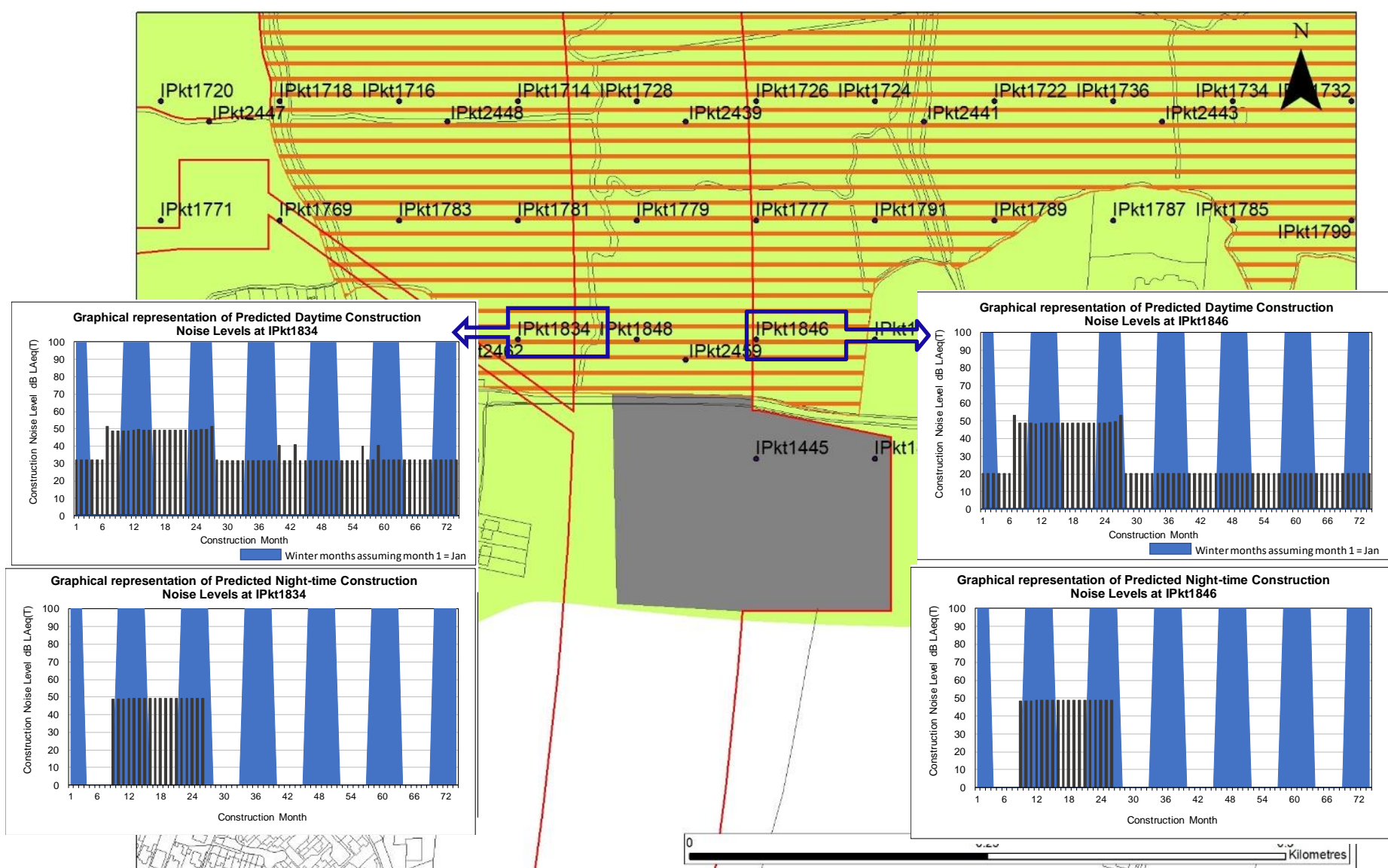


Noise level profiles through construction at key locations

Thames Estuary and Marshes Ramsar

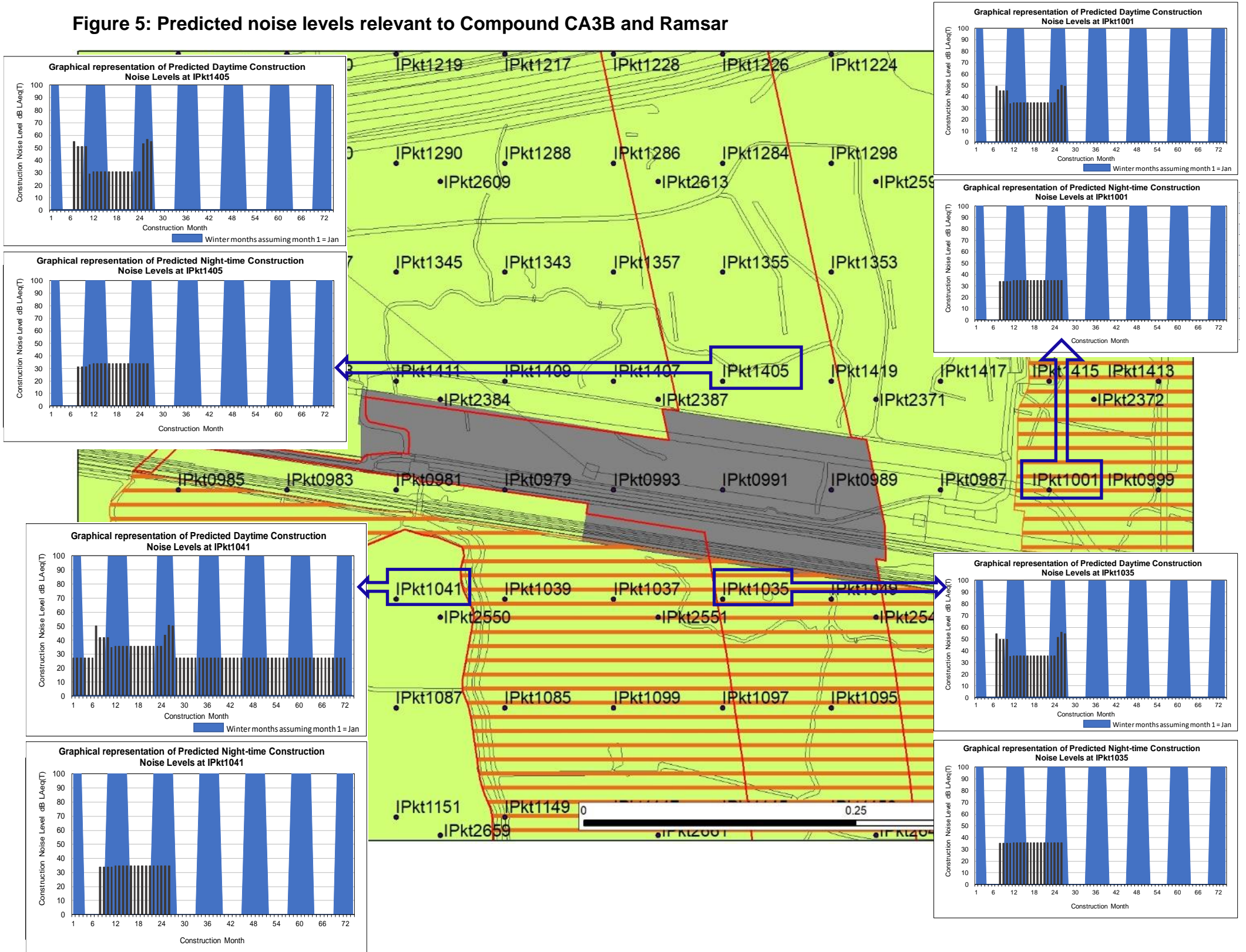
In the southern part of the Ramsar, adjacent to Compound CA3A, there is no noise level greater than 55dB recorded at any point during the construction period. As shown on the contours above the night-time noise change is predicted to exceed 3dB when the compound to operating at night (between month 8 and Month 26). Figure 4 provides the graphical representation of the noise levels at two locations within the Ramsar to illustrate the changes in noise levels through the construction period.

Figure 4: Predicted noise levels relevant to Compound CA3A works and the Ramsar



In the northern part of the Ramsar, adjacent to Compound CA3B, there is no noise level greater than 55dB recorded at any point during the tunnelling period. The compound set up, during the summer months, does generate noise levels above 55dB in a limited area of the Ramsar (see graph IPkt1035 in figure 5 below). As shown on the contours above the noise change does not exceed 3dB, even when the compound to operating at night (between month 8 and Month 26). Figure 5 provides the graphical representation of the noise levels at the locations within the Ramsar and functionally linked land to illustrate the changes in noise levels through the construction period.

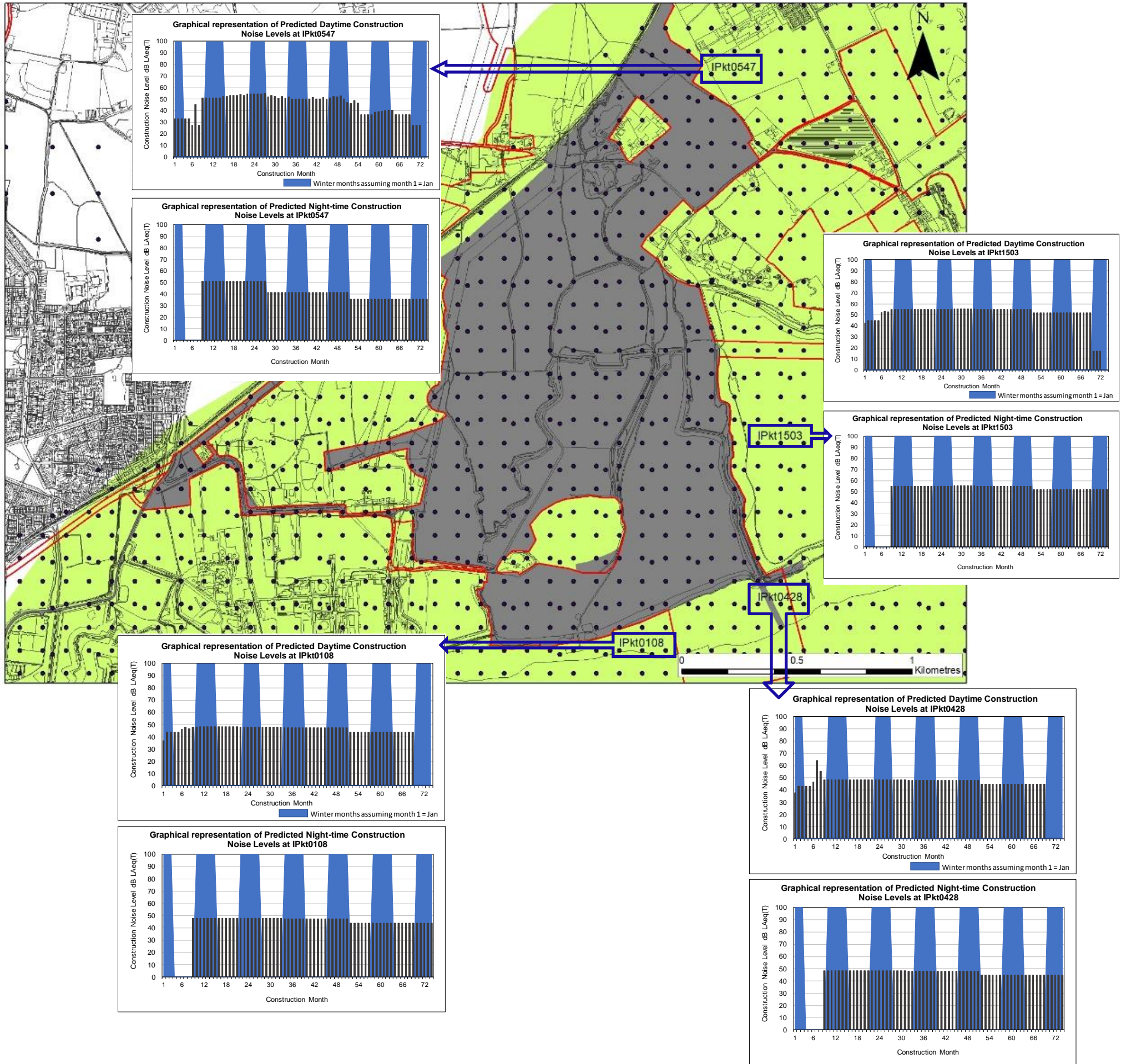
Figure 5: Predicted noise levels relevant to Compound CA3B and Ramsar



Noise changes within functionally linked land

The noise levels within functionally linked land adjacent to compound CA5 do exceed the 55db and 3dB change thresholds as shown in the contour plots above, although generally the levels are at or below 55dB day and night. Figure 6 illustrates the noise level profiles within the functionally linked land. The intertidal area is only affected when the north portal discharge pipeline is installed during the summer months (when qualifying features are not present and so not having any impact on them).

Figure 6 Predicted noise levels relevant to Compound CA5 and FLL



Annex KK 13 April 2021 Technical Note - Ramsar Surface Water Ecology Baseline (Construction surface water discharge)

HRA Technical Note: Construction surface water discharge

Introduction

The joint (NE and EA) consultation meeting on 3rd March 2021 discussed the construction surface water discharge from Compound CA3, the measures that the Project has committed to discharge clean water at greenfield run off rate and the discharge permits that would be apply post DCO consent. As part of this discussion NE were keen to understand the likely environmental parameters that would form part of the discharge permit.

Any parameters would apply to the good practice measures already committed to by the Project, but because they have been developed specifically in relation to the Thames Estuary and Marshes Ramsar, they are considered to be mitigation that applies at HRA Stage 2 and this effect pathway has been taken forward to the Appropriate Assessment report.

This note has been produced to facilitate agreement on the HRA conclusion on changes in surface water – construction in the SoCG prior to NE seeing the final resubmission draft of the Screening and Appropriate Assessment reports.

Prior to applying for the discharge permit the Project will complete pre-construction surveys to collect the hydrological and ecological data required to allow the EA to determine the permit application and derive appropriate environmental parameters. The parameters put forward in this technical note are precautionary and although do not prejudice any permitting decisions made by the EA, are considered to reflect a “no greater than” threshold that would protect the receiving environment and be sufficient to conclude no adverse effects in the HRA for the DCO application.

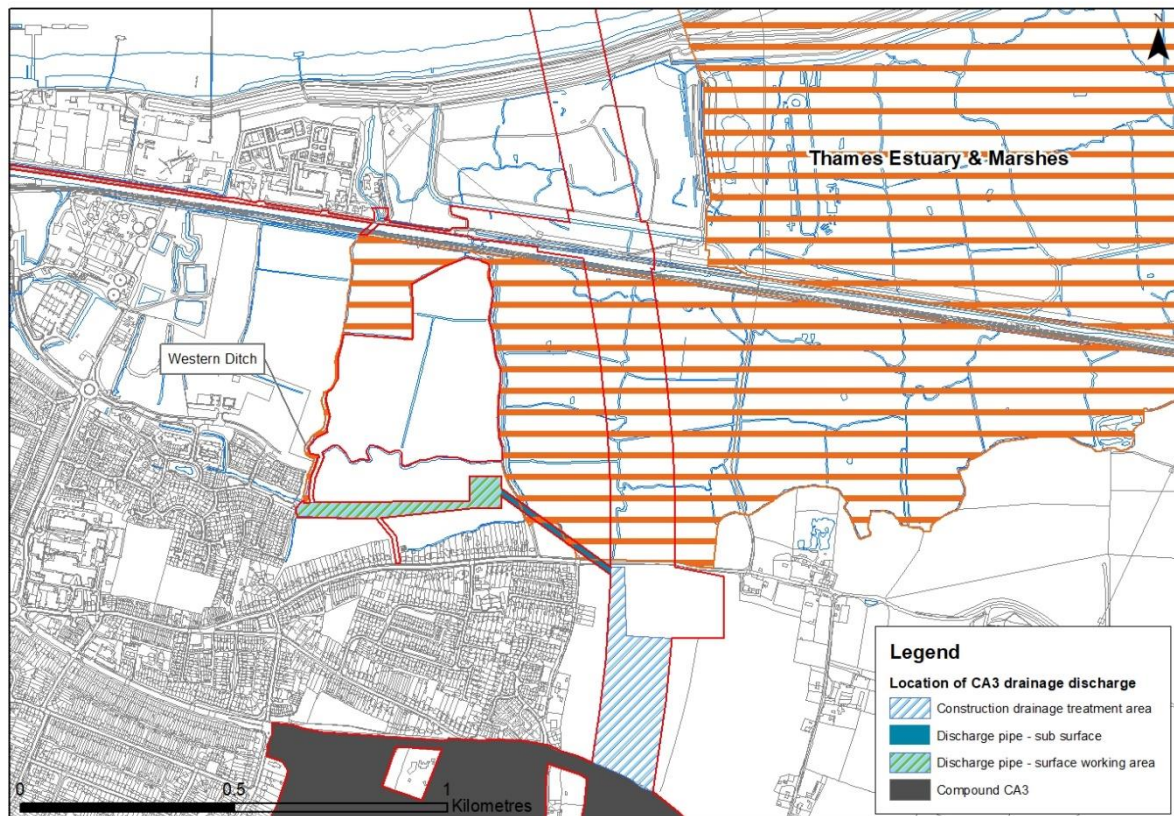
Baseline

Proposed discharge

The Project proposes to collect, and discharge site run off from Compound CA3 during the construction phase. The compound, covering a total area of approximately 155ha, will accommodate a range of land uses including haul roads, car parks and temporary buildings/cabins, as well as temporary chalk stockpiles and creation of a new permanent area of landscaping. The site run off will be collected and discharged as follows:

- Runoff from areas of the compound that have a low risk of entrained chalk and sediment fines will be collected and allowed to infiltrate to ground, via a vegetated soakaway, to replicate the existing hydrological regime.
- Runoff from higher risk areas (covering an area of around 65 hectares) e.g. the chalk stockpiles, will be collected, attenuated and treated as required before being discharged to the “western ditch” as shown in Figure 1.

Figure 1: Location of proposed discharge



Receiving ditch

The western ditch is an EA Main River and part of the Thames Estuary and Marshes Ramsar. It referred to within the ES Appendix 14.2 Water Feature Survey Report as Fenners Marsh Ditch (waterbody ID – DI-1S05ZZZ1) and during the water features survey one water field sample was taken with the following result:

- pH – 7.03,
- Temperature – 14.6°C,
- Electrical Conductivity - 990µS/cm.

The channel width was recorded as 2m and depth approximated as 1m and the field notes were as follows:

- *"Ditch covered with algae and pond weed. Pretty shallow ditch. Occasional pipes used to cross over between agricultural land and railway. Search for spring from the north to the southern part, no evidence of spring."*

The western ditch flows south to north under the railway line and into the ditches sampled at Point G and Point H. (see Figure 3).

Ramsar ditch network

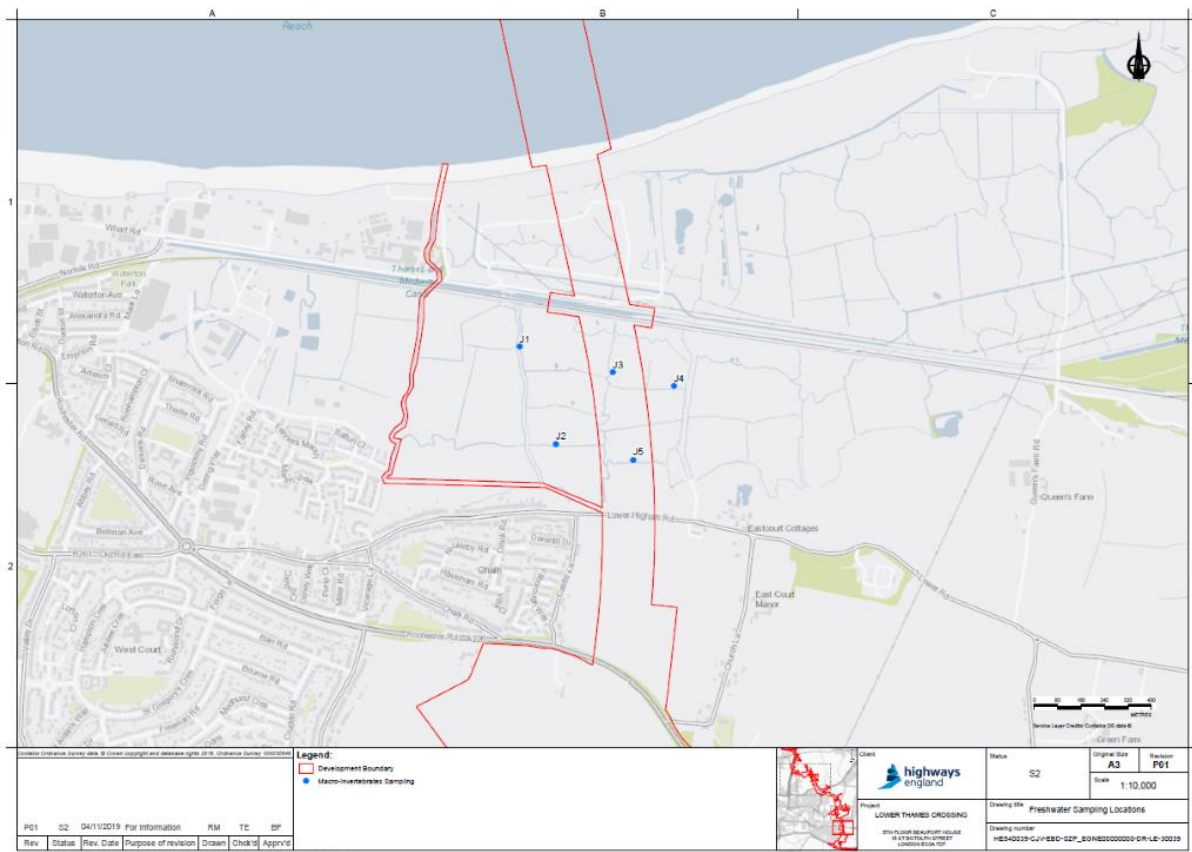
Limited information was available for the western ditch and the following baseline information on the wider ditch network within the Order Limits has been extracted from the ES Appendix 8-4 Freshwater Ecology and ES Appendix 14.2 Water Feature Survey Report.

ES Appendix 8-4 Freshwater Ecology

Surveys were completed on 22 August 2018 at sites J1 to J5 (see Figure 2) and all of the sites are within the Thames Estuary and Marshes Ramsar. The surveys comprised:

- macroinvertebrates
- macrophytes
- physical characteristics
- water chemistry

Figure 2: Location of sites J1 to J5 (Order Limits shown are now revised)



Macroinvertebrates

Table 1 lists the macroinvertebrate species that are listed on the Ramsar citation and two of those were recorded during the sampling: *Stratiomys longicornis* at site J4 and *Hydrochus ignicollis* at site J5.

Table 1: Thames Estuary and Marshes Ramsar macro-invertebrates (Ramsar Information Sheet, 2000)

Species	Group	National Importance	Red Data Book Score
<i>Bagous longitarsis</i>	Coleoptera (beetles)	Endangered	1
<i>Erioptera bivittata</i>	Cranefly	Vulnerable	2
<i>Lestes dryas</i>	Damselfly	Vulnerable	2
<i>Cercyon bifenestratus</i>	Coleoptera (beetles)	Rare	3
<i>Hydrochus elongatus</i>	Coleoptera (beetles)	Rare	3
<i>Hydrochus ignicollis</i>	Coleoptera (beetles)	Rare	3
<i>Ochthebius exaratus</i>	Coleoptera (beetles)	Rare	3
<i>Hydrophilus piceus</i>	Coleoptera (beetles)	Rare	3
<i>Stratiomys longicornis</i>	Soldier fly	Rare	3

Macrophytes

Water soldier *Stratiotes aloides*, a nationally scarce species, is the only aquatic macrophyte designated in Criterion 2 for the Thames Estuary and Marshes Ramsar Site (JNCC, 2004) and was not found in this study.

Physical characteristics and water chemistry

Table 2 and 3 summarise the data collected at each of the sample points. The ditches samples were between 2.5 and 5m wide and generally fairly shallow, 0.8-1.5m deep.

Table 2: Physical characteristics of the ditch sample points

Site Name	Wetted width (m)	Depth (m)	% macrophyte cover		
			Submerged	Emergent	Floating
J1	3	1-1.5	100	1	<1
J2	3	0.8	80	6	60
J3	5	1.5	70	21	95
J4	2.5	0.3	85	6	5
J5	3	1.2	90	5	90

Table 3: Water chemistry recorded during freshwater ecology surveys

Name	Turbidity	Conductivity	pH	Oxygen (%)	Salinity
J1	Slight	1224	7.52	92.0	0.61
J2	Slight	485.7	8.04	85.5	0.26
J3	Clear	717	7.96	71.0	0.35
J4	Clear	2419	8.37	76.3	1.25
J5	Clear	632	9.86	139.9	0.31

Appendix 14.2 Water Feature Survey Report

The survey data was collected at the locations shown in Figure 3 and comprised:

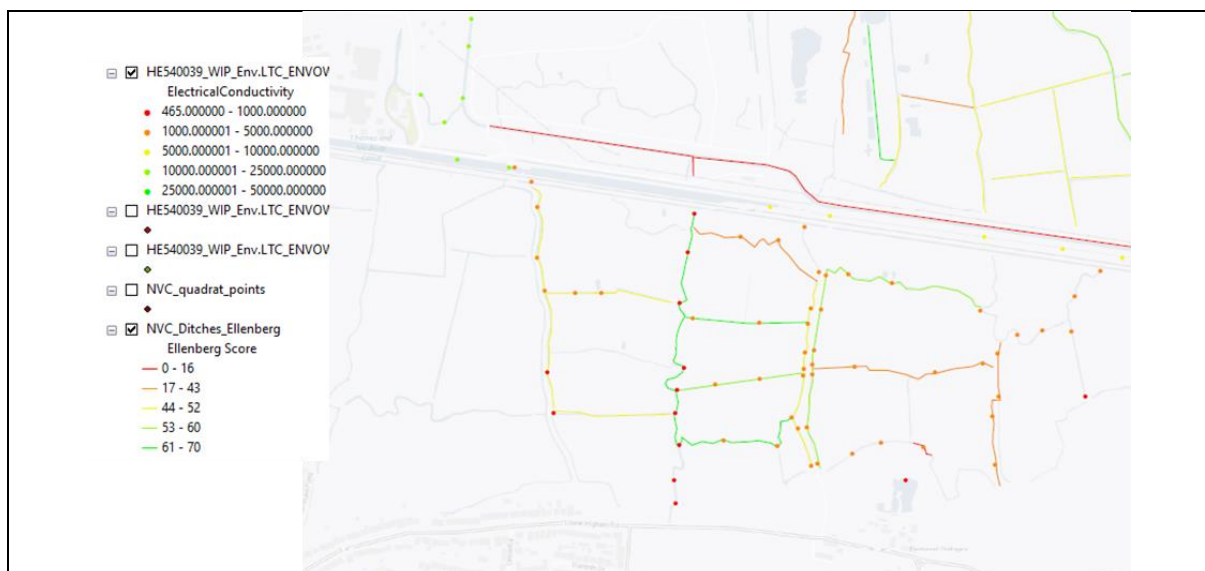
- Water Quality monitoring – 13 June 2019 to 25 July 2019
- Roboduck monitoring – data collected Jan 2020

Figure 3: Location of water sampling points



Ellenberg scores (for nitrate and salinity) were also calculated using NVC data as shown in Figure 4. The higher the Ellenberg score the more the vegetation that was recorded was considered intolerant to high nitrate or salinity. The western ditch itself not included but data gives an indication of salinity/nitrate variability across the surveyed ditches within the Ramsar.

Figure 4: Ditch Electrical Conductivity and Ellenberg Scores



The water quality monitoring results (see Table 4) identified generally consistent pH, temperature and dissolved oxygen values between the locations. pH values are generally neutral to slightly acidic, ranging from 6.8 to 9.7, with an average (mean and median) of 7.1 to 7.7. Temperature values range from 14 to 30°C, with an average (mean and median) of 17 to 20°C. Dissolved oxygen ranges from 0 to 290%, with an average (mean and median) of between 40 and 90% - these high DO concentrations are coincident with heavily vegetated and slow moving or stagnant waters.

There are two distinct trends within the electrical conductivity data set, such that the measurements taken in the small ditches (Points A-E and K) have a range of 500 to 1200µS/cm (microsiemens per centimetre) and an average (mean and median) of 700 to 800µS/cm. Meanwhile, the measurements taken in the Denton New Cut and its western tributaries (Points G, H and J) have a range of 1,000 to 40,000µS/cm, with an average (mean and median) at Points G and H of 12,000 and 20,000µS/cm respectively and at Point J of 3,000 and 6,000µS/cm for the median and mean respectively.

The Roboduck data identified similar trends to the field sampling and laboratory testing results. The dataset identifies a range of neutral to slightly acidic pH, from 6.74 to 8.82, with an average (mean and median) of around 8.0. In addition, the EC values in the small ditches, in the Filborough Marshes, have a range of 700-1,500µS/cm and an average (mean and median) of around 800 µS/cm. The value of EC increases with proximity to the Denton New Cut, which is identified with an average (mean and median) of 3,500µS/cm and a maximum of 3,700µS/cm.

Table 4: Surface water features water quality monitoring (field sampling)

Point		Electrical Cond (EC)	pH	Temp	Dissolved Oxygen (DO)
		(µS/cm)	-	(°C)	(%Sat)
A (Ramsar South, Filborough Marshes)	Max	926	8.32	28.88	89.27
	Mean	723	7.47	17.61	45.81
	Median	717	7.40	16.95	45.84
	Min	664	6.89	14.10	0.29
	Lab 1	797	7.37	12.70	9.19
	Lab 2	943	7.74	12.30	9.46
B (Ramsar, Filborough Marshes)	Max	1183	9.29	26.42	288.75
	Mean	750	7.78	18.96	87.61
	Median	715	7.64	18.40	61.69
	Min	536	6.85	15.53	2.33
	Lab 1	693	7.31	12.90	6.40
	Lab 2	844	7.73	11.95	8.78
C (Ramsar)	Max	1289	9.25	25.96	260.79
	Mean	770	7.75	19.80	93.59

Point		Electrical Cond (EC)	pH	Temp	Dissolved Oxygen (DO)
		($\mu\text{S/cm}$)	-	($^{\circ}\text{C}$)	(%Sat)
North, Filborough Marshes)	Median	697	7.52	19.15	91.12
	Min	475	7.01	16.38	6.87
	Lab 1	684	7.06	11.90	6.89
	Lab 2	932	7.62	11.10	9.70
D (Ramsar North, Filborough Marshes)	Max	1012	8.83	27.40	227.74
	Mean	742	7.13	18.88	36.13
	Median	714	7.01	18.53	18.83
	Min	486	6.56	15.12	0.00
	Lab 1	757	7.18	12.30	7.29
	Lab 2	934	7.66	11.85	8.75
E (Ramsar South, Filborough Marshes)	Max	1034	9.67	27.61	190.27
	Mean	729	7.81	18.94	81.13
	Median	709	7.54	18.31	62.75
	Min	527	7.11	15.03	18.92
	Lab 1	31	6.92	10.80	5.45
	Lab 2	950	7.82	11.90	10.80
G (Steam west of DNC)	Max	32703	8.46	27.12	163.12
	Mean	12091	7.75	19.83	93.42
	Median	10191	7.69	19.60	92.21
	Min	1813	7.26	15.77	40.12
	Lab 1	6813	7.53	14.30	7.95
	Lab 2	1240	7.12	12.00	9.38
H (DNC Discharge)	Max	40815	8.43	30.80	164.44
	Mean	19624	7.73	20.42	93.55
	Median	17890	7.68	19.97	86.01
	Min	2580	7.05	16.19	27.85
	Lab 1	5526	7.65	13.00	8.14
	Lab 2	2710	7.55	10.65	9.09
J (DNC Discharge)	Max	36477	8.68	29.90	143.38
	Mean	6655	7.70	20.66	74.23
	Median	2929	7.66	20.53	72.75
	Min	965	7.16	15.66	27.91

Point		Electrical Cond (EC)	pH	Temp	Dissolved Oxygen (DO)
		($\mu\text{S/cm}$)	-	($^{\circ}\text{C}$)	(%Sat)
	Lab 1	635	7.78	14.80	7.73
	Lab 2	1364	8.10	10.43	8.26
K (Ramsar, Filborough Marshes)	Max	1057	8.15	28.15	78.86
	Mean	776	7.44	18.38	43.88
	Median	744	7.40	17.79	45.57
	Min	597	6.90	15.05	17.78

Risk of effects from discharge

The receiving ditch (the western ditch) is within the Ramsar for part of its length. It is similar to the other ditches within the Ramsar and is likely to have some saline influence (see Figure 4) closer to the River Thames, particularly at high tide. No macrophytes listed on the Ramsar citation were recorded and there is no reason to assume they would be present within the western ditch. Two macroinvertebrates listed on the Ramsar citation were recorded in the nearby ditch network and may be present in the western ditch as well. These species are associated with slowing moving water ditches and *Stratiomys longicornis* is a brackish water species.

Therefore, making a precautionary assumption that these species are present, the discharge to the receiving ditch would need to be such that the flow and salinity gradient was unaltered to be confident that the Ramsar macro invertebrates, if present, were unaffected.

Proposed Parameters

The Project has committed to the discharge to the western ditch being made at greenfield rates representing pre-development conditions, and given the underlying permeable soils and geology, these rates are low. Although discharges rates would be restricted, additional volumes of water would be received by the western ditch and its connecting waterways. This is because currently a large proportion of the rainfall received by the land to be occupied by compound CA3 would soak away to ground and only reach the ditch network within the Ramsar slowly via soil seepages.

Calculations have been completed to quantify the effects of the additional volumes of discharge on water levels in the receiving western ditch and connecting ditches. The ReFH¹ point source application estimates a runoff rate in a 1 in 1 year rainstorm of 2l/s from the 65 hectares of compound CA3 that will be discharge to the western ditch. This rate increases to 7.2l/s during a 1 in 30 year rainstorm.

From site observations, these ditches currently support very low flow velocities and as they are subject to tide locking when water levels in the River Thames rise on the regular tidal cycle (approximately two 6 hours periods in every 24 hours), there would be periods of no flow.

¹ (Wallingford Hydro Solutions, 2019) The Revitalised Flood Hydrograph Model.

During tide locking the ditch network stores water and a typical depth of water has been observed as around 1m.

The western ditch has reach length from the proposed discharge outfall location to the outfall to the River Thames of approximately 880m, and a connecting network of ditches (illustrated in Figure 5) with a reach length of approximately 1366m. A channel cross section area of 2m² has been selected as representative.

Table 4 provides a summary of the predicted water level change in the western ditch as a result of the additional volumes of discharge, assuming the worst-case tide locked condition over a 6 hour duration.

Figure 5: Western ditch reach lengths used in calculations

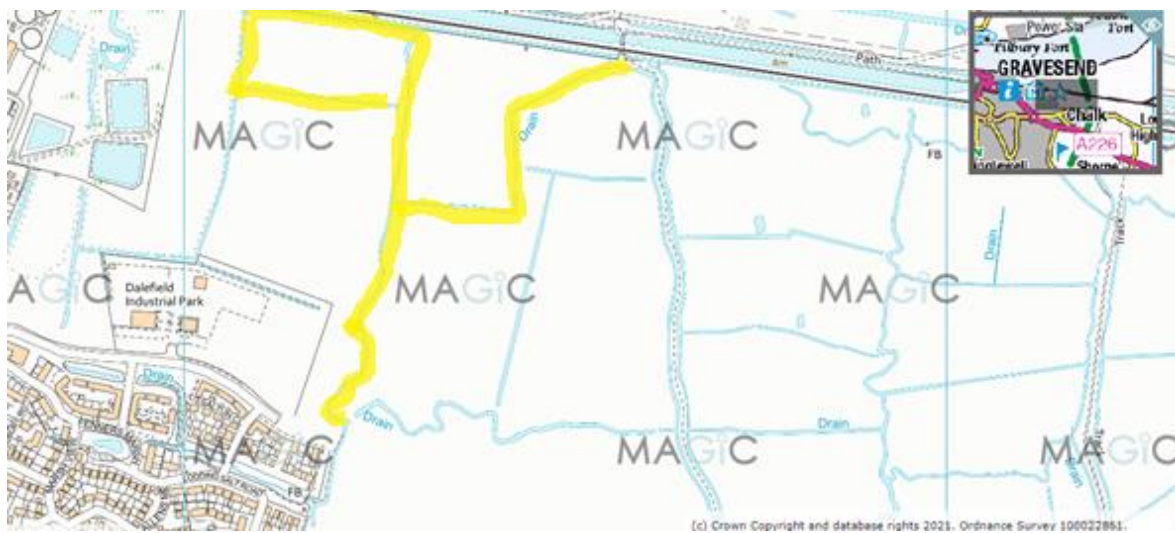


Table 5: Predicted water level change within western ditch as a result of the proposed discharge

Design Storm	Volume of Runoff* (m ³)	Change in Water Depth** (m)
1 in 1 year	390	0.087
1 in 2 year	454	0.101
1 in 30 year	1207	0.269

*from compound run off area of 65 hectares **relative to a baseline water depth of 1m

To minimise water level change in the ditch network it is proposed to provide sufficient storage within the compound drainage treatment area to allow for discharges not to exceed the 1 in 1 year event runoff volume under tide locked conditions.

Following review of the baseline data collected and calculations completed to estimate changes in water depth the Project will commit to the proposed discharge rate and chemical parameters set out below:

Discharge Rates	Chemical Parameters
Limited to greenfield rates for a 1 in 1 year rainstorm (2 l/s)	Suspended solids – annual mean 25mg l ⁻¹ ²
	pH – within range collected during survey work: min – 6.56, max – 9.86

Proposed wording for commitment in REAC

RDWE033

Water discharged into the western ditch from the South Portal construction compound would be treated to the standard specified within the discharge licence consent granted by the Environment Agency and released at greenfield runoff rates. The runoff collection and management system would be operated until full reinstatement of the compound area is complete.

The water quality standards for the discharge into the western ditch will include (but not be limited to) the following parameters and would not exceed these values unless otherwise agreed by the Environment Agency as part of its discharge licence consent, which would be set following consultation with Natural England: Discharge rate of no more than 2l/s⁻¹; chemical composition of suspended solids less than or equal to 25mg/l⁻¹; and pH between 6.56 and 9.86.

² UKTAG (2008); UK Environmental Standards and Conditions (Phase 2); Final (SR1 – 2007); March 2008. http://www.wfduk.org/sites/default/files/Media/Environmental%20standards/Environmental%20standards%20phase%202_Final_110309.pdf

Annex LL1 22 April 2021 Technical Note - Habitat enhancement to maintain baseline functionality of functionally linked land (Revision 2)

LTC HRA Technical Note: Habitat enhancement to maintain baseline functionality of functionally linked land (Rev2)

1 Introduction

This technical note has been revised following discussion with the RSPB on the reinstatement of compound 3b. It has been concluded that the habitats proposed to enhance functionality for the functionally linked land would not be suitable for this land parcel. Therefore, although the proposal is still to provide biodiversity enhancement when compound 3b is reinstated it will not be part of the HRA habitat enhancement package as described within this technical note.

The following mitigation measures will be included in DCO 2.0 application that are additional to the proposal at DCO 1.0.

- Permanent enhancement of land adjacent to Coalhouse Fort
- Temporary enhancement of 3 arable fields to the south of the firing range
- Increased monitoring

In addition to definition and assessment of these measures within the HRA SIAA report, securing of the proposals will be achieved variously through the following:

- Environmental Principles
- Environmental Masterplan (EMP)
- Outline landscape and ecology management plan (OLEMP)
- REAC commitments

Appropriate securing mechanisms for proposed mitigation measures are summarised in the table below.

Measure	Duration Temp / Perm	Env. Principles	Masterplan	OLEMP	REAC
Coalhouse Fort	Perm	YES	YES	YES	n/a
3 arable fields	Temp	n/a	n/a	n/a	YES
Monitoring	Temp	n/a	n/a	YES	YES

2 Proposed amendments to the Environmental Principles

The Environmental Principles are to be amended with the following additions:

2.4 Permanent enhancement of land adjacent to Coalhouse Fort

Insert ref number	Enhancement of functionally linked land associated with the Thames Estuary and Marshes SPA/Ramsar	The land parcel adjacent to Coalhouse Fort shall be used for habitat enhancement to maintain baseline functionality of functionally linked land associated with the Thames Estuary and Marshes SPA/Ramsar. The land will be used to create a series of shallow scrape habitats, high tide roost features and coastal grazing marsh habitat suitable for use by the qualifying features of the SPA/Ramsar (LE6.2 Banks and ditches, LE6.1 Water bodies and associated plants, LE6.4 Marsh and wet grassland).
-------------------	---	--

2.5 Temporary enhancement of 3 arable fields to the south of the firing range

This enhancement is only required on a temporary basis, for the duration of the construction period and will be defined and secured through a REAC commitment. Therefore, it is not appropriate to define Environmental Principles.

2.6 Monitoring

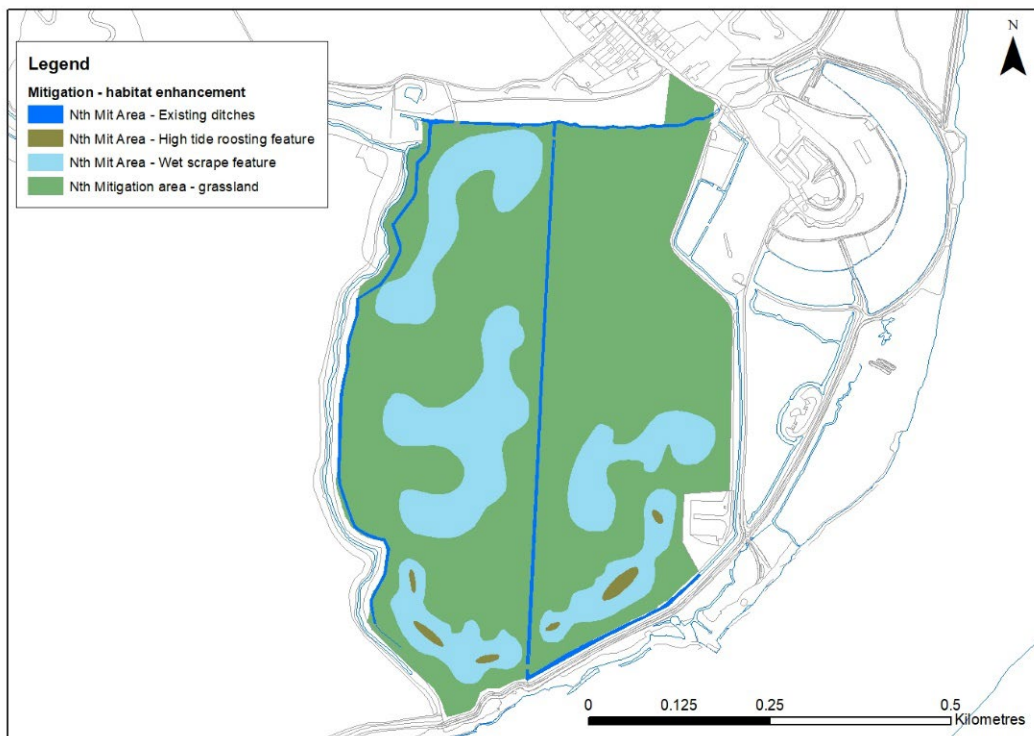
Monitoring is included as specific REAC commitments and/or included within the prescriptions in the OLEMP for each enhancement measure, and so a separate monitoring principle is not required.

3 Proposed amendments to the Environmental Masterplan (EMP)

The EMP is to be amended as follows:

3.4 Permanent enhancement of land adjacent to Coalhouse Fort

Reference to Coalhouse Fort water vole habitat to be removed and replaced with the following proposals:



3.4.1 Environmental function codes (From LD 117 Landscape design. Table 4.2a)

- For all elements - EFD Nature conservation and biodiversity

3.4.2 Landscape element codes (From LD 117 Landscape design. Table 4.2b)

- For wet scrape features - LE6.1 Water bodies and associated plants
- For high tide roost features – LE6.2 Banks and ditches
- For grassland (coastal grazing marsh) features - LE6.4 Marsh and wet grassland

3.5 Temporary enhancement of 3 arable fields to the south of the firing range

This enhancement is only required on a temporary basis, for the duration of the construction period and will be defined and secured through a REAC commitment. Therefore, it will not be included on the EMP.

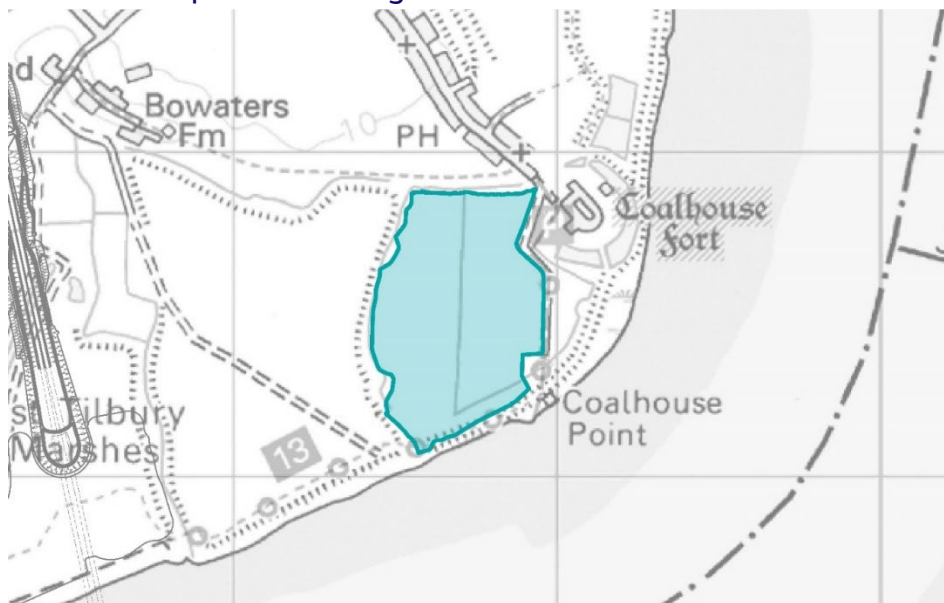
4 Proposed amendments to the OLEMP

The draft OLEMP is to be amended as follows:

4.4 Permanent enhancement of land adjacent to Coalhouse Fort as wintering bird habitat

Reference to Coalhouse Fort water vole habitat to be removed but location figure below to be retained.

4.4.1 Description of Management Area



This management area is located to the west of Coalhouse Fort just to the North of the River Thames.

The management area extends west to a drainage ditch on the boundary to the East Tilbury landfill.

The existing landscape is comprised of arable, agricultural land, and is low-lying at its natural level in contrast to the surrounding land which has been raised as part of landfill activities.

An existing ditch runs through the middle of the management area, bisecting the area as it runs in a north-south alignment.

The management area is approximately 34ha in size.

This management area is shown in the Environmental Masterplan (Application Document 6.2, Figure 2.4) Section 9 Sheets 15, 16, 19, & 20

4.4.2 Management Aims and Objectives

The management aim and objectives of this area are:

- To provide a series of shallow scrape habitats, high tide roost features and coastal grazing marsh habitat suitable for use by the qualifying features of the Thames Estuary and Marshes SPA/Ramsar.
- To provide habitats similar to those immediately north of Tilbury Fort that currently support foraging and roosting qualifying features of the SPA/Ramsar and in line with guidance from Natural England.

4.4.3 Typologies Present

The planting and habitat typologies present within this area are listed below:

- LE6.1 Water bodies and associated plants – Shallow scrape habitat
- LE6.2 Banks and ditches – High tide roost features
- LE6.4 Marsh and wet grassland – Coastal grazing marsh

4.4.4 Outline management prescriptions

The outline management prescriptions and programmes for the typologies listed above will be detailed in the OLEMP as follows:

4.4.4.1 *LE6.1 Water Bodies and associated plants – Shallow scrape habitat*

4.4.4.1.1 Description

Shallow scrape habitats are proposed within the Project design, their primary function being to maintain the functionality of functionally linked land associated with the Thames Estuary and Marshes SPA/Ramsar. They do not form part of the Project drainage design and would be designed to maximise their value to the qualifying features of the SPA/Ramsar, following good practice guidance such as RSPB's 'Scrape creation for wildlife' and 'Creating wader scrapes and flashes on farmland - Information and advice note (2003). Evidence of efficacy can be found at <https://www.conservationevidence.com/actions/153>

4.4.4.1.2 Outline Aims and Objectives

The following outline aims and objectives are for all shallow scrape habitats.

- To provide enhanced functionality within functionally linked land associated with the Thames Estuary and Marshes SPA/Ramsar by providing foraging habitat for a range of bird qualifying features of the SPA/Ramsar.
- Scrapes to be managed to provide optimum habitat for foraging waterfowl.

4.4.4.1.3 Outline Prescriptions

The work activities to complete the enhancement of the land adjacent to Coalhouse Fort will be completed before the compounds 5, 3A and 3B are set up.

The exact details of the work activities will be developed between all parties during the development of the LEMP and subsequent work-specific method statements.

This will be based on the Highways England's Manual of Contract Documents for Highways Works, Series 3000 unless otherwise agreed with Highways England. The table below describes the programme of work for establishment and initial maintenance (first five years).

Action			Years 1-5 of the Construction Period				
Task	Responsibility	Season	1	2	3	4	5
Excavation of wet scrape habitats for foraging waterfowl features of the Thames Estuary and Marshes SPA/Ramsar Excavated material to be used for construction of high tide roost features.	Principal Contractor (PC)	Summer	Y	-	-	-	-
Removal of all trees, shrubs, fencing posts, etc. that could act as predator observation points within 300m of scrapes.	PC	Summer	Y	-	-	-	-
Enable grazing management of the surrounding coastal grazing marsh and high tide roost features to include scrape edges / margins	PC	Summer	Y	Y	Y	Y	Y
Attendance of quarterly site inspections with the Ecological Clerk of Works	Ecological Clerk of Works (EcCOW) appointed by PC	Quarterly	Y	Y	Y	Y	Y
Removal from scrapes of floating litter, debris, or other contaminants – weekly as part of general litter maintenance	EcCOW appointed by PC	As required	Y	Y	Y	Y	Y
Annual removal of unwanted vegetation from scrapes including edges / margins	EcCOW appointed by PC	Summer	Y	Y	Y	Y	Y
Annual removal of shrubs within 300m of scrapes that could act as predator observation points and reduce overall sightlines for foraging waterfowl.	EcCOW appointed by PC	Summer	Y	Y	Y	Y	Y

4.4.4.1.4 Outline Measure of Success

To ensure that the management objectives are achieved, the following monitoring targets have been devised to measure success:

- Shallow water and exposed mud habitats available for foraging by qualifying waterfowl features of the Thames Estuary and Marshes SPA/Ramsar.
- Vegetation largely absent and not interfering with foraging of waterfowl.
- Absence of obstructions to sightlines of waterfowl or predator observation points within 300m of scrapes.

4.4.4.1.5 Outline Monitoring Frequency and Methods

The aim of the suggested monitoring programme is to ascertain whether the outline measures of success listed above have been achieved.

The monitoring will commence in the first year after the habitats are created and will comprise:

- Habitat establishment and suitability.
- Bird use.

Frequency of monitoring visits to record the habitat establishment and suitability will be determined by the success of establishment and the frequency of monitoring adjusted accordingly to ensure relevant follow up operations are undertaken. At this stage an annual visit for the first 5 years following creation is proposed and carried out in late summer.

During construction and for five years post construction, annual surveys will be undertaken of use of scrapes by passage and wintering waterfowl, with monthly visits August to March inclusive. Surveys will record:

- Waterfowl species and numbers at both low and high tide during daylight.
- Waterfowl species and numbers at high tide nocturnally.
- Distribution of waterfowl in relation to the scrape habitats.
- Disturbing stimuli and waterfowl behaviours in response to them (including where no response).
- Management requirements such as vegetation removal.

Highways England's appointed monitoring party will carry out the monitoring visits and feed back to the steering group as part of annual monitoring reporting.

Action			All construction years and post construction years 1-5				
Task	Responsibility	Season	1	2	3	4	5
Annual check of habitat suitability	Highways England's appointed monitoring party	Late summer	Y	Y	Y	Y	Y
Annual survey of waterfowl	Highways England's appointed monitoring party	August to March	Y	Y	Y	Y	Y

4.4.4.2 LE6.2 Banks and Ditches – High tide roost features

4.4.4.2.1 Description

This typology includes raised ground or bank features within or adjacent to wet scrape habitats that are suitable for roosting of waterfowl feature species of the Thames Estuary and Marshes SPA / Ramsar during high tides.

The form of high tide roost features may vary, but vegetation would be absent or short / sparse between August and March inclusive to facilitate roosting by waterfowl.

4.4.4.2.2 Outline Aims and Objectives

The following outline aims and objectives are for all high tide roost features.

- To provide enhanced functionality within functionally linked land associated with the Thames Estuary and Marshes SPA/Ramsar by providing high tide roosting habitat for a range of bird qualifying features of the SPA/Ramsar.
- Areas to be managed to provide optimum habitat for roosting waterfowl.

4.4.4.2.3 Outline Prescriptions

The work activities to complete the enhancement of the land adjacent to Coalhouse Fort will be completed before the compounds 5, 3A and 3B are set up.

The exact details of the work activities will be developed between all parties during the development of the LEMP and subsequent work-specific method statements.

This will be based on the Highways England's Manual of Contract Documents for Highways Works, Series 3000 unless otherwise agreed with Highways England. The table below describes the programme of work for establishment and initial maintenance (first five years).

Action			Years 1-5 of the Construction Period				
Task	Responsibility	Season	1	2	3	4	5
Spreading of material excavated during creation of wet scrape habitats to form raised ground and banks suitable for roosting waterfowl	Principal Contractor (PC)	Summer	Y	-	-	-	-
Attendance of quarterly site inspections with the Project Ecological Clerk of Works	Ecological Clerk of Works (EcCOW) appointed by PC	Quarterly	Y	Y	Y	Y	Y
High tide roost features to be grazed during the summer and mown / strimmed in late summer where necessary to provide a short / sparse vegetation between August and March.	PC	Summer	Y	Y	Y	Y	Y
Selective spot treatment of herbicide as required for larger pernicious weeds	EcCOW appointed by PC	Twice yearly - May and September	Y	Y	Y	Y	Y
Injurious weeds are to be eradicated, removed and disposed of off-site, as per the latest DEFRA / Natural England guidance.	EcCOW appointed by PC	As required	Y	Y	Y	Y	Y

Action			Years 1-5 of the Construction Period				
All litter / foreign debris to be removed and taken off site	EcCOW appointed by PC	As required	Y	Y	Y	Y	Y

4.4.4.2.4 Outline Measure of Success

To ensure that the management objectives outlined previously are achieved, the following monitoring targets have been devised to measure the success of the management objectives:

- High tide roosting features available for roosting qualifying waterfowl features of the Thames Estuary and Marshes SPA/Ramsar.
- High tide roost features sufficiently elevated, so they are available for roosting waterfowl at spring high tides.
- Vegetation of high tide roost features sufficiently low / sparse between August and March inclusive to not deter roosting by waterfowl.
- Absence of obstructions to sightlines of waterfowl or predator observation points within 300m of high tide roost features.

4.4.4.2.5 Outline Monitoring Frequency and Methods

The aim of the suggested monitoring programme is to ascertain whether the outline measures of success listed above have been achieved.

Monitoring will commence in the first year after the habitats are created and will comprise:

- Habitat establishment and suitability.
- Bird use.

Frequency of monitoring visits to record the habitat establishment and suitability will be determined by the success of establishment and the frequency of monitoring adjusted accordingly to ensure relevant follow up operations are undertaken. At this stage an annual visit for the first 5 years following creation is proposed and carried out in late summer.

During construction and for five years post construction, annual surveys will be undertaken of use of high tide roosting features by passage and wintering waterfowl, with monthly visits August to March inclusive. Surveys will record:

- Waterfowl species and numbers at both low and high tide during daylight.
- Waterfowl species and numbers at high tide nocturnally.
- Distribution of waterfowl in relation to the high tide roost features.
- Disturbing stimuli and waterfowl behaviours in response to them (including where no response).
- Management requirements such as vegetation removal.

Highways England's appointed monitoring party will carry out the monitoring visits and feed back to the steering group as part of annual monitoring reporting.

Action			All construction years and post construction years 1-5				
Task	Responsibility	Season	1	2	3	4	5
Annual check of habitat suitability	Highways England's appointed monitoring party	Late summer	Y	Y	Y	Y	Y
Annual survey of waterfowl	Highways England's appointed monitoring party	August to March	Y	Y	Y	Y	Y

4.4.4.3 LE6.4 Marsh and Wet Grassland – Coastal grazing marsh

4.4.4.3.1 Description

The coastal grazing marsh typology is located within the areas of enhanced functionally linked land associated with the Thames Estuary and Marshes SPA/Ramsar and includes areas of seasonally wet grassland and shallow edged ditches.

4.4.4.3.2 Outline Aims and Objectives

- To create and maintain coastal grazing marsh habitat suitable for foraging of passage and wintering waterfowl features of the Thames Estuary and Marshes SPA/Ramsar.
- To maintain a grassland sward between August and March inclusive at a height of approximately 10cm or below through summer grazing and late summer mowing where necessary.
- To maintain the ditch network as open ditches with shallow profiled banks through ditch clearance and bank profiling on a ten-year rotational management regime. Ditch management to be carried out only on one bank with one fifth of ditches being managed each year.

4.4.4.3.3 Outline Prescriptions

The work activities to complete the enhancement of the land adjacent to Coalhouse Fort will be completed before the compounds 5, 3A and 3B are set up.

The exact details of the work activities will be developed between all parties during the development of the LEMP and subsequent work-specific method statements.

This will be based on the Highways England's Manual of Contract Documents for Highways Works, Series 3000 unless otherwise agreed with Highways England. The table below describes the programme of work for establishment and initial maintenance (first five years).

Action			Years 1-5 of the Construction Period				
Task	Responsibility	Season	1	2	3	4	5
Sow suitable coastal grazing marsh grassland mix.	Principal Contractor (PC)	Spring / summer	Y	-	-	-	-
Clear one side of one fifth of ditches and reprofile banks to shallow gradient.	PC	Spring / summer	Y	Y	Y	Y	Y
Instigate grazing regime and late summer mowing where required to maintain sward height of approximately 10cm or below between August and March inclusive.	PC	Summer	Y	Y	Y	Y	Y
Attendance of quarterly site inspections with the Project Ecological Clerk of Works	Ecological Clerk of Works (EcCOW) appointed by PC	Quarterly	Y	Y	Y	Y	Y
Removal from water bodies of floating litter, debris, fly tipping, surface weeds, contaminants and animal carcasses – weekly as part of general litter maintenance	EcCOW appointed by PC	As required	Y	Y	Y	Y	Y
Any unsuccessful grassland sowing to be replaced annually.	EcCOW appointed by PC	Spring / summer	N	Y	Y	Y	Y
Injurious weeds are to be eradicated, removed and disposed of off-site, as per the latest DEFRA / Natural England guidance.	EcCOW appointed by PC	As required	Y	Y	Y	Y	Y

4.4.4.3.4 Outline Measure of Success

To ensure that the management objectives outlined previously are achieved, the following monitoring targets have been devised to measure the success of the management objectives:

- Coastal grazing marsh available for foraging by qualifying waterfowl features of the Thames Estuary and Marshes SPA/Ramsar.
- The sward height is maintained at approximately 10cm or below between August and March inclusive.
- The grassland supports species typical of coastal grazing marsh with no scrub.
- Ditch habitats provide diversity of habitat without interfering with foraging of waterfowl.
- Absence of obstructions to sightlines of waterfowl or predator observation points.

4.4.4.3.5 Outline Monitoring frequency and methods

The aim of the suggested monitoring programme is to ascertain whether the outline measures of success listed above have been achieved.

Monitoring will commence in the first year after the habitats are created and will comprise:

- Habitat establishment and suitability
- Bird use

Frequency of monitoring visits to record the habitat establishment and suitability will be determined by the success of establishment and the frequency of monitoring adjusted accordingly to ensure relevant follow up operations are undertaken. At this stage an annual visit for the first 5 years following creation is proposed and carried out in late summer.

During construction and for five years post construction, annual surveys will be undertaken of use of coastal grazing marsh created through the project by passage and wintering waterfowl, with monthly visits August to March inclusive. Surveys will record:

- Waterfowl species and numbers at both low and high tide during daylight.
- Waterfowl species and numbers at high tide nocturnally.
- Distribution of waterfowl in relation to the coastal grazing marsh habitats.
- Disturbing stimuli and waterfowl behaviours in response to them (including where no response).
- Management requirements such as vegetation mowing or weed eradication.

Highways England's appointed monitoring party will carry out the monitoring visits and feed back to the steering group as part of annual monitoring reporting.

Action			All construction years and post construction Years 1-5				
Task	Responsibility	Season	1	2	3	4	5
Annual check of habitat suitability	Highways England's appointed monitoring party	Late summer	Y	Y	Y	Y	Y
Annual survey of waterfowl	Highways England's appointed monitoring party	August to March	Y	Y	Y	Y	Y

4.5 Temporary enhancement of 3 arable fields to the south of the firing range

As these works will be temporary construction works, these will not be referenced within the OLEMP. These will be defined and secured through a REAC commitment.

5 Proposed amendments to the REAC commitments

REAC commitments will be added and amended as follows:

5.4 Permanent enhancement of land adjacent to Coalhouse Fort

No additional or changes to commitments made at DCO Application 1.0 are required as the measures necessary are secured through the Environmental Principles, EMP and OLEMP.

5.5 Temporary enhancement of 3 arable fields to the south of the firing range

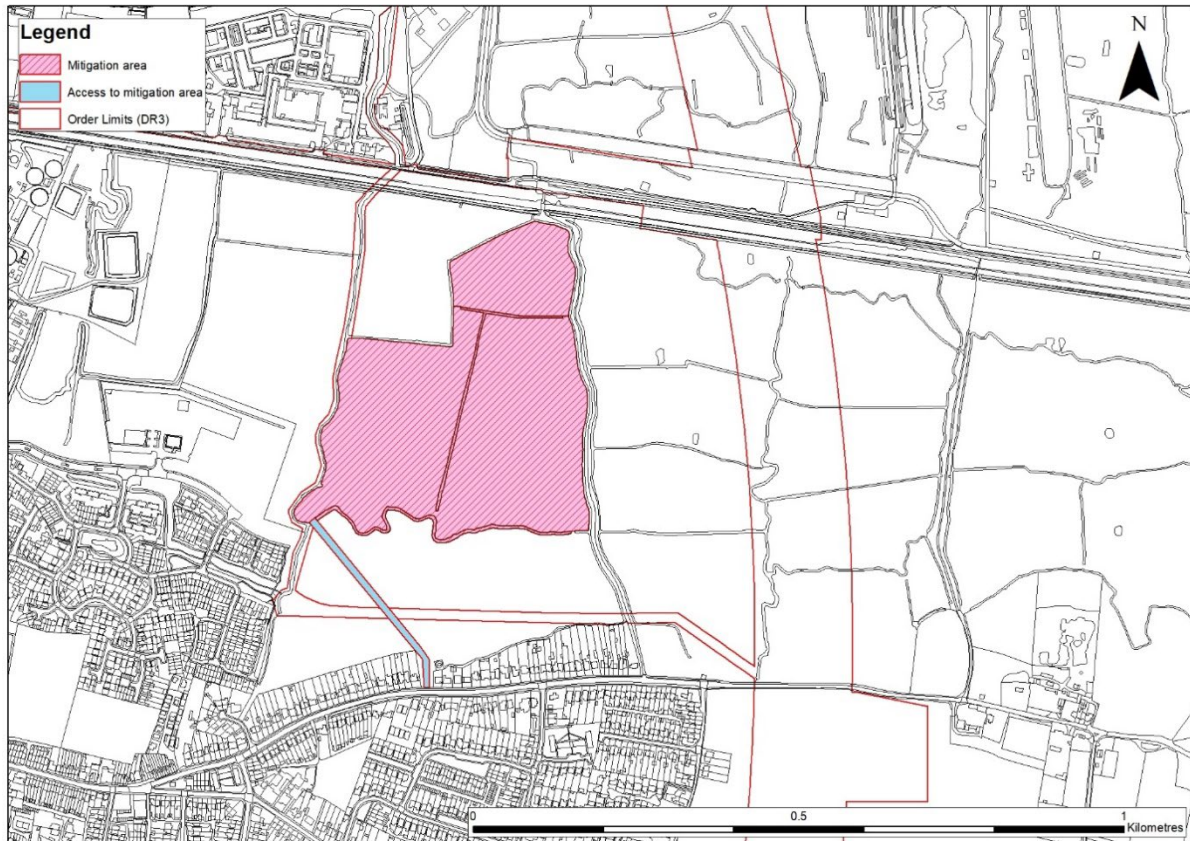


Figure 1: Location of the 3 arable field (Land Registry ref. K794941)

Issue	REAC commitment at DCO Application 1.0	New REAC commitment for DCO Application 2.0
Change of management of arable land for the construction period	N/A – new Commitment	HR007 To provide enhanced functionality of functionally linked land associated with the Thames Estuary and Marshes SPA/Ramsar during the construction period, the management of the three fields in the plot south of the Metropolitan Police firing range and adjacent to the SPA/Ramsar (Land Registry ref. K794941) will consist of either a standing ripe crop ready to be harvested, winter stubbles or grass ley from 1st October – 1st March each year throughout the construction and operation of compounds CA3A and CA3B.

5.6 Monitoring

Issue	REAC commitment at DCO Application 1.0 (Removed from the REAC)	New REAC commitment for DCO Application 2.0
<p>Inclusion of recording of behaviours in response to disturbing stimuli as well as numbers of birds</p> <p>Plus</p> <p>Recording of use of mitigation areas by target bird species</p>	<p>MB004</p> <p>An annual bird survey will be undertaken whilst works are being carried out in the area below mean high water springs. The survey will be undertaken between 01 September and 31 March inclusive and to a specification submitted to the MMO.</p>	<p>HR009</p> <p>Between 01 September and 31 March inclusive during each year of the LTC construction period, undertake monthly bird survey surveillance visits from fixed vantage points to observe functionally linked land associated with the Thames Estuary and Marshes SPA/Ramsar (as identified in HRA Figure XX (Application Document Ref 6.5) that lies within 300m of Order limits of the Project. The surveys will record numbers of waterfowl present and any behaviours in response to disturbance stimuli (including no response) to a specification developed in consultation with Natural England.</p> <p>If the bird surveillance visits show a change in bird behaviour the contractor will investigate if this is attributable to construction activities, and if confirmed, review mitigation measures in consultation with Natural England."</p>

6 Efficacy of the proposed enhanced habitats

The evidence to demonstrate that the proposed enhancements of functionally linked land would provide additional functionality from their existing state is as follows:

6.4 Land near Coalhouse Fort

The proposed change from arable farmland to a mosaic of coastal grazing marsh, shallow scrapes and high tide roost features is designed to create a similar mosaic of habitats as currently found in the area around Tilbury Fort. The surveys have shown that the existing use of the land near Coalhouse Fort is very low and limited to lapwing occasional use, see figure 2. The surveys also showed that the Tilbury Fort area supports a range of SPA/Ramsar qualifying features at all times and states of tide, see figure 3. The proposed habitats are therefore demonstrably more suitable than the existing habitats for use by qualifying feature species.

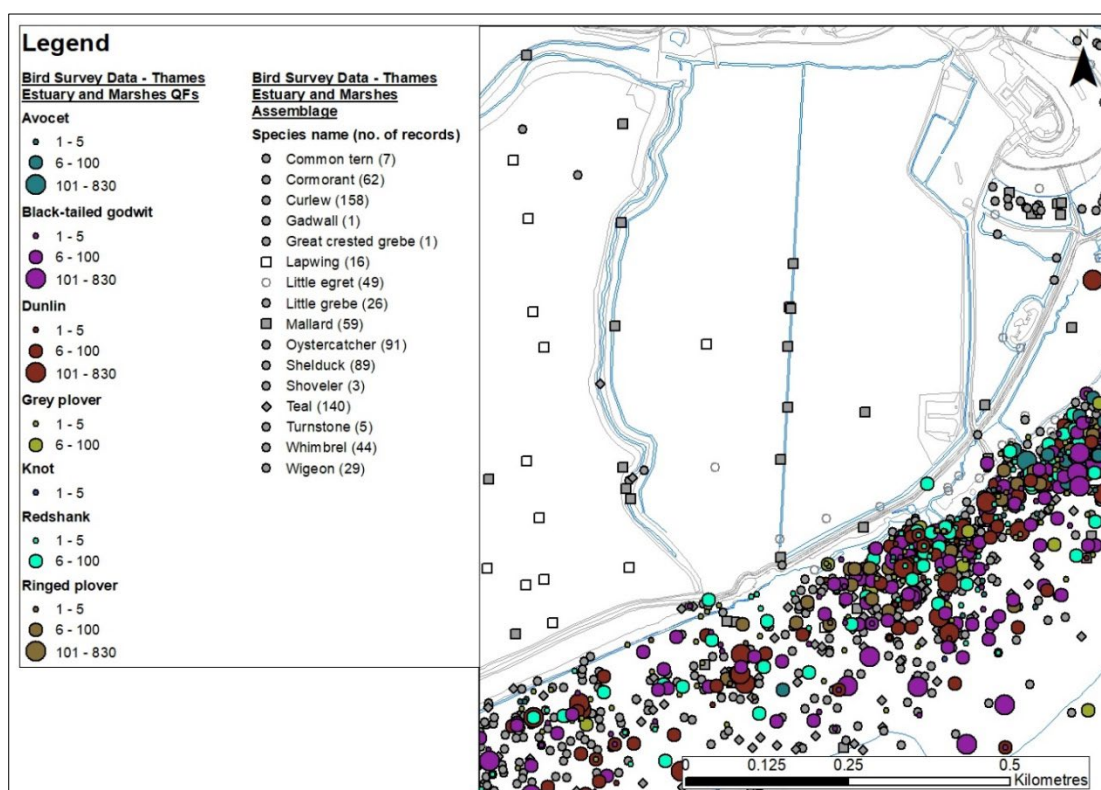


Figure 2 Distribution of Thames Estuary and Marshes QFs and Assemblage at the land near Coalhouse Fort

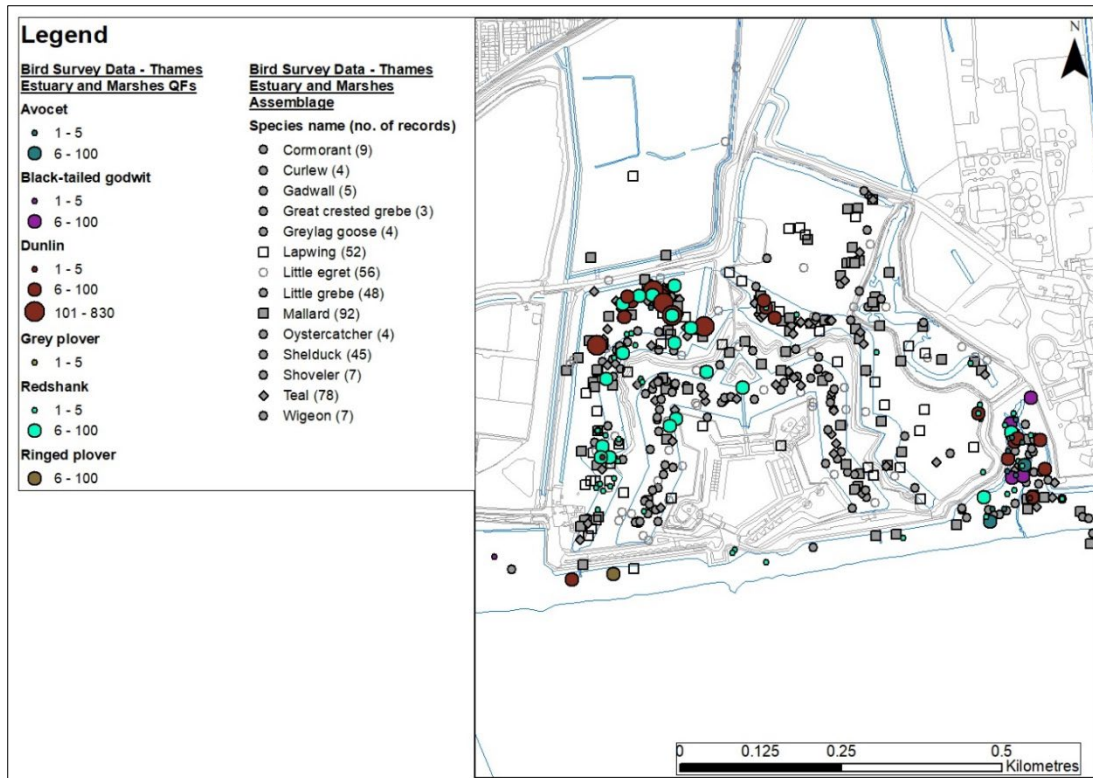


Figure 3: Distribution of Thames Estuary and Marshes QFs and Assemblage at Tilbury Fort habitat mosaic

In addition, the geographical location of the proposed habitat creation is adjacent to intertidal mud and saltmarsh habitat that has also been shown by surveys to support relatively high concentrations of a range of qualifying species. It would therefore be certain that these birds would be able to find the new habitat easily and there would be no barriers between where the birds are currently using and the new habitats.

The habitat creation would be carried out as soon as possible after award of the DCO and prior to any significant construction effects and would be managed permanently by Highways England or its appointed contractors. Therefore, these enhanced habitats would provide additional functionality of the functionally linked land in both construction and operation of the Project.

6.5 Three arable fields to the south of the firing range

The surveys of this area showed no use by qualifying feature species and limited use of the fields by Assemblage species such as lapwing and mallard when the management of the fields was under winter cereal crops, see figure 4. Noting that the surrounding fields are grassland.

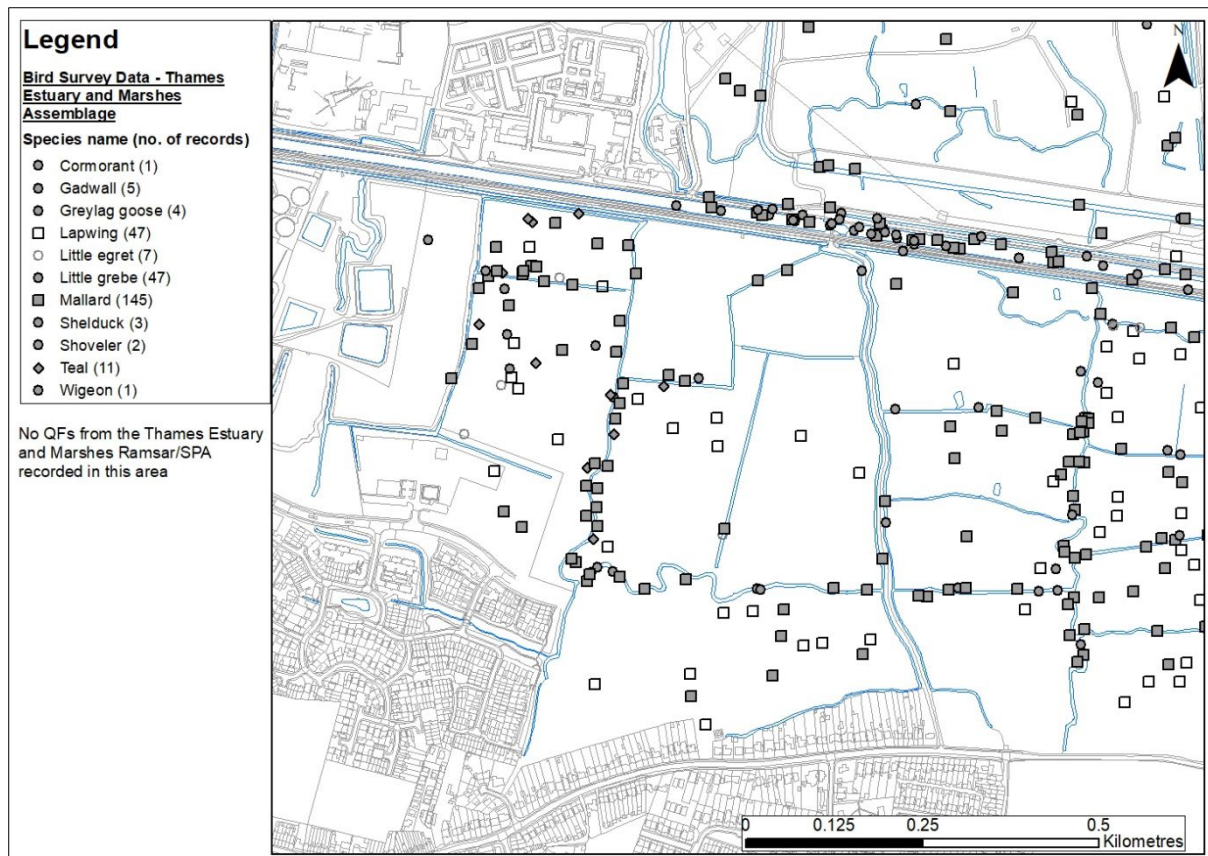


Figure 4: Distribution of Thames Estuary and Marshes QFs and Assemblage at the 3 arable fields

Whilst winter cereal crops are used by qualifying feature species from time to time, it is generally understood that these species use grassland or winter stubbles from spring sown crops preferentially, notwithstanding other variables such as wetness and recent ploughing that can increase earthworm availability temporarily.

Earthworm availability is thought to be a key food resource for wintering waterfowl using functionally linked land. This would be increased during the winter if the land is managed either under grassland or spring crop management regimes. Grassland management has increased earthworm availability because it is generally a long-term management with absent or only occasional ploughing, which would increase biomass. Spring cropping has increased earthworm availability because the worm biomass developed during the summer months would not be reduced by autumn ploughing.

The Project would enforce management of these fields as either grassland or spring sown crops throughout the construction period to provide short grass or stubble during the passage and wintering season, which would be of higher value to wintering qualifying feature species than the existing management which has developing cereal crops during the passage/winter season.

The effects on functionally linked land south of the river are only associated with the construction period as there is no permanent land requirement. Therefore, this enhancement will be for the duration of the construction period only (prior to return to arable production post construction) and would be effective at increasing the functionality of the functionally

linked land during the period when effects reducing potential functionality have been predicted.

6.6 Quantification to illustrate no net loss of function of FLL

The abundance of birds within the habitat provides a measure of its functionality and we have used this measure to illustrate how the Project mitigates the loss of FLL during the construction and operation phases.

To evidence the predicted increase in function of enhanced habitat on the mitigation areas we have assessed the abundance of birds on a number of exemplar¹ habitat plots. Based on the survey data of bird use of existing exemplar habitats, it is expected that the new habitats created in the mitigation areas would attract similar numbers of birds. The increase in functionality of the mitigation areas can therefore be identified by comparing existing use (from survey data) and expected future use (from survey data of existing exemplar habitat) in the habitat to be created).

Using field data collected during Project survey work 2017 – 2019, the winter/passage months (Aug–Apr Incl.) data has been used in the analysis as it is effects on FLL for overwintering birds that requires mitigation.

The exemplar plots have been chosen as they reflect the habitat objectives of the mitigation plots as follows:

- Tilbury Fort – the mosaic of scrapes, open water and grassland which would be created within the mitigation plot adjacent to Coalhouse Fort
- Ramsar grass – the agricultural grassland types within the Ramsar which would be created within the 3 arable fields mitigation plot

The exemplar plots are all terrestrial FLL (above MHW) and no intertidal areas have been used, as likely significant effects are only on terrestrial FLL.

The following data (see Table 5.1 to Table 5.4) has been compiled for each of the exemplar plots, the mitigation areas and the areas affected by land take:

- Species diversity – total number of species recorded in plot (including split Thames Estuary and Marches SAC/Ramsar QFs or Assemblage)
- Species abundance - Total number of individuals recorded (all surveys)
- Plot size in hectares
- Calculated the species abundance per hectare
- The expected future abundance on mitigation plots has been calculated by multiplying the plot size by the abundance per hectare of the equivalent exemplar plot

The functionality of the habitat has been calculated for the baseline (existing habitat within the Order Limits), during construction and during operation.

¹ Exemplar – Habitat types include features that would be created in the new mitigation areas for example scrapes, grassland etc.



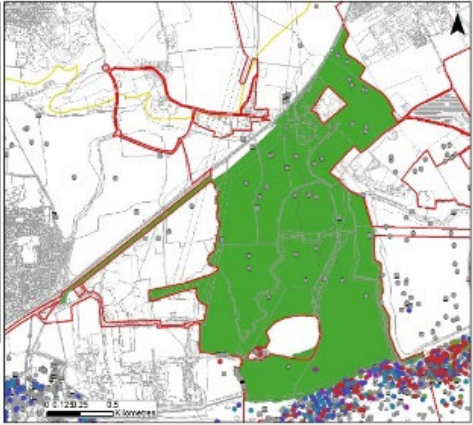
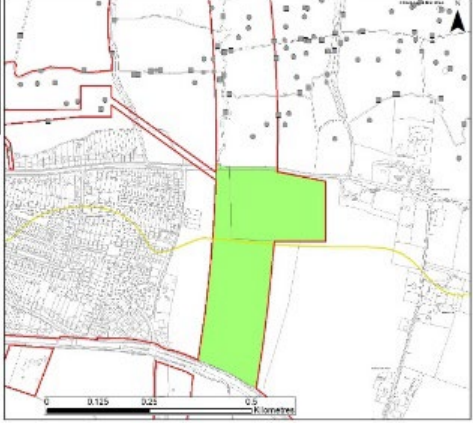
Coalhouse Fort – existing plot	<p>Legend</p> <p>Bird Survey Data</p> <p>Thames Estuary and Marshes</p> <p>QFs & Assemblage</p> <ul style="list-style-type: none"> ● Avocet (36) ● Black-tailed godwit (106) ● Coot (2) ● Grey plover (84) ● Kingfisher (2) ● Redwing (88) ● Ringed plover (41) ● Common tern (2) ● Curlew (7) ● Curlew (106) ● Lesser (16) ● Little egret (36) ● Little grebe (10) ● Murre (27) ● Oystercatcher (21) ● Shelduck (48) ● Teal (81) ● Turnstone (5) ● Wren (18) ● Wren (1) 	3 QFs: 0 Assemblage: 3	88	34.4	2.6	165	5,676
3 Arable fields – existing plot	<p>Legend</p> <p>Bird Survey Data</p> <p>Thames Estuary and Marshes</p> <p>QFs & Assemblage</p> <ul style="list-style-type: none"> ● Gull (2) ● Lesser (1) ● Little grebe (7) ● Murre (4) ● Teal (2) 	5 QFs: 0 Assemblage: 5	88	14.3	6.2	19	272

Table 5.3 Construction land take - Existing habitat functionality

Name	Location	Species diversity	Species abundance	Plot size (ha)	Abundance /ha
Compound 5	<p>Legend Bird Survey Data Thames Estuary and Marshes QF's & Assemblage</p> <ul style="list-style-type: none"> ● Jackdaw (5) ● Black-headed gull (118) ● Dove (34) ● Grey plover (43) ● Pheasant (142) ● Ringed plover (22) ● Common tern (1) ● Cormorant (45) ● Oulka (128) ● Goshawk (2) ● Golden plover (1) ● Great crested grebe (2) ● Shovling gull (5) ● Lapwing (115) ● Little egret (76) ● Little grebe (34) ● Murrelet (41) ● Oystercatcher (48) ● Shelduck (150) ● Shoveler (16) ● Teal (78) ● Wintertail (2) ● Wigeon (30) 	<p>13 QFs: 4 Assemblage: 9</p>	490	260	1.88
Compound 3a	<p>Legend Bird Survey Data Thames Estuary and Marshes QF's & Assemblage</p> <ul style="list-style-type: none"> ● Goshawk (4) ● Lapwing (17) ● Little grebe (4) ● Oulka (56) ● Shoveler (1) ● Teal (2) 	0	0	4.5	0


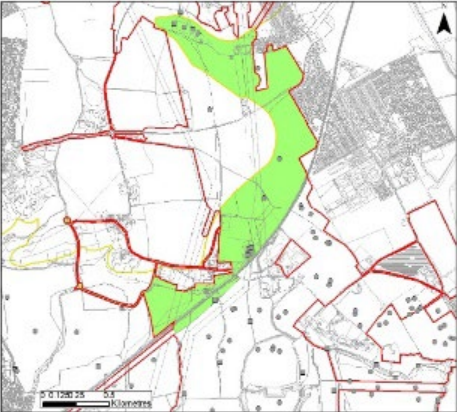

Name	Location	Species diversity	Species abundance	Plot size (ha)	Abundance /ha
Compound 3b	<p>Legend Bird Survey Data Thames Estuary and Marshes QFs & Assemblage</p> <ul style="list-style-type: none"> ● Corvidae (1) ○ Lark (1) ○ Lark sp. (1) ○ Lark sp. (1) ○ Lark (2) 	<p>2 QFs: 0 Assemblage: 2</p>	<p>3</p>	<p>3.24</p>	<p>0.93</p>
Land take north of Tilbury Rail	<p>Legend Bird Survey Data Thames Estuary and Marshes QFs & Assemblage</p> <ul style="list-style-type: none"> ● Greylag gannet (1) ○ Lark (1) ○ Lark sp. (1) ○ Lark sp. (1) ○ Lark (2) ○ Lark (1) ○ Lark (1) 	<p>4 QFs: 0 Assemblage: 4</p>	<p>778</p>	<p>98</p>	<p>7.94</p>

Table 5.4 Permanent land take – Existing habitat functionality

Name	Location	Species diversity	Species abundance	Plot size (ha)	Abundance /ha
North Portal	<p>Legend</p> <p>Bird Survey Data</p> <p>Thames Estuary and Marshes QP & Assemblage</p> <ul style="list-style-type: none"> ● Avocet (85) ● Black-tailed godwit (287) ● Dunlin (170) ● Grey plover (159) ● Knot (5) ● Redshank (220) ● Ringed plover (91) ● Cootman tern (8) ● Cormorant (78) ● Curlew (278) ● Goshawk (1) ● Golden plover (1) ● Great crested grebe (2) ● Greylag goose (5) ● Lapwing (120) ● Little egret (133) ● Little grebe (53) ● Maltard (175) ● Oystercatcher (66) ● Shelduck (189) ● Shoveler (11) ● Teal (306) ● Turnstone (5) ● Whimbrel (21) ● Wigeon (91) 	<p>5</p> <p>QF: 1</p> <p>Assemblage: 4</p>	<p>176</p>	<p>99.8</p>	<p>1.76</p>

6.6.1 Summary of impact assessment using functionality

The table below illustrates the change in functionality of the FLL affected by the Project and with the provision of the proposed habitat enhancement plots in which the functionality would be expected to increase.

Table 5.5 Summary of existing and predicted functionality

	Functionality (species abundance)		
	Existing	Construction	Operation
FLL within Order limits (not including mitigation areas)	1271	0	1095 ²
Mitigation area adjacent to Coalhouse Fort	88	5,676	5,676
Mitigation area Compound 3b reinstatement	3	0	0
Mitigation area 3 arable fields	88	272	0
Total	1450	5948	6,771
Ratio to existing		4:1	4.5:1

² Calculated: Total of abundance of construction land take minus total abundance in permanent land take

Annex LL2 28 July 2021 Feedback (partial) received from Natural England

Date: 28 July 2021
Our ref: DAS/2566
Your ref: FLL Coalhouse Fort



Customer Services
Hornbeam House
Crewe Business Park
Electra Way
Crewe
Cheshire
CW1 6GJ

0300 060 3900

BY EMAIL ONLY

Dear [REDACTED]

Discretionary Advice Service (Charged Advice)

Contract Ref: DAS2566

Development proposal and location: Lower Thames Crossing NSIP: review of LTC HRA
Technical Note: Habitat enhancement to maintain baseline functionality of functionally linked land (Rev2)

Thank you for your consultation on the above Technical Note, which was initially sent to Natural England on 23rd February 2021 with revision 2 following on 22nd April 2021.

This advice is being provided as part of Natural England's Discretionary Advice Service. Lower Thames Crossing has asked Natural England to provide advice upon:

- Proposals for functionally linked land at Coalhouse Fort.

This advice is provided in accordance with the Quotation (5461/205152) and Agreement dated 17th January 2017.

The advice within this letter should be read in conjunction with our wider comments on the range of HRA Technical Notes in our letter dated 24th June 2021. We note that the provision of mitigation land at Coalhouse Fort is linked to impact pathways including construction noise and mitigation; operational noise and visual disturbance; and on a precautionary basis construction and operational lighting (pending light contour mapping).

General Comments

Overall, in principle Natural England is supportive of the general direction described to enhance land to meet the broad aspirations of the Technical Note, noting its location: pending feasibility studies, the land identified does appear to have the opportunity to contribute to the nature conservation and biodiversity interest in the Coalhouse Fort area, in particular for the broad intertidal bird assemblage target species.

In terms of the specific legal need for the project to avoid adverse effects on European site integrity as required by the Habitats Regulations, we welcome the proposals to provide additional functionally linked land. We consider that an adverse effect can be avoided, subject to the advice we have provided below, and so long as the proposal can demonstrate it is feasible through appropriate studies (e.g. hydrological and topographical), and that existing interest can be fully considered. This advice is also conditioned on further review by our specialists to advise on the scale of the mitigation land offered, to follow in due course.

It is important for the proposals in this area to account for any existing interest as part of the

baseline. For example, the central and boundary ditches include areas of reed / sea club rush (esp. in the borrowdyke at the southern end). This, along with scrub in boundary areas, may support significant breeding bird interest, and so decisions about proposed scrub removal and other habitat modifications need to be carefully considered. This reflects the need to both conserve existing interest and enhance the area in the manner described.

In particular, we advise that although the main focus in the Technical Note is driven by Habitats Regulations requirements, when providing our advice we are keen to ensure that the wider range of biodiversity interests are accounted for to ensure that an integrated outcome is achieved in this location. For example, we note that the Thames Estuary and Marshes Ramsar site adjoins this field, and that designation includes invertebrate and vascular plant interest. Ramsar criterion 2 notes 'the site supports more than 20 British Red Data Book invertebrates and populations of GB Red Book endangered least lettuce (*Lactuca saligna*), as well as the vulnerable slender hare's ear (*Bupleurum tenuissimum*), divided sedge (*Carex divisa*), sea barley (*Hordeum marinum*), Borrer's saltmarsh-grass (*Puccinellia fasciculata*), and dwarf eelgrass (*Zostera noltei*). Please refer to the [Ramsar information sheet](#) for full details. Although there is overlap, the [SSSI notified species](#) should also be considered, for any additional species. The adjacent Thurrock Council field south of Coalhouse Fort shows the type of brackish grassland and ditch habitats that may be achieved noting this supports a number of nationally scarce plants.

It is important that adequate long-term provision is made for sustainable management by a suitable third party, which may include land ownership transfer with lease arrangement to a suitably experience organisation or other arrangements as appropriate.

There are several examples of where habitats are managed to create appropriate conditions for wildlife similar to the target features proposed at the Coalhouse Fort mitigation parcel, for example at the RSPB South Essex Marshes around Wat Tyler (Bowers, West Canvey and Vange Marshes). Whilst the funding mechanisms are different with these examples (e.g. environmental stewardship funding cannot be used for measures that are required to be delivered through development mitigation unless additionality can be clearly demonstrated), they would provide useful comparisons to understand how target habitat features can be achieved, managed and maintained in this area of Essex. In our experience however, the proposed enhancement works at the Coalhouse Fort field embrace the type of proposal that we would be seeking to achieve through Countryside Stewardship and we anticipate that these would be relatively easily delivered on the ground. Natural England would look to work alongside any future land owner / manager to achieve an optimum site contributing across its various objectives. It is appropriate to note that Thurrock Council are a contiguous land owner to this site, and we would be happy to contribute to any discussions with Thurrock Council if this would be helpful to complement current nature conservation efforts being made locally.

With all the above examples, Natural England has made efforts to ensure that existing significant nature conservation interest is conserved alongside the enhancements proposed by specific scheme design. This has often required detailed ecological and / or hydrological assessment to ensure appropriate decisions are made, and we advise the Lower Thames Crossing project should also seek to align with these best practise principles.

Consistent with this, Natural England would advise that appropriate efforts are made to address specific on-the-ground issues such as making sure the ground levels and the hydrology are understood and interpreted correctly. This will also help to inform what capital works are needed to achieve required water levels. Provided that an appropriate degree of confidence can be gained from such investigations, our view is that this site should be able to deliver the required target habitats.

We would like to emphasise that although in our view the proposals for this area do represent a significant positive step in the right direction to achieve the *type* of habitats required, and offer the opportunity to contribute more widely to landscape scale outcomes at the Coalhouse Fort node, we have not yet fully analysed the bird data in detail to have confidence that the *scale* of the proposals are adequate to avoid an adverse effect on site integrity (accounting for scaling up that is typically

required of mitigation sites, for reasons linked with confidence in delivery; time lag for maturation; geographical distancing; fragmentation etc). That said, we note and welcome your analysis in the Note on this point, in section 6.6, which appears to show a mitigation ratio of ~4:1. We have asked our specialists to review the proposals and will provide further advice in due course.

It would be helpful if a link could be provided to the raw bird survey data that informs the graphics of bird distribution. E.g. is this data contained within the DCO v1.0?

Specific Comments

Building on the 'in principle' position outlined above, we note that there is a need to mitigate for specific notified interest features of the Thames Estuary and Marshes Special Protection Area (SPA) and Ramsar site, noting the range of impact pathways described in the Technical Note series. It is important that the proposals for the Coalhouse Fort field are able to quantitatively and / or qualitatively (as appropriate) demonstrate they can deliver at least equivalent to the area affected, accounting for habitat set up and maturation time but also lead in time for adoption by target species.

With this in mind, we note the efforts made by the Technical Note to audit the mitigation proposals.

- It is not clear what is meant by 'Environmental Principles', for example are these the same as 'Design Principles' referred to elsewhere in LTC documents?
- A short summary within the Technical Note on why certain measures are not to be included as REAC commitments would be helpful.
- Reference is made to 'maintain baseline functionality of functionally linked land' however please note that in seeking to achieve this with sufficient certainty, it will be necessary to account for the range of variables involved, to ensure that there is confidence that the mitigation will be effective in avoiding an adverse effect. Such factors include the difficulty in creating the required habitats; distance from area of loss; fragmentation of habitats; etc. Hence simply 'maintaining' the resource level may not account for these uncertainties, and some scaling up may therefore be appropriate.
- Reference is made to earlier intentions to use the Coalhouse Fort land as water vole habitat, however we are unclear whether final alternative arrangements have been made for water voles and would welcome clarification.
- Reference is made to 'wintering birds' e.g. section 4, however please note the mitigation is also for passage birds.
- Further reference should be made to current and future public access in these areas to ensure that mitigation land would not suffer from any greater disturbance than the baseline.
- Reference to habitats at Tilbury Fort is noted, however it would be useful if this section were expanded to describe in more detail which birds are present in that area and what habitats are in use by the various qualifying species.
- Paragraph 4.4.4.1.1 could be strengthened to describe why FLL is important in this area and why the proposed FLL mitigation would maintain the strategic role for FLL in this section of the estuary in providing connectivity to upper estuary important areas such as Tilbury Fort and the inter-tidal resource further upstream (including the role in severe weather conditions).
- Some indication of infrastructure requirements required to achieve target habitats would be useful and how the system would work (i.e. rainwater fed, or pumped etc.).
- Reference is made to the first 5 years but some indication of long-term arrangements is also needed (e.g. a statement of intent with links to a REAC commitment to implement arrangements).
- Reference is made to removal of fence posts, however it is unclear how the land would be grazed without these?
- The measures of success should reference target species using existing FLL resource and

an indication of numbers.

- The seasonal span should make reference to the [Seasonality Tables](#) in the Conservation Objectives (i.e. may extend beyond August – March).
- Section 6.6 states that likely significant effects are only on terrestrial FLL however we understood that the disturbance zone included areas of foreshore habitat? Our initial review of the technical note is that it does not appear to account for disturbance during the construction phase of the intertidal area south of compound 5. Clarification is requested, as this would influence the calculations provided at section 6.
- Further commentary should be included which references the deteriorating condition of the sea wall and how this may / may not affect the target habitats and species, including (if known) where responsibility would fall for maintenance etc.).

Natural England has separately provided advice (meeting on 15th July 2021) to LTC regarding compensation for a ditch which will be lost to the route which is thought to be of high / national quality for aquatic invertebrates (as surveyed by LTC team). One suggestion is that this could be provided within the Coalhouse Fort FLL mitigation land parcel, and we invite LTC to review internally to understand what implications this may have for FLL provision.

The advice provided in this letter has been through Natural England's Quality Assurance process

The advice provided within the Discretionary Advice Service is the professional advice of the Natural England adviser named below. It is the best advice that can be given based on the information provided so far. Its quality and detail is dependent upon the quality and depth of the information which has been provided. It does not constitute a statutory response or decision, which will be made by Natural England acting corporately in its role as statutory consultee to the competent authority after an application has been submitted. The advice given is therefore not binding in any way and is provided without prejudice to the consideration of any statutory consultation response or decision which may be made by Natural England in due course. The final judgement on any proposals by Natural England is reserved until an application is made and will be made on the information then available, including any modifications to the proposal made after receipt of discretionary advice. All pre-application advice is subject to review and revision in the light of changes in relevant considerations, including changes in relation to the facts, scientific knowledge/evidence, policy, guidance or law. Natural England will not accept any liability for the accuracy, adequacy or completeness of, nor will any express or implied warranty be given for, the advice. This exclusion does not extend to any fraudulent misrepresentation made by or on behalf of Natural England.

Yours sincerely

██████████
██

Annex MM 22 April 2021 Technical note - Iteration of the extent of functionally linked land

HRA Technical Note: Iteration of the extent of functionally linked land

Introduction

The purpose of this technical note is to set out the process that has been completed, in consultation with Natural England, to identify the European sites potentially affected by the Project. This is only related to identifying sites with mobile species that use land outside the site boundary. European sites identified as being within 200m of the affected road network, and therefore potentially affected by changes in air quality (nitrogen deposition) are unchanged.

The understanding and agreement of the significance of areas affected by the Project to the European site network has evolved as the Project has progressed. Consultation on the development of the HRA since 2019 started by identifying relevant (potentially affected) European sites by investigating the ecological connectivity between the Project and European sites to identify potential LSE pathways. Using an initial rationale for ecological connectivity, an extent of functionally linked land for European sites was determined, which was used to identify an initial list of potentially affected European sites. Since the initial list was suggested and consulted on, the extent of functionally linked land has been refined following further review of the ornithology data set, habitat types present and advice from Natural England.

With the iteration of the approach and refinement of the identified functionally linked land, the European sites identified as potentially affected by the Project has changed from all four sites that make up the Greater Thames Estuary Complex to one site, the Thames Estuary and Marshes SPA and Ramsar.

As the HRA reporting for the resubmission of the DCO application will be on the basis of the current understanding of the project and its potential LSE pathways ('where we are now' – as opposed to 'how we got to where we are now'), the list of European sites considered in the HRA will be different from the DCO 1.0 HRA (note the sites considered for air quality effects on European sites remain unchanged). The iteration of the evidence we have used to determine the relevant European sites (having had regard for consultation advice) considered in the HRA ('how we got to where we are') will be reported in an appendix to the HRA reporting: the evidence plan. The content of this technical note will be included in that evidence plan.

As a result of this, the SoCG tracker (that lists agreement on all HRA conclusions) has been updated to remove the conclusions relating to the three sites with functionally linked land unaffected by the Project through land take and disturbance:

- Benfleet and Southend SPA & Ramsar,
- Medway Estuary and Marshes SPA & Ramsar
- The Swale SPA and Ramsar.

Ecological Connectivity and Functionally Linked Land

Determining ecological connectivity

The evidence and process that was used to review the potential ecological connectivity between the land affected by the Project and any European sites was set out within the evidence base and reported within the HRA screening report that the Project completed in June 2020 as part of the withdrawn DCO 1.0 submission. It is summarised as follows:

1. Reviewed the species records collated as part of the Project and listed all those that could be a European site qualifying feature – recorded on the Evidence base “Qualifying species present” tab
2. Determined the extent of sensitivity for those species and the location of European sites that listed them on the JNCC Protected sites data base (JNCC, 2019) - recorded on the Evidence base “Species extent of sensitivity” tab (see Annex 1 Qualifying Species Evidence)
3. Completed a spatial analysis to identify any overlaps between the extent of sensitivity (EoS) and the zone of influence (Zol) of the Project (see Annex 2) - recorded on the Evidence base “Species extent of sensitivity” tab (see Annex 1 Connectivity Figures)
4. This identified that the following European sites could be connected to the species that had been recorded using the habitats within the Project Zol:
 - Benfleet and Southend Marshes SPA and Ramsar
 - Medway Estuary and Marshes SPA and Ramsar
 - The Swale SPA and Ramsar
 - Thames Estuary and Marshes SPA and Ramsar
 - Crouch and Roach Estuaries
 - Essex Estuaries SAC
 - Outer Thames Estuaries SPA
5. The site data for each of the European sites was reviewed to verify ecological connectivity and the following sites had no connectivity.
 - The Essex Estuaries SAC (Natural England, 2014), shown on Figure 9 in Annex 1, was scoped out of the assessment as although it is within 100km and does support common seal *Phoca vitulina*, common seal is not listed as a qualifying feature. The qualifying features are all habitats and therefore no pathway to effect exists for this European site.
 - The Crouch and Roach Estuaries (Mid Essex Coast phase 3) SPA and Ramsar site was scoped out of this assessment as, although potential connectivity was identified via the EoS, as shown on Figure 10 in Annex 1, the site is not listed by Natural England as being part of the Greater Thames Complex (Natural England, 2014). The Site Improvement Plan for the Greater Thames Complex groups the following sites: Benfleet and Southend Marshes, Medway Estuary and Marshes, Thames Estuary and Marshes, and The Swale, and implies their bird populations are intrinsically linked (see following section on Greater Thames Complex).

- The Outer Thames Estuary SPA has been scoped out of this assessment as, although potential connectivity was identified via the EoS, as shown on Figure 11 in Annex 1, the species for which the SPA is designated have not been recorded within the Project Zol. They are also unlikely to use the habitats potentially affected as they are seabirds rather than waterfowl.

Consideration of the Greater Thames Complex

The proximity of the relevant European sites to one another and the overlap in the extent of sensitivities during the overwintering period means that the HRA species in this area are likely to move between the sites, making it difficult to assign an individual or group of individuals recorded outside the site boundary to a particular European site. The Site Improvement Plan (Natural England, 2014) defines these sites as the Greater Thames Complex. If the birds from each European site do act as a metapopulation, then they might move (at least at times) in important numbers from their site to within the zone of influence of the Project that lies within their foraging ranges. If, however, the birds are more locally based within their European sites and a smaller area of local functionally linked land, they might be expected to only move a relatively short distance from their site in any significant numbers.

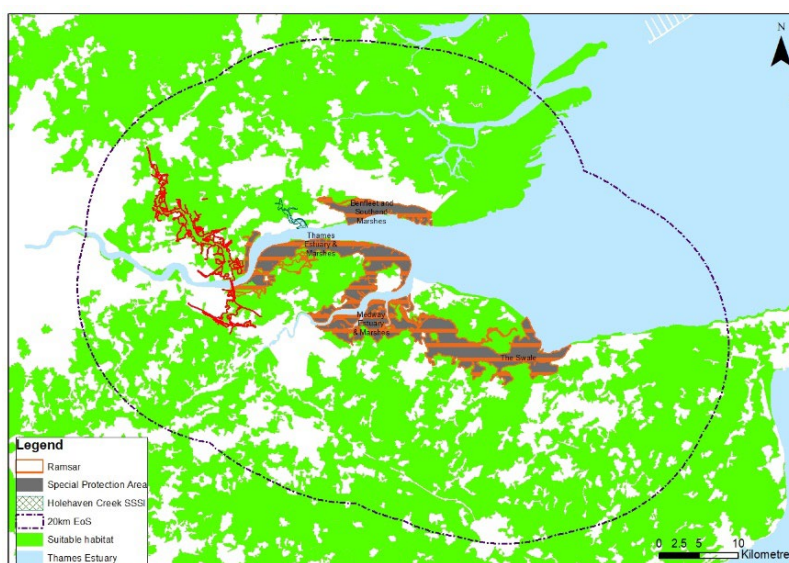
Defining functionally linked land

The following steps illustrate the process that has been used to define the extent of functionally linked land for the potentially connected sites, Benfleet and Southend Marshes, Medway Estuary and Marshes, Thames Estuary and Marshes, and The Swale.

1. Mapped all suitable habitat (see section on definition below) within the 20km EoS of the four European sites identified. At this early stage NE indicated that the populations of birds from the Thames Estuary and Ramsar SPA/Ramsar used the Holehaven Creek SSSI and this SSSI should be included as functionally linked land.

FLL defined as: All suitable habitat within the 20km EoS was functionally linked to all four sites in the Greater Thames Complex. Extent shown in Figure 1.

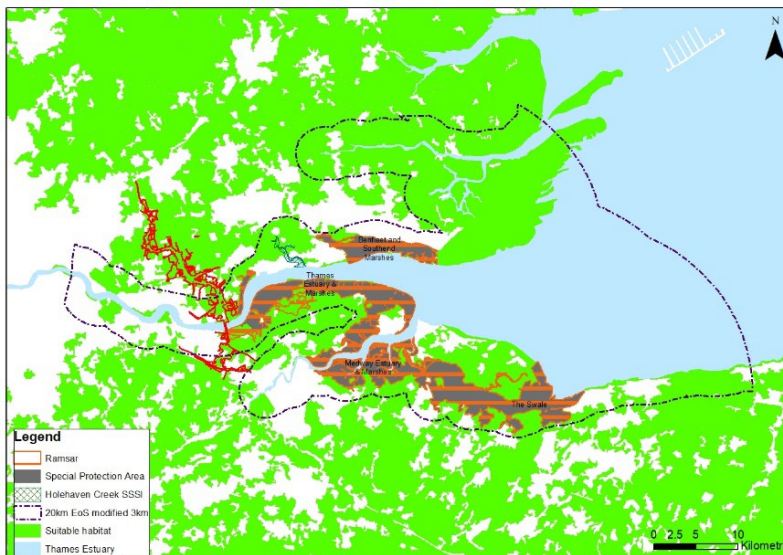
Figure 1: Extent of FLL within 20km EoS



- Reviewed the ornithology data collected for the Project to determine the distribution of the qualifying bird features within the suitable habitats and found that they were generally within 3km of the River Thames.

FLL defined as: All suitable habitat within the 20km EoS and closer to the River Thames (within approx. 3km) was functionally linked to all four sites in the Greater Thames Complex. Extent shown in Figure 2.

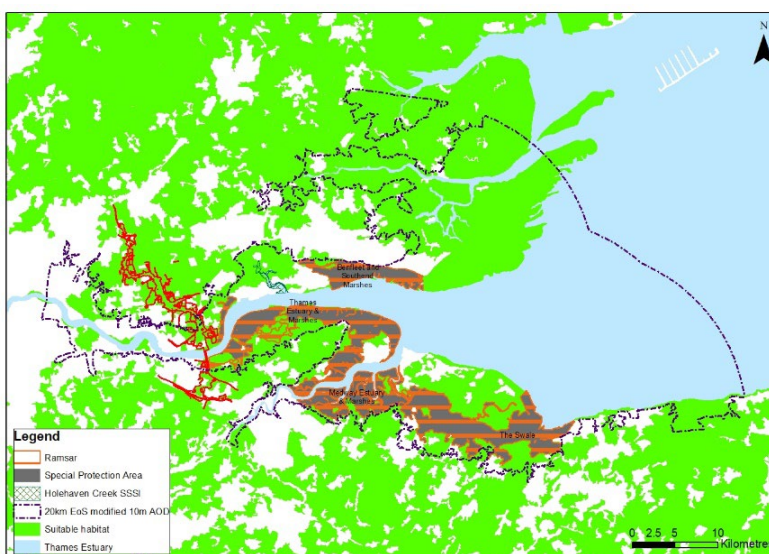
Figure 2 Extent of FLL within 20km EoS and 3km of the river



- A more detailed look at the pattern of use observed indicated that the birds appeared to use land closer to the River Thames, within at most 3km but generally confined to the lower-lying areas, below 10m AOD (above ordnance datum).

FLL defined as: All suitable habitat within the 20km EoS and below 10m AOD was functionally linked to all four sites in the Greater Thames Complex. Extent shown in Figure 3.

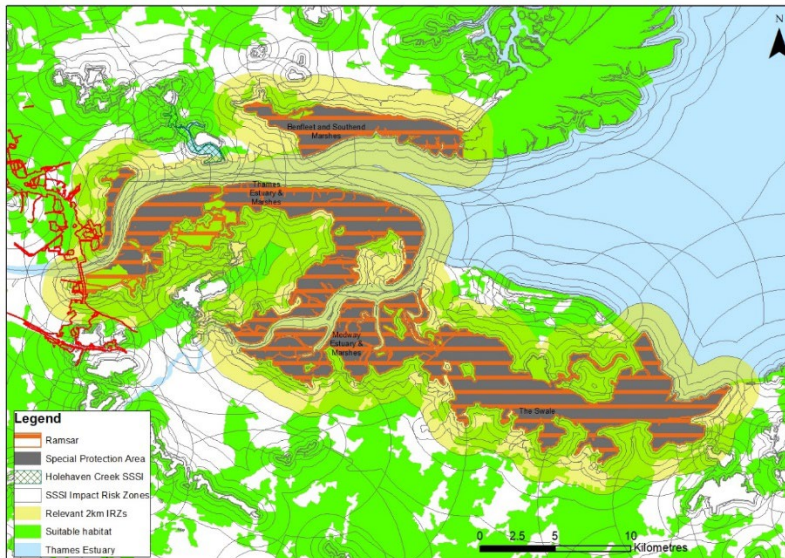
Figure 3 Extent of FLL within 20km EoS and below 10m AOD



- Following discussion with NE on the purpose of the NE SSSI Impact Risk Zones, the habitat within approximately 2km were considered by NE to be the areas at significant risk from road projects and essentially contain the habitats functionally linked to the European site.

FLL defined as: Notwithstanding the rationale from the previous step, all habitat within approximately 2km of the European site is considered to be functionally linked. Extent shown in Figure 4.

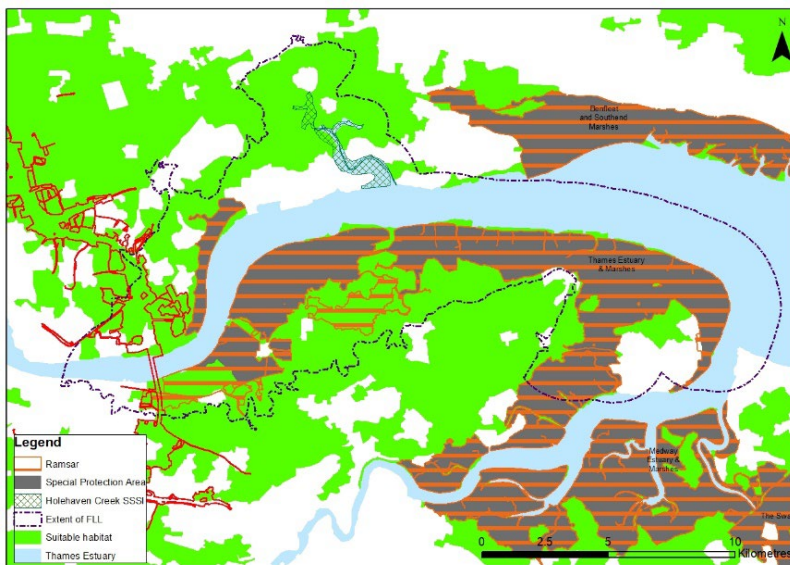
Figure 4: Extent of FLL within 2km IRZ



- Reviewed the spatial relationship between the zone of influence of the Project and the FLL and found that the habitats within the ZOI were therefore only functionally linked to the Thames Estuary and Marshes SPA and Ramsar and not the other sites within the Greater Thames Complex.
- In bringing the EoS and IRZ approaches together this resulted in the extent of FLL being refined i.e. the habitats within the Thames Estuary and Marshes IRZ that were also below 10m AOD. Discussion with NE refined the FLL extent further to include Holehaven Creek SSSI and Tilbury Fort.

FLL defined as: Functionally linked land is considered to be all suitable habitat within the Thames Estuary and Marshes IRZ and below 10m AOD, but including the area surrounding Tilbury Fort and the Holehaven Creek SSSI. Extent shown in Figure 5.

Figure 5: Extent of FLL for Thames Estuary and Marshes SPA & Ramsar



Defining suitable habitat

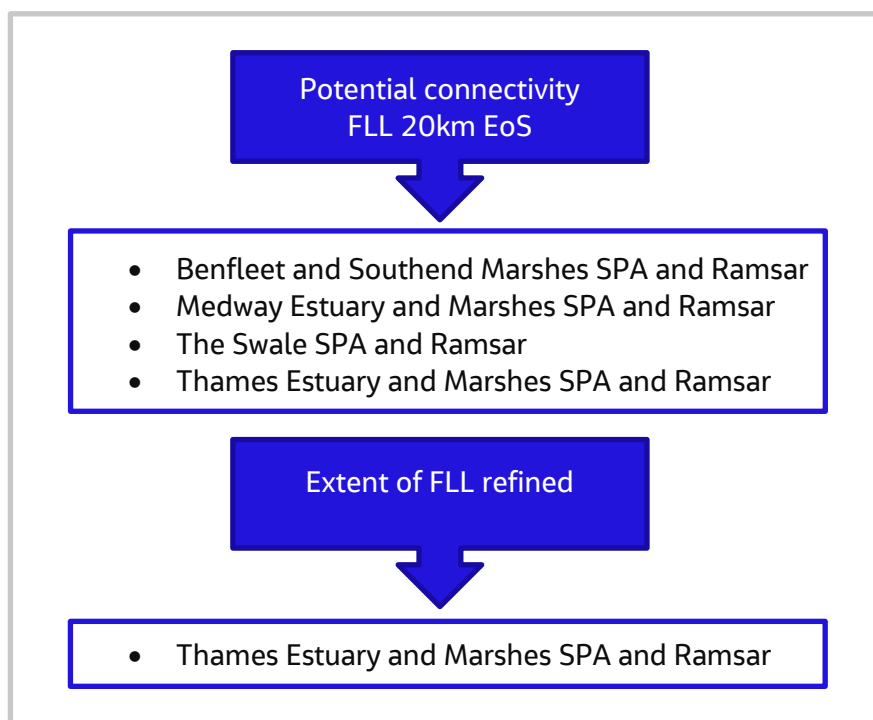
The habitat types recorded within the potentially functionally linked land that were considered suitable for the qualifying species and assemblages, as defined by Natural England's supplementary advice and observed within the ornithology surveys, are listed in Table 1. The data used to map the extent of suitable habitat within functionally linked land was the Corine Land Cover Habitat Mapping 2018 ESRI shapefile (European Environment Agency and the Joint Research Centre, 2020).

Table 1. Area of suitable habitat types within the functionally linked land

Habitat type (Corine Land Cover class)	Habitat type (equivalent Phase 1 habitat)	Potential equivalent suitable habitat as described by the supplementary advice
211: Non-irrigated arable land	Arable	
231: Pastures	Improved and semi-improved grassland	Freshwater and coastal grazing marsh
321: Natural grasslands	Semi improved, unimproved and marshy grassland	Freshwater and coastal grazing marsh
411: Inland marshes	Reedbeds, swamp and marshy grassland	Freshwater and coastal grazing marsh
421: Salt marshes	Salt marsh	Saltmarsh
423: Intertidal flats	Intertidal	Intertidal mud, sand and muddy sand
512: Water bodies	Standing water	Coastal lagoons
522: Estuaries	Running water - brackish	Coastal lagoons
523: Sea/ocean		

Change in European sites identified at Screening

The flow chart below illustrates the change in European sites identified as potentially affected by the Project.



Proposed HRA / SoCG update

The tables below set out the lines within the SoCG tracker (conclusions from the HRA reporting at DCO 2.0) that will be removed now that these European sites are no longer considered likely to be affected by the Project.

Table 2 SoCG Lines relating to the Conclusions of HRA Stage 1 Screening

Site	Item Number	Pathway
Benfleet and Southend Marshes SPA & Ramsar	HRA 7	Change in air quality - dust emissions – construction
	HRA 9	Land take in the terrestrial and aquatic environment (functionally linked habitat only)
	HRA 10	Changes in noise & vibration - operation
	HRA 11	Changes in noise & vibration - construction works and vehicles
	HRA 12	Changes in noise and vibration - intertidal works only (outfall construction and jetty maintenance) - underwater and above ground
	HRA 13	Changes in visual disturbance - people/vehicles in eyeline - construction

Site	Item Number	Pathway
	HRA 41	Changes in noise & vibration - tunnel construction only. Underwater and above ground
	HRA 42	Changes in light levels - construction
	HRA 43	Changes in visual disturbance - operation (vehicles in "eyeline")
Medway Estuary and Marshes SPA & Ramsar	HRA 14	Change in air quality - dust emissions – construction
	HRA 16	Land take in the terrestrial and aquatic environment (functionally linked habitat only)
	HRA 17	Changes in noise & vibration - operation
	HRA 18	Changes in noise & vibration - construction works and vehicles
	HRA 19	Changes in noise and vibration - intertidal works only (outfall construction and jetty maintenance) - underwater and above ground
	HRA 20	Changes in visual disturbance - people/vehicles in eyeline - construction
	HRA 44	Changes in noise & vibration - tunnel construction only. Underwater and above ground
	HRA 45	Changes in light levels - construction
	HRA 46	Changes in visual disturbance - operation (vehicles in "eyeline")
The Swale SPA & Ramsar	HRA 50	Changes in noise & vibration - tunnel construction only. Underwater and above ground
	HRA 51	Changes in light levels - construction
	HRA 52	Changes in visual disturbance - operation (vehicles in "eyeline")
	HRA 28	Change in air quality - dust emissions – construction
	HRA 30	Land take in the terrestrial and aquatic environment (functionally linked habitat only)
	HRA 31	Changes in noise & vibration - operation
	HRA 32	Changes in noise & vibration - construction works and vehicles
	HRA 33	Changes in noise and vibration - intertidal works only (outfall construction and jetty maintenance) - underwater and above ground
	HRA 34	Changes in visual disturbance - people/vehicles in eyeline - construction

Table 3: Lines relating to the Conclusions of HRA Stage 2 Appropriate Assessment

Site	Item Number	Pathway
Benfleet and Southend Marshes SPA & Ramsar	HRA 77	Changes in noise & vibration - operation
	HRA 53	Land take in the terrestrial and aquatic environment (functionally linked habitat only)
	HRA 54	Changes in noise & vibration - construction works and vehicles
	HRA 55	Changes in noise and vibration - intertidal works only (outfall construction and jetty maintenance) - underwater and above ground
	HRA 56	Changes in visual disturbance - people/vehicles in eyeline - construction
	HRA 82	Changes in visual disturbance - operation (vehicles in "eyeline")
Medway Estuary and Marshes SPA & Ramsar	HRA 78	Changes in noise & vibration - operation
	HRA 57	Land take in the terrestrial and aquatic environment (functionally linked habitat only)
	HRA 58	Changes in noise & vibration - construction works and vehicles
	HRA 59	Changes in noise and vibration - intertidal works only (outfall construction and jetty maintenance) - underwater and above ground
	HRA 60	Changes in visual disturbance - people/vehicles in eyeline - construction
	HRA 83	Changes in visual disturbance - operation (vehicles in "eyeline")
The Swale SPA & Ramsar	HRA 65	Land take in the terrestrial and aquatic environment (functionally linked habitat only)
	HRA 66	Changes in noise & vibration - construction works and vehicles
	HRA 67	Changes in noise and vibration - intertidal works only (outfall construction and jetty maintenance) - underwater and above ground
	HRA 68	Changes in visual disturbance - people/vehicles in eyeline - construction
	HRA 85	Changes in visual disturbance - operation (vehicles in "eyeline")
	HRA 80	Changes in noise & vibration - operation

References

Cutts, N., Phelps, A. & Burdon, D., 2009. *Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Report to Humber INCA*. s.l.:Institute of Estuarine and Coastal Studies University of Hull.

European Environment Agency and the Joint Research Centre, 2020. *Copernicus Land Monitoring Service - Corine Land Cover 2018 Version 2020_20u1*. [Online]
Available at: <https://land.copernicus.eu/pan-european/corine-land-cover/clc2018>
[Accessed 19 May 2020].

Highways England, 2019. *DMRB Vol. 11 Section 3 Part 1 LA105 Air Quality*. [Online]
Available at:
<http://www.standardsforhighways.co.uk/ha/standards/dmr/vol11/section3/LA%20105%20Air%20quality-web.pdf>
[Accessed 05 Jan 2020].

Highways England, Transport Scotland, Welsh Government & Department for Infrastructure, 2019. *Design Manual for Roads and Bridges LA105 Air Quality*. [Online]
Available at: <https://www.standardsforhighways.co.uk/prod/attachments/84e6ac61-561a-49a8-af95-2dbe1fc5faa1>
[Accessed March 2020].

Highways England, Transport Scotland, Welsh Government & Department for Infrastructure, 2020d. *Design Manual for Roads and Bridges LA 111 Noise and vibration*. [Online]
Available at:
<http://www.standardsforhighways.co.uk/ha/standards/dmr/vol11/section3/LA%20111%20Revision%201%20Noise%20and%20vibration-web.pdf>
[Accessed March 2020].

JNCC, 2019. *UK Protected Area Datasets for Download*. [Online]
Available at: <https://jncc.gov.uk/our-work/uk-protected-area-datasets-for-download/>
[Accessed 23 Oct 2019].

Natural England, 2014. *Site Improvement Plan: Essex Estuaries (SIP077)*. [Online]
Available at: <http://publications.naturalengland.org.uk/publication/5459956190937088>
[Accessed 29 Nov 2019].

Natural England, 2014. *Site Improvement Plan: Greater Thames Complex (SIP 134)*. [Online]
Available at: <http://publications.naturalengland.org.uk/publication/6270737467834368>
[Accessed 29 Nov 2019].

Annex 1

Qualifying Species Evidence (attached separate pdf)

Connectivity Figures – Figure 7-14 (attached separate pdf)

Annex 2

Zone of Influence of the Project

The potential impacts and associated Zol are described in Table 2 and have been used to determine a single Zol (600m which encompasses all impacts) for the Project as a whole to allow European sites to be identified where a pathway to effect may exist. The changes in air quality on the wider road network are not included within this Zol as they have been included within the specific screening criteria that identify the European sites within 200m of the ARN.

Table 4: The potential impacts and Zol at construction and operation

Potential Impact	Zol
Land take - terrestrial and aquatic (marine) environment - construction	Area within the Order Limits such as construction compounds CA5, CA3A, and CA3B. Project will only be constructed on land that is controlled within the powers of the DCO and so no land take could occur outside the Order Limits.
Vehicle collision with species during operation	Area of new carriageway Area where species interaction with vehicles is possible
Species collision with overhead utilities infrastructure - operation	Area of overhead utilities realignment Area where species interaction with overhead utilities infrastructure is possible
Change in air quality – dust emissions – construction	Area within the 200m of the Order Limits where dust effects could occur in absence of mitigation. Defined by DMRB LA 105 (Highways England, et al., 2019)
Change in air quality – vehicle emissions – construction	Area within 200m of construction areas and construction phase ARN. Defined by DMRB LA 105 (Highways England, et al., 2019)
Change in air quality – vehicle emissions – operation	Areas within 200m of the operational (2027 opening year) ARN. Defined by DMRB LA 105 (Highways England, et al., 2019)
Changes in noise and vibration – vehicles – operation	Area within 600m of the Project alignment and existing routes that are bypassed/improved or new routes identified. Defined by DMRB LA 111 (Highways England, et al., 2020d)
Changes in noise and vibration – all construction work and associated vehicle movements	Areas within 300m of the Order Limits defined by DMRB LA 111 (Highways England, et al., 2020d). Defined by DMRB LA 111 (Highways England, 2020) as: <i>'The study area for the construction vehicle</i>

Potential Impact	Zol
	<i>assessment for the ES will consider any road/route identified within the Transport Assessment as experiencing temporary increases in heavy vehicle movements accounting for a predicted increase in road traffic noise of greater than 1dB during the construction phase. The study area will consider the effects resulting from temporary road closures and diversions where appropriate.'</i>
Changes in noise and vibration – underwater and above ground – tunnel construction only	Changes within the surrounding area where the TBM is in operation.
Changes in light levels – construction	Within Order Limits, primarily construction compounds and work areas, where lighting is used such as construction compounds CA5, CA3A and CA3B.
Changes in light levels – operation	Highway lighting is associated with the main line and junctions across the Project and within the tunnel. The Zol is limited to the area immediately either side of the highway.
Changes in visual disturbance – people/machines in eyeline – construction	The zone of theoretical visibility (map produced (usually digitally) to specific criteria to illustrate the area(s) from which a project can theoretically be visual) has been calculated to a 5km extent from the Project Construction Compounds. Sensitivity to visual disturbance is limited to areas within 300m of the activity (Cutts, et al., 2009).
Changes in visual disturbance – vehicles in eyeline – operation	The zone of theoretical visibility has been calculated to a 5km extent from the Project. Sensitivity to visual disturbance is limited to areas within 300m of the Project (Cutts, et al., 2009).
Change in recreational pressure – construction and operation	Note: technical note issued specific to recreational disturbance risks.
Changes in surface water quality and quantity – construction	The risk is associated with construction compounds CA03 and CA05 and associated earthworks areas where rainfall run off enters the water course network within European sites or associated functionally linked land (see Section 6.1). It is generally limited to areas within 500m of the Order Limits as set out in ES Chapter 14 Road Drainage and Water Environment (Application Document 6.1).
Changes in surface water quality and quantity – operation	Project design is such that no change is anticipated. Zol not applicable as Project to be built with an attenuated road drainage system so discharges will comply with quality and permit standards and

Potential Impact	Zol
	chemical composition within Environment Agency agreed parameters. Discharge will be at agreed rates pre-determined by the Environment Agency and would be equivalent to greenfield runoff rates. The size and tidal influence of the receiving watercourse will be such that no changes are expected to be perceivable.
Changes in groundwater quality and quantity – tunnel construction and operation	Groundwater modelling outputs are reported within the ES Appendix 14.7 Water Framework Directive (Application Document 6.3).
Introduction/spread of non-native species – terrestrial environment	The risk is particularly associated with earthworks areas where non-natives could be spread or introduced with imported material.

Annex NN 12 May 2021 Technical Note - Ramsar Surface Water Ecology Baseline (Construction surface water discharge) Revision 1

HRA Technical Note: Construction surface water discharge – Rev 1

Introduction

The joint (NE and EA) consultation meeting on 3rd March 2021 discussed the construction surface water discharge from Compound CA3, the measures that the Project has committed to discharge clean water at greenfield run off rates and the discharge permits that would apply post DCO consent. As part of this discussion NE were keen to understand the likely environmental parameters that would form part of the discharge permit.

Any parameters would apply to the good practice measures already committed to by the Project, but because they have been developed specifically in relation to the Thames Estuary and Marshes Ramsar, they are considered to be mitigation that applies at HRA Stage 2 and this effect pathway has been taken forward to the Appropriate Assessment report.

This note has been produced to facilitate agreement on the HRA conclusion on changes in surface water – construction in the SoCG prior to NE seeing the final resubmission draft of the Screening and Appropriate Assessment reports.

Prior to applying for the discharge permit the Project will complete pre-construction surveys to collect the hydrological and ecological data required to allow the EA to determine the permit application and derive appropriate environmental parameters. The parameters put forward in this technical note are precautionary and although do not prejudice any permitting decisions made by the EA, are considered to reflect a “no greater than” threshold that would protect the receiving environment and be sufficient to conclude no adverse effects in the HRA for the DCO application.

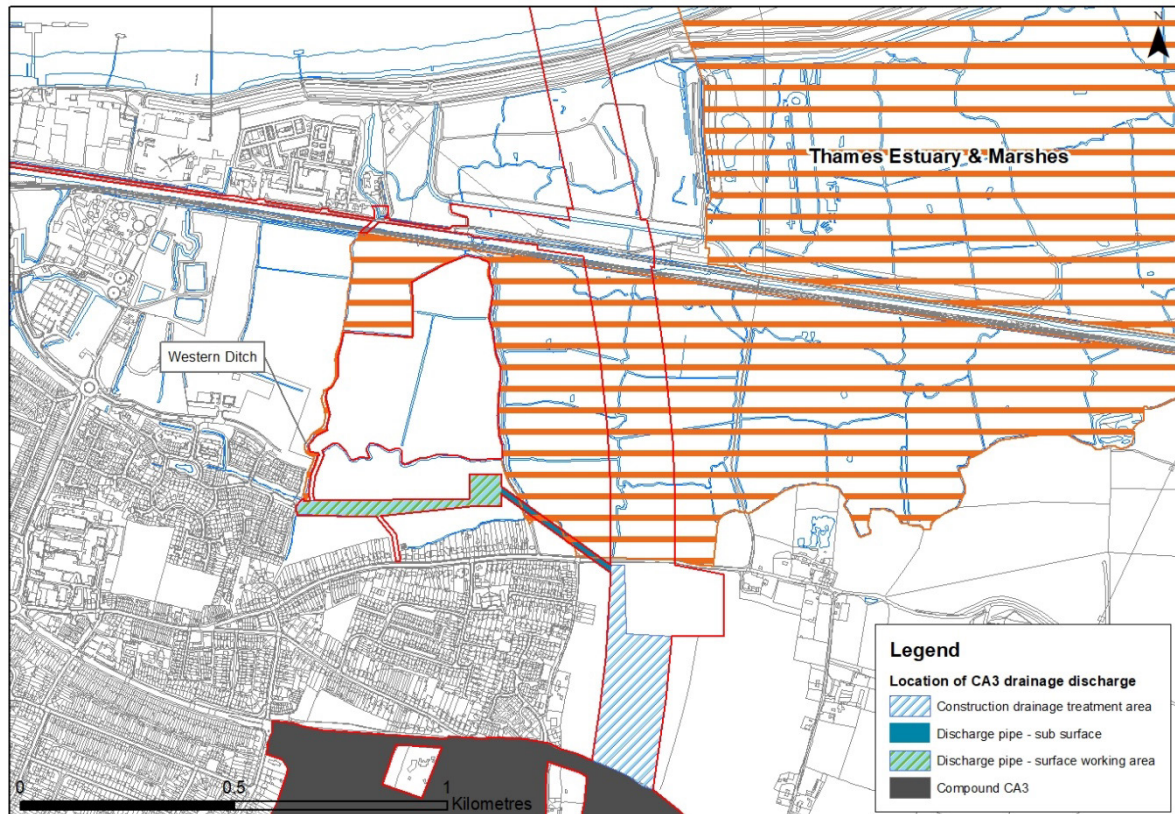
Baseline

Proposed discharge

The Project proposes to collect, and discharge site run off from Compound CA3 during the construction phase. The compound, covering a total area of approximately 155ha, will accommodate a range of land uses including haul roads, car parks and temporary buildings/cabins, as well as temporary chalk stockpiles and creation of a new permanent area of landscaping. The site run off will be collected and discharged as follows:

- Runoff from areas of the compound that have a low risk of entrained chalk and sediment fines will be collected and allowed to infiltrate to ground, via a vegetated soakaway, to replicate the existing hydrological regime.
- Runoff from higher risk areas (covering an area of around 65 hectares) e.g. the chalk stockpiles, will be collected, attenuated and treated as required before being discharged to the “western ditch” as shown in Figure 1.

Figure 1: Location of proposed discharge



Receiving ditch

The western ditch is an EA Main River and part of the Thames Estuary and Marshes Ramsar. It is referred to within the ES Appendix 14.2 Water Feature Survey Report as Fenners Marsh Ditch (waterbody ID – DI-1S05ZZZ1) and during the water features survey one water field sample was taken with the following result:

- pH – 7.03,
- Temperature – 14.6°C,
- Electrical Conductivity - 990µS/cm.

The channel width was recorded as 2m and depth approximated as 1m and the field notes were as follows:

- *"Ditch covered with algae and pond weed. Pretty shallow ditch. Occasional pipes used to cross over between agricultural land and railway. Search for spring from the north to the southern part, no evidence of spring."*

The western ditch flows south to north under the railway line and into the ditches sampled at Point G and Point H. (see Figure 3).

Ramsar ditch network

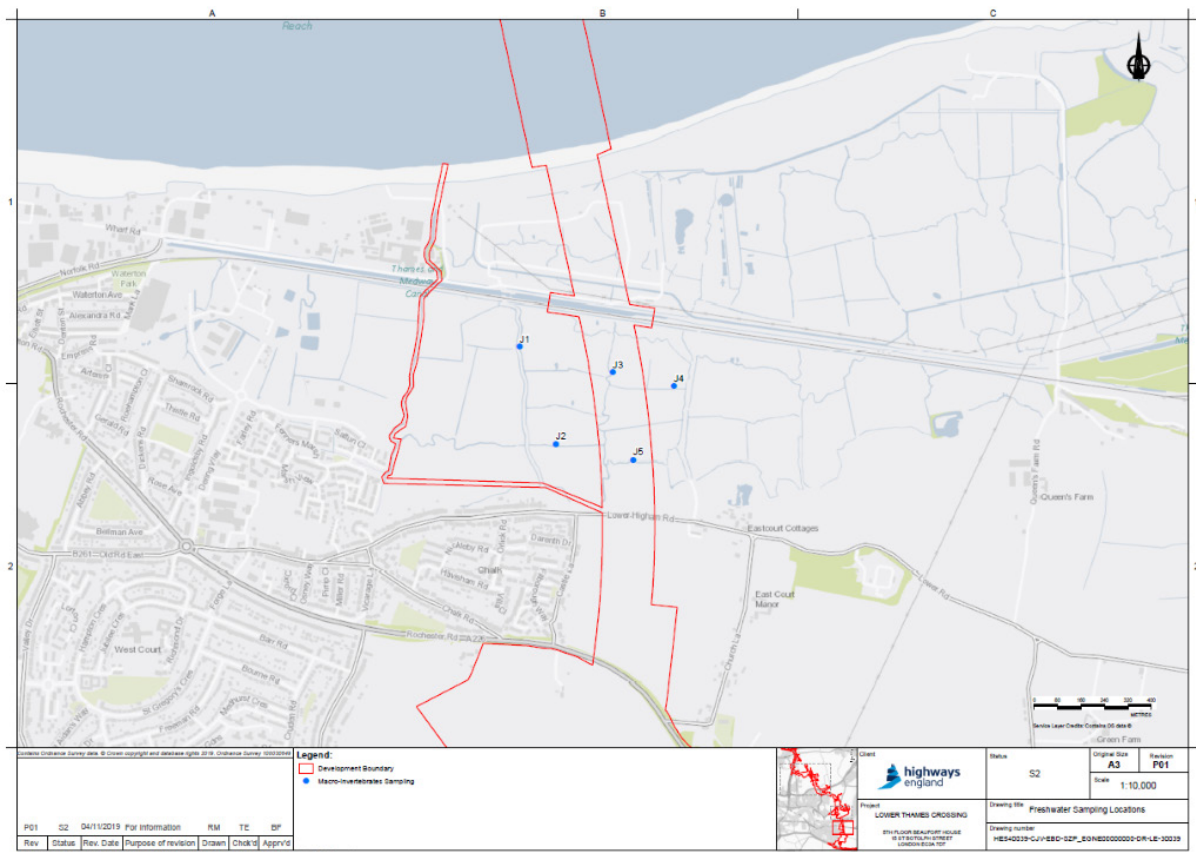
Limited information was available for the western ditch and the following baseline information on the wider ditch network within the Order Limits has been extracted from the ES Appendix 8-4 Freshwater Ecology and ES Appendix 14.2 Water Feature Survey Report.

ES Appendix 8-4 Freshwater Ecology

Surveys were completed on 22 August 2018 at sites J1 to J5 (see Figure 2) and all of the sites are within the Thames Estuary and Marshes Ramsar. The surveys comprised:

- macroinvertebrates
- macrophytes
- physical characteristics
- water chemistry

Figure 2: Location of sites J1 to J5 (Order Limits shown are now revised)



Macroinvertebrates

Table 1 lists the macroinvertebrate species that are listed on the Ramsar citation and two of those were recorded during the sampling: *Stratiomys longicornis* at site J4 and *Hydrochus ignicollis* at site J5.

Table 1: Thames Estuary and Marshes Ramsar macro-invertebrates (Ramsar Information Sheet, 2000)

Species	Group	National Importance	Red Data Book Score
<i>Bagous longitarsis</i>	Coleoptera (beetles)	Endangered	1
<i>Erioptera bivittata</i>	Cranefly	Vulnerable	2
<i>Lestes dryas</i>	Damselfly	Vulnerable	2
<i>Cercyon bifenestratus</i>	Coleoptera (beetles)	Rare	3
<i>Hydrochus elongatus</i>	Coleoptera (beetles)	Rare	3
<i>Hydrochus ignicollis</i>	Coleoptera (beetles)	Rare	3
<i>Ochthebius exaratus</i>	Coleoptera (beetles)	Rare	3
<i>Hydrophilus piceus</i>	Coleoptera (beetles)	Rare	3
<i>Stratiomys longicornis</i>	Soldier fly	Rare	3

Macrophytes

Water soldier *Stratiotes aloides*, a nationally scarce species, is the only aquatic macrophyte designated in Criterion 2 for the Thames Estuary and Marshes Ramsar Site (JNCC, 2004) and was not found in this study.

Physical characteristics and water chemistry

Table 2 and 3 summarise the data collected at each of the sample points. The ditches samples were between 2.5 and 5m wide and generally fairly shallow, 0.8-1.5m deep.

Table 2: Physical characteristics of the ditch sample points

Site Name	Wetted width (m)	Depth (m)	% macrophyte cover		
			Submerged	Emergent	Floating
J1	3	1-1.5	100	1	<1
J2	3	0.8	80	6	60
J3	5	1.5	70	21	95
J4	2.5	0.3	85	6	5
J5	3	1.2	90	5	90

Table 3: Water chemistry recorded during freshwater ecology surveys

Name	Turbidity	Conductivity	pH	Oxygen (%)	Salinity
J1	Slight	1224	7.52	92.0	0.61
J2	Slight	485.7	8.04	85.5	0.26
J3	Clear	717	7.96	71.0	0.35
J4	Clear	2419	8.37	76.3	1.25
J5	Clear	632	9.86	139.9	0.31

Appendix 14.2 Water Feature Survey Report

The survey data was collected at the locations shown in Figure 3 and comprised:

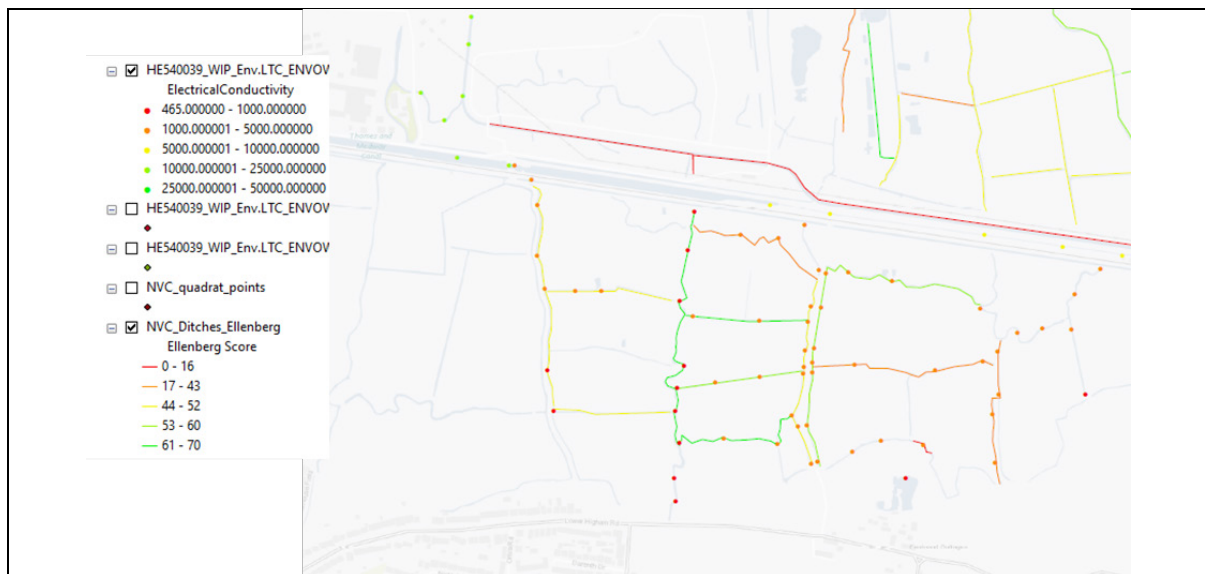
- Water Quality monitoring – 13 June 2019 to 25 July 2019
- Roboduck monitoring – data collected Jan 2020

Figure 3: Location of water sampling points



Ellenberg scores (for nitrate and salinity) were also calculated using NVC data as shown in Figure 4. The higher the Ellenberg score the more the vegetation that was recorded was considered intolerant to high nitrate or salinity. The western ditch itself was not included but data gives an indication of salinity/nitrate variability across the surveyed ditches within the Ramsar.

Figure 4: Ditch Electrical Conductivity and Ellenberg Scores



The water quality monitoring results (see Table 4) identified generally consistent pH, temperature and dissolved oxygen values between the locations. pH values are generally neutral to slightly acidic, ranging from 6.8 to 9.7, with an average (mean and median) of 7.1 to 7.7. Temperature values range from 14 to 30°C, with an average (mean and median) of 17 to 20°C. Dissolved oxygen ranges from 0 to 290%, with an average (mean and median) of between 40 and 90% - these high DO concentrations are coincident with heavily vegetated and slow moving or stagnant waters.

There are two distinct trends within the electrical conductivity data set, such that the measurements taken in the small ditches (Points A-E and K) have a range of 500 to 1200µS/cm (microsiemens per centimetre) and an average (mean and median) of 700 to 800µS/cm. Meanwhile, the measurements taken in the Denton New Cut and its western tributaries (Points G, H and J) have a range of 1,000 to 40,000µS/cm, with an average (mean and median) at Points G and H of 12,000 and 20,000µS/cm respectively and at Point J of 3,000 and 6,000µS/cm for the median and mean respectively.

The Roboduck data identified similar trends to the field sampling and laboratory testing results. The dataset identifies a range of neutral to slightly acidic pH, from 6.74 to 8.82, with an average (mean and median) of around 8.0. In addition, the EC values in the small ditches, in the Filborough Marshes, have a range of 700-1,500µS/cm and an average (mean and median) of around 800 µS/cm. The value of EC increases with proximity to the Denton New Cut, which is identified with an average (mean and median) of 3,500µS/cm and a maximum of 3,700µS/cm.

Table 4: Surface water features water quality monitoring (field sampling)

Point		Electrical Cond (EC)	pH	Temp	Dissolved Oxygen (DO)
		(µS/cm)	-	(°C)	(%Sat)
A (Ramsar South,	Max	926	8.32	28.88	89.27
	Mean	723	7.47	17.61	45.81
	Median	717	7.40	16.95	45.84

Point		Electrical Cond (EC)	pH	Temp	Dissolved Oxygen (DO)
		($\mu\text{S}/\text{cm}$)	-	($^{\circ}\text{C}$)	(%Sat)
Filborough Marshes)	Min	664	6.89	14.10	0.29
	Lab 1	797	7.37	12.70	9.19
	Lab 2	943	7.74	12.30	9.46
B (Ramsar, Filborough Marshes)	Max	1183	9.29	26.42	288.75
	Mean	750	7.78	18.96	87.61
	Median	715	7.64	18.40	61.69
	Min	536	6.85	15.53	2.33
	Lab 1	693	7.31	12.90	6.40
	Lab 2	844	7.73	11.95	8.78
C (Ramsar North, Filborough Marshes)	Max	1289	9.25	25.96	260.79
	Mean	770	7.75	19.80	93.59
	Median	697	7.52	19.15	91.12
	Min	475	7.01	16.38	6.87
	Lab 1	684	7.06	11.90	6.89
	Lab 2	932	7.62	11.10	9.70
D (Ramsar North, Filborough Marshes)	Max	1012	8.83	27.40	227.74
	Mean	742	7.13	18.88	36.13
	Median	714	7.01	18.53	18.83
	Min	486	6.56	15.12	0.00
	Lab 1	757	7.18	12.30	7.29
	Lab 2	934	7.66	11.85	8.75
E (Ramsar South, Filborough Marshes)	Max	1034	9.67	27.61	190.27
	Mean	729	7.81	18.94	81.13
	Median	709	7.54	18.31	62.75
	Min	527	7.11	15.03	18.92
	Lab 1	31	6.92	10.80	5.45
	Lab 2	950	7.82	11.90	10.80
G (Steam west of DNC)	Max	32703	8.46	27.12	163.12
	Mean	12091	7.75	19.83	93.42
	Median	10191	7.69	19.60	92.21
	Min	1813	7.26	15.77	40.12
	Lab 1	6813	7.53	14.30	7.95

Point		Electrical Cond (EC)	pH	Temp	Dissolved Oxygen (DO)
		($\mu\text{S/cm}$)	-	($^{\circ}\text{C}$)	(%Sat)
	Lab 2	1240	7.12	12.00	9.38
H (DNC Discharge)	Max	40815	8.43	30.80	164.44
	Mean	19624	7.73	20.42	93.55
	Median	17890	7.68	19.97	86.01
	Min	2580	7.05	16.19	27.85
	Lab 1	5526	7.65	13.00	8.14
	Lab 2	2710	7.55	10.65	9.09
J (DNC Discharge)	Max	36477	8.68	29.90	143.38
	Mean	6655	7.70	20.66	74.23
	Median	2929	7.66	20.53	72.75
	Min	965	7.16	15.66	27.91
	Lab 1	635	7.78	14.80	7.73
	Lab 2	1364	8.10	10.43	8.26
K (Ramsar, Filborough Marshes)	Max	1057	8.15	28.15	78.86
	Mean	776	7.44	18.38	43.88
	Median	744	7.40	17.79	45.57
	Min	597	6.90	15.05	17.78

Risk of effects from discharge

The receiving ditch (the western ditch) is within the Ramsar for part of its length. It is similar to the other ditches within the Ramsar and is likely to have some saline influence (see Figure 4) closer to the River Thames, particularly at high tide. No macrophytes listed on the Ramsar citation were recorded and there is no reason to assume they would be present within the western ditch. Two macroinvertebrates listed on the Ramsar citation were recorded in the nearby ditch network and may be present in the western ditch as well. These species are associated with slowly moving water ditches and *Stratiomys longicornis* is a brackish water species.

Therefore, making a precautionary assumption that these species are present, the discharge to the receiving ditch would need to be such that the flow and salinity gradient was unaltered to be confident that the Ramsar macro invertebrates, if present, were unaffected.

Proposed Parameters

The Project has committed to the discharge to the western ditch being made at greenfield rates representing pre-development conditions, and given the underlying permeable soils and geology, these rates are low. Although discharges rates would be restricted, additional volumes of water would be received by the western ditch and its connecting waterways. This is because currently a large proportion of the rainfall received by the land to be occupied by compound CA3 would soak away to ground and only reach the ditch network within the Ramsar slowly via soil seepages.

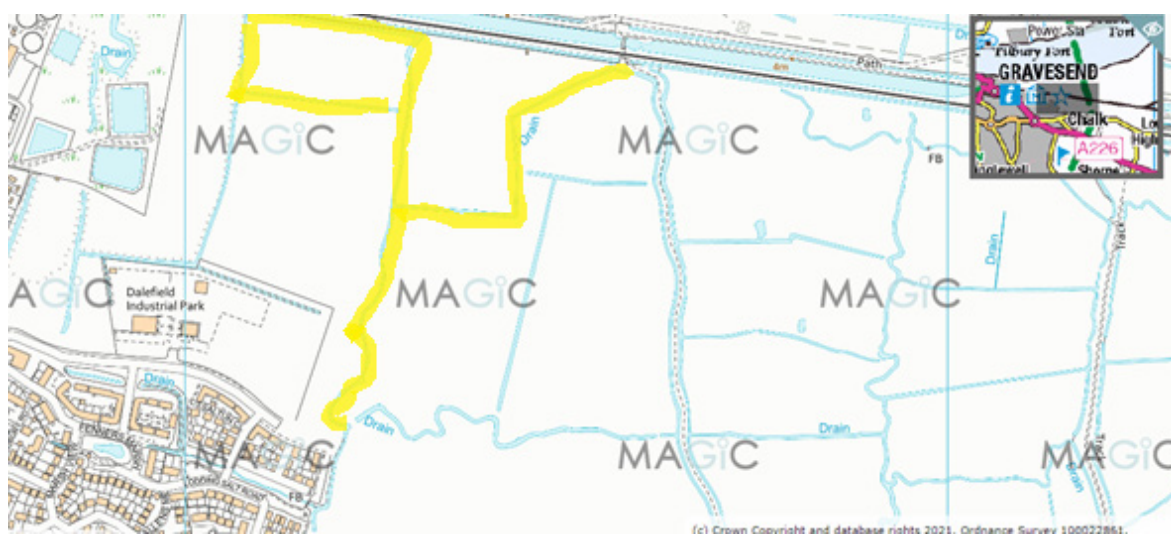
Calculations have been completed to quantify the effects of the additional volumes of discharge on water levels in the receiving western ditch and connecting ditches. The ReFH¹ point source application estimates a runoff rate in a 1 in 1 year rainstorm of 2l/s from the 65 hectares of compound CA3 that will be drained to the western ditch. This rate increases to 7.2l/s during a 1 in 30 year rainstorm.

From site observations, the ditches currently support very low flow velocities and as they are subject to tide locking when water levels in the River Thames rise on the regular tidal cycle (approximately two 6 hours periods in every 24 hours), there would be periods of no flow. During tide locking the ditch network stores water and a typical depth of water has been observed as around 1m.

The western ditch has reach length from the proposed discharge outfall location to the outfall to the River Thames of approximately 880m, and a connecting network of ditches (illustrated in Figure 5) with a reach length of approximately 1366m. A channel cross section area of 2m² has been selected as representative.

Table 4 provides a summary of the predicted water level change in the western ditch as a result of the additional volumes of discharge, assuming the worst-case tide locked condition over a 6 hour duration.

Figure 5: Western ditch reach lengths used in calculations



¹ (Wallingford Hydro Solutions, 2019) The Revitalised Flood Hydrograph Model.

Table 5: Predicted water level change within western ditch as a result of the proposed discharge

Design Storm	Volume of Runoff* (m ³)	Change in Water Depth** (m)
1 in 1 year	390	0.087
1 in 2 year	454	0.101
1 in 30 year	1207	0.269

*from compound run off area of 65 hectares **relative to a baseline water depth of 1m

To minimise water level change in the ditch network it is proposed to provide sufficient storage within the compound drainage treatment area to allow for discharges not to exceed the 1 in 1 year event runoff volume under tide locked conditions.

Following review of the baseline data collected and calculations completed to estimate changes in water depth the Project will commit to the proposed discharge rate and chemical parameters set out below:

- **Discharge Rates:** Limited to greenfield rates for a 1 in 1 year rainstorm (2 l/s)
- **Chemical Parameters:** The parameters proposed align with those set out in the DEFRA publication *Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment*². The water quality standards of the discharge would not exceed the standards recorded for each of the parameters during the pre-construction surveys.
 - pH
 - biochemical oxygen demand
 - dissolved oxygen
 - total ammonia
 - unionised ammonia
 - suspended solids
 - phosphorus
 - specific pollutants
 - benzyl butyl phthalate
 - carbendazim
 - chlorothalonil
 - copper
 - diazinon
 - 3,4-dichloroaniline
 - 2,4-dichlorophenol
 - glyphosate
 - manganese
 - methiocarb
 - pendimethalin
 - permethrin
 - tetrachloroethane

² DEFRA and Welsh Government (2014) Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment May 2014
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/307788/river-basin-planning-standards.pdf

- toluene
- triclosan
- zinc

Proposed wording for commitment in REAC

RDWE033

Water discharged into the western ditch from the South Portal construction compound would be treated to the standard specified within the discharge licence consent granted by the Environment Agency and released at greenfield runoff rates. The runoff collection and management system would be operated until full reinstatement of the compound area is complete.

The water quality standards for the discharge into the western ditch will include (but not be limited to) the following parameters and would not exceed these values unless otherwise agreed by the Environment Agency as part of its discharge licence consent, which would be set following consultation with Natural England: Discharge rate of no more than 2ls^{-1} ; chemical composition of; pH, biochemical oxygen demand, dissolved oxygen, total ammonia, unionised ammonia, suspended solids, phosphorus, benzyl butyl phthalate, carbendazim, chlorothalonil copper, diazinon, 3,4-dichloroaniline, 2,4-dichlorophenol, glyphosate, manganese, methiocarb, pendimethalin, permethrin, tetrachloroethane, toluene, triclosan, and zinc, with standards no greater than that recorded during the pre-construction survey.

Annex OO 12 May 2021 Revised Technical Note - Dust measures (Revision 1)

HRA Technical Note: Efficacy of measures to avoid and reduce dust emissions.

Rev1: 11 May 2021

Introduction

Following discussion within meeting 2/12/2020 & 9/12/2020 Natural England requested that the HRA screening report included evidence of the efficacy of the measures to avoid and reduce dust emissions. The note has been updated following further discussion on the fortnightly consultation call on 5/5/2021 and restructuring of the HRA report (primarily concerning consideration of functionally linked land).

This technical note provides extracts from the HRA report, to support the resubmission of the DCO application, to illustrate how the assessment of effects on dust has been updated – to facilitate agreement on the conclusion in the SoCG prior to Natural England seeing the final resubmission draft of the HRA report.

Proposed text in the HRA Report (relating to screening)

Zone of influence

The zone of influence for dust emissions is described in Table 4.1: The potential impacts and Zol at construction and operation. It is defined in DMRB LA 105 (Highways England, et al., 2019) as the area within 200m of the Order Limits where dust effects could occur in absence of mitigation.

Sites identified with potential LSE

Section 5.2 describes the European sites that could be affected by dust emissions (without any measures in place) are those:

1. within 200m of the Order Limits - Thames Estuary and Marshes Ramsar; and,
2. where functionally linked land is within 200m of the Order Limits - Thames Estuary and Marshes SPA/Ramsar.

Measures that reduce/avoid

The measures that are relied upon in the HRA report when assessing LSE are set out within Section 4.5 Assumptions, Project design and environmental measures as follows:

"Change in air quality – dust emissions - construction

Construction

The following measures would be implemented to minimise and manage dust at source during the construction phase.

Implement good practice measures to reduce dust during demolition works such as [AQ002]:

- a. Soft strip inside buildings before demolition (i.e. retain external walls and windows where safe and practicable to provide a screen against dust).*
- b. Use water suppression where practicable for dust control, during demolition operations.*
- c. Avoid explosive blasting, using appropriate manual or mechanical alternatives.*
- d. Bag and remove any biological debris or damp down such material before demolition.*

Implement good practice controls to reduce dust during works, such as [AQ0003]:

- a. Cover with topsoil and re-vegetate earthworks and exposed areas including soil stockpiles to stabilise surfaces.*
- b. Use a cover such as hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil.*
- c. Remove the cover systematically during work to reduce exposure of areas that are not being worked on.*
- d. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless required for a particular process, in which case ensure that appropriate additional control measures are in place to prevent escape.*
- e. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored with suitable emission control systems to prevent escape.*
- f. For small supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.*

Implement good practice controls to reduce track-out during works such as [AQ0004]:

- a. Use of water-assisted dust sweepers on the access and local roads to remove any material tracked out of the site.*
- b. Avoid dry sweeping of large areas.*
- c. Ensure vehicles entering and leaving worksites are securely covered to prevent escape of materials during transport.*
- d. Inspect haul routes for integrity, instigate necessary repairs and record in site log book.*
- e. Access gates to be sited at least 10m from receptors e.g. residential properties where practicable.*
- f. Apply dust suppressants to locations where large volume of vehicles enter and exit the construction site.*

Implement good practice controls to manage dust during construction such as [AQ0005]:

- a. Undertake onsite and offsite inspections to monitor dust.*
- b. Plan site layout so that machinery and dust-causing activities are located away from receptors, as far as this is reasonably practicable.*
- c. Erect suitable solid screens or barriers around dusty activities or the site boundary.*
- d. Avoid site runoff of water or mud.*
- e. Remove waste materials that have a potential to produce dust from site as soon as reasonably practicable.*
- f. Cover, seed or fence stockpiles to prevent wind whipping.*
- g. Cutting/grinding/sawing equipment to use water as dust suppressant or suitable local extract ventilation.*

- h. Ensure an adequate water supply on the site for effective dust/particulate matter suppression, using recycled water where reasonably practicable.*
- i. Use enclosed chutes, conveyors and covered skips to reduce escape of dust.*
- j. Reduce drop heights from conveyors, loading shoves, hoppers and other loading or handling equipment to a practical minimum; and use fine water sprays on such equipment where appropriate.*
- k. Ensure equipment is readily available onsite to clean any spillages and clean up spillages as soon as the spill is identified.*
- l. Reuse and recycle waste to reduce dust from waste materials."*

The committed measures are all established good practice methods and are considered to be effective at containing dust when used at source and are defined in many industry standards for use on construction sites, for example the "Environmental good practice on site guide (CIRIA C741)" (Charles & Edwards, 2015).

Assessment of no LSE

The assessment of LSE is carried out in Section 7. The text explaining the reliance and efficacy of the committed measures reads as follows.

Efficacy of good practice measures

Whilst no studies of the efficacy of the good practice measures are available in the literature to specifically demonstrate their effectiveness in preventing significant effects on nearby receptors, the measures have been developed over many years by the industry and there is very high confidence in their efficacy. The construction industry standards have been in place for many years and there has been no call or need for updating it in recent years, suggesting that they represent a mature and successful set of guidelines. There is no reasonable scientific doubt that measures that have proved successful on multiple projects in the past; protecting multiple habitat types and people without significant complaint; would not be equally successful at mitigating dust effects on European site habitats.

The effect in the Thames Estuary and Marshes SPA / Ramsar

Alone

"The Project would minimise the dust effects at receptors by managing dust at source, as outlined in paragraphs 4.5.7 to 4.5.11 (this is the text within the assumptions section above). These measures are integral to the Project and would prevent any LSE on the SPA / Ramsar or its associated functionally linked land as any pathway to effect would be disrupted.

In-combination

The pathway to effect alone would be disrupted at source, therefore there cannot be a feasible risk of this effect acting in combination with other plans and projects, so the Project could not contribute to any in combination effect.

Therefore, a conclusion is reached of no LSE on the Thames Estuary and Marshes SPA / Ramsar due to construction dust as a result of the Project alone or in-combination with other plans and projects."

Annex PP 12 May 2021 Technical Note - No LSE from Lighting Construction and Operation

HRA Technical Note: No LSE from Lighting in Construction and Operation

Rev1: 11 May 2021

Introduction

Following discussion within the fortnightly consultation call 3/2/2021 and email dated 23/2/2021, Natural England requested that the HRA screening report included evidence of the efficacy of the measures to avoid and reduce lighting effects. This note has been updated following further discussion on the call on 5/5/2021 and restructuring of the HRA report (primarily concerning consideration of functionally linked land).

This technical note provides extracts from the HRA report, to support the resubmission of the DCO application, to illustrate how the assessment of the effects of lighting in construction and operation has been updated – to facilitate agreement on the conclusion in the SoCG prior to Natural England seeing the final resubmission draft of the HRA report.

Proposed text in the HRA Report (relating to screening)

Zone of influence

The zone of influence for changes in lighting is described in Table 4.1: The potential impacts and Zol at construction and operation as follows:

- Changes in light levels – construction: Within Order Limits, primarily construction compounds and work areas, where lighting is used such as construction compounds CA5, CA3A and CA3B.
- Changes in light levels – operation: Highway lighting is associated with the main line and junctions across the Project and within the tunnel. The Zol is limited to the area immediately either side of the highway.

Sites identified with potential LSE

Section 5.2 describes the European sites that could be affected by changes in lighting (without any measures in place) and these are:

1. Thames Estuary and Marshes Ramsar
 - a. during construction lighting within compounds CA3A and CA3B.
2. Functionally linked land associated with Thames Estuary and Marshes SPA/Ramsar
 - a. during construction lighting within compounds CA3A, CA3B and CA5.
 - b. during operation lighting (5 pairs of columns) along the highway approaching/exiting the north portal

Measures that reduce/avoid

The measures that are relied upon in the HRA report when assessing LSE are set out within Section 4.5 Assumptions, Project design and environmental measures. The measures are described in the HRA report as follows.

"Changes in lighting construction and operation

Construction

4.5.27 Construction compounds and worksites (which includes compounds CA5, CA3A and CA3B) would be lit for safety, security and working requirements, with a lux (lighting) level appropriate to the task and in line with industry best practice.

4.5.28 As required by the CoCP (Application Document 7.1 1), the Contractors would assess the required lux level to ensure visual intrusion and light spillage are kept to a minimum, particularly in close proximity to residential properties and busy roads where it may cause nuisance or distraction. Where necessary, the Contractors would provide lighting to site boundaries to ensure the safety of passing pedestrians.

4.5.29 Specific measures such as vertical lighting would be employed near or on the River Thames to mitigate potential impacts on wildlife and marine traffic.

4.5.30 Temporary lighting would be designed to minimise disturbance to the local areas typically by using inward-facing lighting equipment, minimising the height, and screening the worksite where possible. The control measures are detailed within the CoCP (Application Document 7.11).

4.5.31 Prior to the commencement of works below mean high water springs, proposals for lighting of marine construction works subject to the Deemed Marine Licence that require 24 hour working will be developed and submitted to the MMO. This would include an assessment of the effects of measures such as directional lighting and controls on lux levels to mitigate effects on waterfowl during 24-hour operations [REAC commitment - MB003].

Operation

4.5.32 The lighting columns include the following measures that would reduce the effect of light spill on the surrounding habitat:

- a. Column heights have been kept as low as practicable while still providing a compliant lighting design.
- b. Luminaires have been selected which emit no light above the horizontal to reduce skyglow and ensure light is only projected to where it is needed.
- c. Light-emitting diode (LED) light sources have been used to reduce energy consumption and offer a more readily recyclable product at the end of life, compared to traditional light source lamps and luminaires.
- d. Lighting levels would be linked to the live traffic flow, so that during quiet periods the lighting is dimmed to reduce energy consumption.

- e. The lighting columns would be placed in the verges projecting towards the central reserve wherever practicable to reduce light spill into adjacent areas."

The committed measures are all established good practice or embedded methods and are considered to be effective at minimising light at source and are defined in industry standards for use on construction sites. The construction measures are a mix of good practice and embedded measures and the operational measures are all embedded within the engineering design.

Assessment of no LSE

The assessment of LSE is carried out in Section 7 and relevant extracts are provided below explaining the reliance and efficacy of the committed measures.

Efficacy of committed measures

Whilst no studies of the efficacy of the committed measures are available in the literature to specifically demonstrate their effectiveness in preventing significant effects on nearby receptors, the measures have been developed over many years by the industry and there is very high confidence in their efficacy. The construction industry standards have been in place for many years and there has been no call or need for updating it in recent years, suggesting that they represent a mature and successful set of guidelines. There is no reasonable scientific doubt that measures that have proved successful on multiple projects in the past; protecting multiple habitat types and people without significant complaint; would not be equally successful at mitigating dust effects on European site habitats.

Changes in light levels - construction

The effect on Thames Estuary and Marshes Ramsar/SPA

"The Project is committed to minimising and managing lighting emissions at source on the construction site (see Section 4.5.27 to 4.5.32 (this refers measures listed above)). These measures are integral to the Project and would prevent any LSE on the SPA / Ramsar or its associated functionally linked land as any pathway to effect would be disrupted. Also, the existence of lighting associated with the various ports and other developments along this part of the River Thames means any construction lighting for this Project would not materially change overall light levels, as shown in the Landscape and Visual Figure 7.18 (Application document reference 6.2), viewpoint S38a and N04 (See copy of figure provided with this briefing note) which clearly illustrate the "night-time glow" associated with the river. Therefore, any residual light spill from the construction compounds would not result in any disturbance to the birds feeding and roosting in these parts of the Ramsar or the functionally linked land associated with the SPA/Ramsar ."

Changes in light levels - operation

The effect on functionally linked land associated with the Thames Estuary and Marshes SPA / Ramsar

"There would be no direct effect on the SPA / Ramsar as the site falls outside the zone of influence of the operational lighting. The road is in tunnel under the majority of the functionally linked land and is only lit within the tunnel and within the cutting at the north portal where five

pairs of lighting columns are proposed on approach to/exit from the tunnel (see Volume 2. General Arrangement Sheet 17 of 47 (Application Document Reference 2.5)).

The Project is committed to a number of design principles relating to the lighting design (see measures listed above) which will reduce the light emissions at source. The lighting columns at the north portal are also within a cutting which will further reduce the effects of any residual light spill. Also, the existence of lighting associated with the various ports and other developments along this part of the River Thames means that the road lighting at the north portal would not materially change overall light levels, as shown in the Landscape and Visual Figure 7.18 (Application document reference 6.2), viewpoint S38a and N04 which clearly illustrate the "night-time glow" associated with the existing river developments. Therefore, the changes in light levels would not result in any disturbance to the birds feeding and roosting in these parts of the functionally linked land.

In combination effects for changes in lighting construction and operation

"The pathway to effect alone would be disrupted at source, therefore there cannot be a feasible risk of this effect acting in combination with other plans and projects, so the Project could not contribute to any in combination effect.

Therefore, a conclusion is reached of no LSE on the Thames Estuary and Marshes SPA / Ramsar, including the functionally linked land, due to lighting as a result of the Project alone or in-combination with other plans and projects."

If you need help accessing this or any other National Highways information, please call **0300 123 5000** and we will help you.

© Crown copyright 2023.

You may re-use this information (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence. To view this licence:

visit www.nationalarchives.gov.uk/doc/open-government-licence/

write to the **Information Policy Team, The National Archives, Kew, London TW9 4DU**, or email psi@nationalarchives.gsi.gov.uk.

Mapping (where present): © Crown copyright and database rights 2023 OS 100030649. You are permitted to use this data solely to enable you to respond to, or interact with, the organisation that provided you with the data. You are not permitted to copy, sub-licence, distribute or sell any of this data to third parties in any form.

If you have any enquiries about this publication email info@nationalhighways.co.uk or call **0300 123 5000***.

*Calls to 03 numbers cost no more than a national rate call to an 01 or 02 number and must count towards any inclusive minutes in the same way as 01 and 02 calls.

These rules apply to calls from any type of line including mobile, BT, other fixed line or payphone. Calls may be recorded or monitored.

Printed on paper from well-managed forests and other controlled sources when issued directly by National Highways.

Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ

National Highways Limited registered in England and Wales number 09346363