

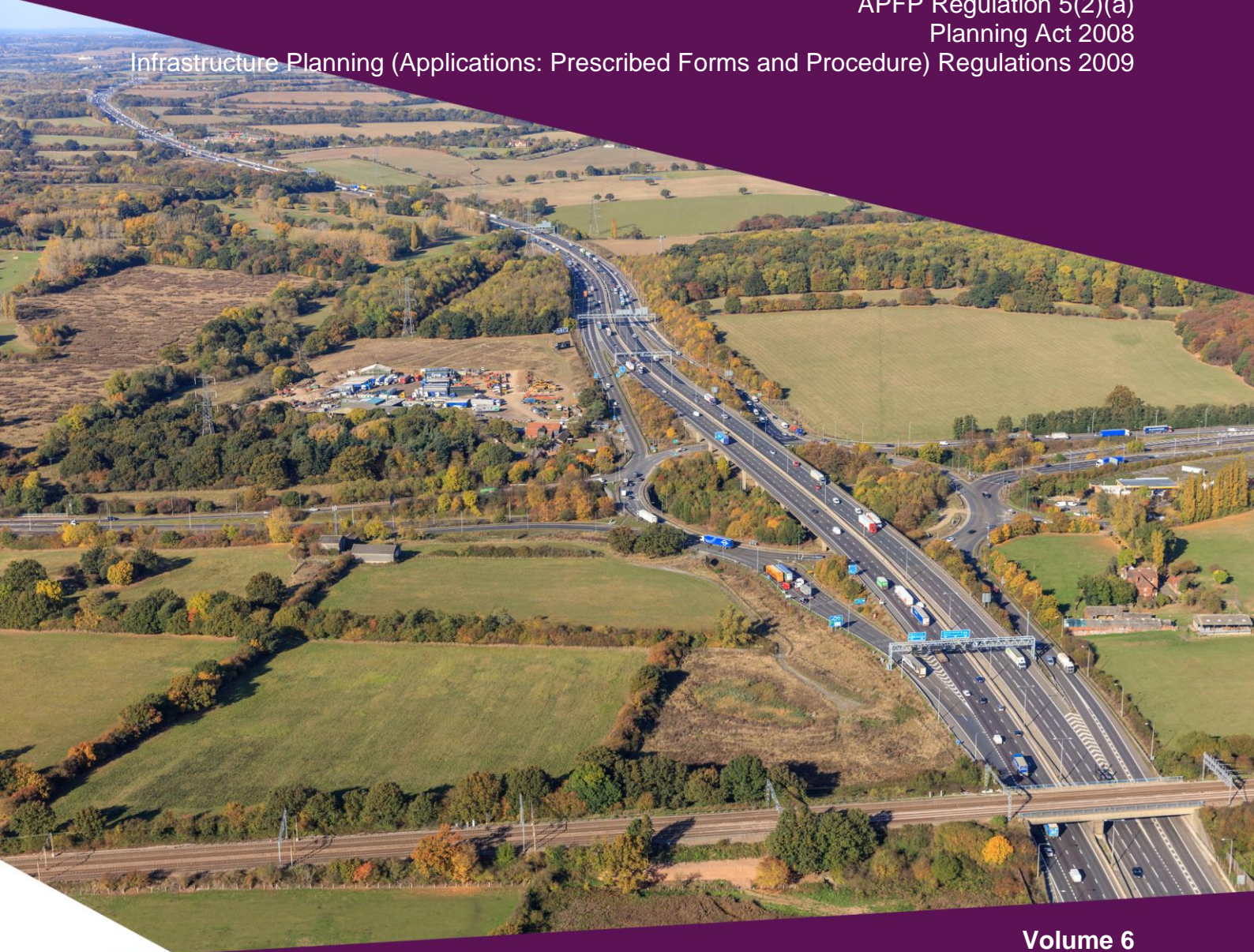
M25 junction 28 improvement scheme TR010029

6.3 Environmental Statement

Appendix 7.16: Outline landscape and ecological management and monitoring plan

APFP Regulation 5(2)(a)
Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

M25 junction 28 scheme Development Consent Order 202[x]

6.3 ENVIRONMENTAL STATEMENT 7.16: OUTLINE LANDSCAPE AND ECOLOGICAL MANAGEMENT AND MONITORING PLAN

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Appendix 7.16

Outline landscape and ecological management and monitoring plan

1. Introduction

1.1 Scope of the document

- 1.1.1 This Outline Landscape and Ecological Management and Monitoring Plan (LEMP) describes the proposed management and monitoring of the landscape and ecological mitigation and compensation features of the M25 junction 28 improvements scheme (the Scheme). This document forms Appendix 7.16 of the Environmental Statement (ES) (application document TR010029/APP/6.3).
- 1.1.2 The Scheme is a Nationally Significant Infrastructure Project (NSIP) and this Outline LEMP has been developed in support of Highways England's application for a Development Consent Order (DCO) to authorise construction, operation and maintenance of the Scheme. An Environmental Impact Assessment (EIA) has been carried out for the Scheme and is reported in the ES (application document TR010029/APP/6.1).
- 1.1.3 Mitigation and compensation measures are provided in the ES to reduce and alleviate significant effects of the Scheme. These include creation of new habitats and natural features such as woodland and grassland, and improvements to existing habitats, such as the river corridors.
- 1.1.4 This Outline LEMP is based on the commitments set out in the ES for the Scheme, and specifically those in the Register of Environmental Actions and Commitments (REAC) (application document TR010029/APP/7.3) and Preliminary environmental design (application document TR010029/APP/6.2).
- 1.1.5 This Outline LEMP sets out the objectives for creation and management of new landscape and ecology features within the Scheme, and targets for the desired long-term condition of new features to implement the mitigation and compensation measures. Management prescriptions are provided for new features that require management beyond the completion of construction including landscaping establishment period¹ of the Scheme in order to meet the target condition.
- 1.1.6 This Outline LEMP has been produced to ensure that new features meet the following broad objectives:
- Visual screening – wherever possible to retain existing screening vegetation; to screen views of new elements of the Scheme from existing and future residents; and to screen views of the existing road and new infrastructure which have been opened up due to construction works from existing and future residents.
 - Landscape integration – to reflect the local rural wooded landscape character and planting style at junction 28; and incorporate elements of a scale redolent of the existing landscape elements.

¹ Refers to the contracted 5-year period where the Principal Contractor is responsible for monitoring the establishment of new planting and seeding and replacing defects.

- Nature conservation and biodiversity – to provide biodiverse, connected habitats, following the guidance of the Lawton Report for ‘more, bigger, better and joined up’ wildlife sites and ecological networks²; and control and eradication of non-native invasive species.

- 1.1.7 A Construction Environmental Management Plan (CEMP) will be produced by the Principal Contractor to mitigate the impacts during the construction phase of the Scheme. This will broadly follow the Outline CEMP (application document TR010029/APP/7.2) and will reflect the mitigation measures set out in the REAC (application document TR010029/APP/7.3) requirements.
- 1.1.8 This Outline LEMP does not include routine vegetation management activities required for safety, such as maintaining visibility splays; or routine maintenance tasks such as rubbish removal, repair to fences, or reinstatement of habitat following incidents or incursions to the verge.
- 1.1.9 The management and maintenance of the Scheme, including all landscape, habitat areas and associated features included in this Outline LEMP, will remain the responsibility of the respective landowner following hand over of the project after the establishment period.
- 1.1.10 This is a preliminary document and this Outline LEMP is based on the preliminary design to date. All details are subject to further work and stakeholder engagement. A final version of the LEMP will be created by the Principal Contractor for implementation during the establishment period and after the establishment period. The LEMP will be substantially in accordance with this Outline LEMP, including the habitat management objectives, targets and prescriptions set out in it. The preparation of a LEMP will be secured by requirement 5 of the DCO and submitted to the Secretary of State (SoS) for their approval in writing, following consultation with the relevant planning authority.
- 1.1.11 The protected species licences and the CEMP will be taken into consideration during the development of the LEMP.

1.2 Structure of the document

- 1.2.1 This document includes the following sections:
- An overview of how the LEMP will be implemented, including roles and responsibilities of individual parties is provided.
 - A brief summary of the environmental context of the Scheme and the potential effects on landscape and visual receptors or biodiversity resources to support the development of this Outline LEMP.
 - The approach to mitigation and compensation design including specific design constraints and assumptions.
 - The objectives for creation and management of new landscape and ecology features, targets for function/condition, and outline prescriptions for management activities.

² Lawton, J.H. et al (2010) Making Space for Nature: a review of England's wildlife sites and ecological network. Report to Defra.

- An outline management plan which includes timescale periods for management requirements.
- Outline specifications for management activities and monitoring.

1.3 Definitions

- Biodiversity resources – biodiversity elements such as designated sites, habitats and populations of species considered during the environmental impact assessment that may incur impacts from the Scheme.
- Ecological Compensation Area – land acquired for mitigation or compensation in relation to effects of the Scheme on biodiversity resources.
- Ecology features – new or retained elements included within the design of the Scheme that provide mitigation or compensation for effects on biodiversity resources.
- Highway verge and associated land – this refers to land within Highways England ownership that forms part of the operational estate required for function of the motorway. This includes embankments, cuttings, land within junctions and attenuation ponds, etc. It does not include land used for mitigation or compensation that is not required for the function of the motorway.
- Landscape and visual receptors – landscape and visual elements considered during the environmental impact assessment that may incur impacts from the Scheme.
- Landscape features – new or retained elements included within the design of the Scheme to mitigate or compensate for effects on landscape and visual receptors.
- Management features – new or retained features subject to management activities that are required to facilitate establishment and desired condition.
- Management plots – areas of land where management is to be carried out.

2. Implementation of the Landscape and ecological management and monitoring plan (LEMP)

2.1 Roles and responsibilities

Highways England

- 2.1.1 Highways England has committed to make resources available for the works described within this Outline LEMP for the duration outlined in Table 6.1. These durations are dependent on habitat type and/or management activities.
- 2.1.2 Highways England will continue to be responsible for carrying out routine maintenance of any highways assets such as road verges and drainage systems as part of their routine asset management programme.

Principal Contractor

- 2.1.3 The appointed Principal Contractor will be responsible for carrying out the detailed design and construction works detailed in the DCO; they will have the overall control of delivering the Scheme.
- 2.1.4 The Principal Contractor will be responsible for restoration and reinstatement of existing habitats and creating the intended habitats in accordance with the Preliminary environmental design (see Figure 2.2, application document TR010029/APP/6.2) in any temporary or permanent land take areas and compensation areas. They will be responsible for constructing any new structures or features (such river enhancements and wildlife ponds).
- 2.1.5 The Principal Contractor will be responsible for monitoring the establishment of new planting and seeding as set out in Table 7.1 and in line with the detailed landscape scheme specification. They will also be responsible for replacing planting defects during the contracted establishment period, and any other management prescriptions provided in Table 6.1 that are scheduled to be undertaken during the establishment period.
- 2.1.6 The Principal Contractor will appoint an appropriately experienced and qualified landscaping contractor. The contractor is to be competent at identifying plant species, including those proposed as part of seeded and planted mixes, as well as any undesirable species, and experienced in the various habitat creation and enhancement works required on this Scheme. Specialist work (such as pond and backwater creation) may be carried out by specialist sub-contractors appointed by the Principal Contractor where particular specific skills, equipment and/or experience are required.

Highways England's maintenance agent

- 2.1.7 It is expected that the long-term management of the management plots will be undertaken by Highways England's maintenance agent responsible for the Highways England estate within the M25 sphere.

Monitoring party

- 2.1.8 Monitoring the progress towards the targets is critical to meeting the objectives. Highways England will appoint a monitoring party to monitor the outcomes of the

works carried out at set intervals during the agreed management/monitoring period following handover. The monitoring shall be undertaken by suitably qualified and experienced ecologists and landscape architects.

- 2.1.9 The monitoring will record details of management works carried out, targets met, and/or remedial actions required. Records of monitoring will be retained for reference. Monitoring will be continued for the duration that management activities are undertaken.
- 2.1.10 Monitoring will be carried out to determine:
- Whether measures have been implemented as agreed
 - The relative success/effectiveness of the measures
 - How to remedy the situation if any of the measures fail
 - If further consultation / approvals are required in the instance that the proposed measures are not proving effective

2.2 Habitat management and monitoring duration

- 2.2.1 The duration of management and monitoring for each landscape/ecology element created or enhanced is 25 years from completion of the authorised development.
- 2.2.2 The LEMP will be reviewed periodically to determine whether the management activities are meeting the objectives.

2.3 Delivery of the LEMP

Adoption of compensation areas

- 2.3.1 The Ecological Compensation Areas (ECAs) will be purchased from the current landowner by Highways England. The Principal Contractor will be responsible for initial maintenance of the compensation areas under the construction contract, which would be for five years. It is Highways England's intention to retain the land and the Highways England's maintenance agent will be responsible for carrying out the long-term management works in the compensation areas.

3. Environmental context

- 3.1.1 The ES describes the landscape and visual receptors and biodiversity resources present within the zone of influence of the Scheme.
- 3.1.2 There are residual effects on landscape and visual receptors, and biodiversity resources, including veteran trees, Ingrebourne River, and Ingrebourne Valley Site of Metropolitan Importance for Nature Conservation.
- 3.1.3 There are potential effects on other biodiversity resources that are expected to be temporary until new habitats created as mitigation and compensation become established. Following establishment, the overall effects on biodiversity resources are expected to be of neutral significance.
- 3.1.4 Full details of mitigation and compensation measures for the effects of the Scheme on landscape and visual receptors and biodiversity resources are found in the Biodiversity and Landscape ES chapters (Chapters 7 and 9 respectively) (application document TR010029/APP/6.1).
- 3.1.5 As mitigation for damage during the construction phase, temporary construction areas (contractor's compounds and haul routes) will be restored to former habitats in a form more beneficial to wildlife compared to the existing conditions prior to construction, where possible.
- 3.1.6 The ES takes into account the effects on protected species from the Scheme and describes the mitigation and compensation required. Certain species (i.e. great crested newt) will require licences to allow construction and management operations to be undertaken in line with protected species legislation.
- 3.1.7 The conditions to be attached to protected species licences will need to be considered in conjunction with this Outline LEMP.
- 3.1.8 Consultation has been undertaken with Natural England, London Borough of Havering and Essex County Council.

4. Mitigation/compensation design approach

4.1 Principles

- 4.1.1 The design development included multi-disciplinary collaboration by taking into account the environment, sustainability, community and external stakeholders as well as constructability, technical performance, cost, programme and resources.
- 4.1.2 Throughout the preliminary design of the Scheme, the principles of the mitigation hierarchy of avoid, mitigate, compensate³ (see Table 4.1) below were followed influencing the approach to the engineering and environmental design.
- 4.1.3 Wherever possible measures were taken to avoid impacts on landscape and visual receptors and biodiversity resources as outlined in Table 4.1. Such features include designated sites, habitats, trees, visual receptors and species populations. Where this was not possible, solutions were sought to minimise the impacts. Only then are mitigation or compensation measures proposed.

Table 4.1: Mitigation hierarchy

Mitigation action	Description
Avoid	Measure(s) taken to ensure an identified effect does not occur. This is the most preferable solution.
Mitigate	Measure(s) taken to decrease the significance of an identified effect. Effects can either become not significant or remain significant, although to a lesser extent. Where effects cannot be avoided this is the next most preferable solution.
Compensate	Where an effect cannot be avoided or reduced, it is proposed to reinstate affected areas, or provide alternative equivalent resource elsewhere (and preferably nearby).

Table Source: Guidelines for Ecological Impact Assessment in The UK And Ireland Terrestrial, Freshwater, Coastal and Marine. Version 1.1 CIEEM, 2019

- 4.1.4 Where potential significant effects have been predicted, during either the construction or operation phases, measures have been incorporated into the design to avoid, mitigate or compensate for these impacts and effects.
- 4.1.5 New features have been designed to be implemented during construction to compensate for residual effects on landscape and visual receptors or biodiversity resources, such as losses from designated sites and habitats, or visual impacts. This includes new habitats within four ECAs, as well as provision of woodland for visual screening. Further details are provided in Section 5.
- 4.1.6 Land that is required as compensation for residual effects on biodiversity resources includes:
- Land within the loop road up to the Weald Brook (not including the attenuation pond enclosure) (ECA A).
 - Land to the north-west of the loop road up to Maylands Golf Club in the west, Cock Wood to the north, and Weald Brook to the east (ECA B).

³ CIEEM (2019) *Guidelines for Ecological Impact Assessment in The UK And Ireland Terrestrial, Freshwater, Coastal and Marine. Version 1.1*. Chartered Institute for Ecology and Environmental Management, Winchester

- The Weald Brook and Ingrebourne River, including its backwaters and banks (ECA C).
- Land south of The Grove, up to the boundary of the A12, which will be bisected by the realigned Ingrebourne River (ECA D).

4.1.7 These areas are shown on the Landscape and ecology management areas drawings (Appendix B).

4.1.8 Landscape and ecology mitigation and compensation features are shown on the Preliminary environmental design drawings, Figure 2.2 (application document TR010029/APP/6.2).

4.1.9 Detailed design will be in general accordance with the preliminary Scheme design showing on the Scheme layout plans and cross sections (application document TR010029/APP/2.6 and TR010029/APP/2.8).

4.2 Mitigation during construction

4.2.1 As part of the mitigation for impacts on landscape and visual receptors and biodiversity resources, the design includes measures for protecting and retaining vegetation and habitats throughout construction. Measures to avoid or mitigate for impacts on landscape and visual receptors, and biodiversity resources during the construction phase have been incorporated into the Outline CEMP (application document TR010029/APP/7.2).

4.2.2 Temporary construction areas (contractor's compounds and haul routes) will be restored in line with the DCO requirements to former habitats after construction. The land will be restored to the reasonable satisfaction of the owners of the land however, Highways England will not be required to:

- Restore the land on which any permanent works under Schedule 1 of the DCO (TR010029/APP/3.1) have been constructed.
- Remove any ground strengthening works which have been placed on the land to facilitate construction of the authorised development.
- Remove any measures installed over or around statutory undertakers' apparatus to protect that apparatus from the authorised development.
- Remove or reposition any apparatus belonging to statutory undertakers or necessary mitigation works.

4.3 Planting and seeding specification

4.3.1 The detailed specifications for ground preparation, planting and seeding will be provided at detailed design stage. This Outline LEMP provides preliminary species mixes in Section 5.

4.4 Monitoring strategy

4.4.1 A suitable programme of monitoring of new features will be implemented to identify and remedy any failings with the management of the ECAs as well as determine success. An outline monitoring specification is set out in Section 7.

4.5 Summary of key design constraints

- 4.5.1 The ECA design is provided in response to the impacts on landscape and visual receptors and biodiversity resources, the landscape character of the area and the historical land-use assumed. These are identified during the environmental impact assessment process and reported in the ES.
- 4.5.2 The preliminary design takes into account the requirements of protected species that will be subject to licence to undertake the works, in particular the European Protected Species Mitigation Licence for great crested newt.
- 4.5.3 Also, the design considers the large population of fallow deer that is present in the area.
- 4.5.4 Vehicular access to the ECAs for management operations have been provided as part of the preliminary design.
- 4.5.5 The design takes into account the predicted state of the ECAs following construction activities, including any damage due to disturbance to the habitat and soils from earthworks and utilities diversions.
- 4.5.6 The mitigation design takes into account the restrictions to maintenance and operational activities within the highway boundary arising from safety requirements. Opportunities of minimal intervention while meeting the objectives of the landscape and biodiversity mitigations, have been sought.
- 4.5.7 The landscape and ecology mitigation and compensation proposals have taken into account, as far as reasonably possible, the interests of the adjacent landowners and any effects the mitigation design might have on external stakeholders.

4.6 Design assumptions

- 4.6.1 The following design assumptions have been made where the mitigation design is subject to further assessments or activities at detailed design or construction stage:
 - Species rich grassland seeding will be on soils stripped of topsoil. Surplus topsoil will be utilised elsewhere on site, taking into account prevention of spread of invasive plant species (see Appendix A).
 - Amenity grassland areas will be on areas prepared with topsoil gained from the site and not imported, taking into account prevention of spread of invasive plant species (see Appendix A).
 - Flood Lowering Areas where marshy grassland is to be created will have a pattern of flooding frequency and average inundation depth to allow establishment and maintenance of the desired marshy grassland species.
 - Mitigation ponds included in the design will be fed by rainwater which runs-off the surrounding land surface, and suitable clay material will be present to form the lining, thus allowing water retention. Rainwater run-off will be, in most years, sufficient to maintain water in the pond for the majority of the year.
 - Access is assumed to be agreed for both sides of the Weald Brook for management.

- Hibernacula construction will utilise materials generated during site clearance.
- Attenuation ponds are not considered for management in this Outline LEMP and will be maintained under a separate maintenance specification. The exception is the surrounds of each attenuation pond, which will include grassland habitat.
- This Outline LEMP does not include routine vegetation management activities required for safety, such as maintaining visibility splays; or routine maintenance tasks such as rubbish removal, repair to fences, or reinstatement of habitat following incidents or incursions to the verge.
- Following treatment of invasive non-native species, disposal will include removal of plant material from site or on-site composting, or burial.

5. Management features – objectives, targets and prescriptions

5.1 Woodland

Mitigation/compensation context

5.1.1 Woodland creation is required for replacement of vegetation lost through construction of the Scheme and for providing visual screening from sensitive receptors. New woodland areas will also aid with integration of the Scheme into the wider landscape context.

5.1.2 In the context of biodiversity, new woodland will provide:

- Compensation for loss of woodland habitat from within the Ingrebourne Valley SMI
- Mitigation/compensation for loss of habitat from the motorway verge and elsewhere outside the SMI
- Mitigation for temporary damage during the construction phase
- Mitigation/compensation for loss of habitat for great crested newt, bats and priority invertebrates

Locations

West of the loop road

5.1.3 Woodland blocks shall be created along the outside perimeter of the loop road (Management Plot W1, see Table 6.1 and Landscape and ecology management areas plan, in Appendix B).

Within highways verge and associated land

5.1.4 Woodland will be created on the new earthworks and elsewhere within the new highway boundary of the Scheme. Woodland will be restricted to locations away from the highway so as not to impact upon sightline zones.

Selected areas within scheme extents particularly outside road corridor

5.1.5 Woodland blocks will be planted within and along the entry and exit slip roads of the M25 where space and sightline zones permit.

Landscape and biodiversity objectives

5.1.6 The following broad objectives will be adopted for the creation, enhancement, retention and management of landscape and biodiversity features throughout the Scheme:

- Visual screening of the road from neighbouring properties and other views
- Tie the Scheme into landscape reflecting local rural wooded landscape character and planting style
- Incorporate elements of a scale redolent of the existing landscape elements

- Integrate retained mature and veteran trees and dead wood habitat
- Improve biodiversity, through providing a diversity of species and structure, which will enhance feeding and shelter opportunities of invertebrates and in turn for other species such as birds and bats

Management approach

- 5.1.7 New woodland will be managed to maintain a dense low canopy that will provide effective visual screening to sensitive receptors. A shrub layer within the woodland will be encouraged through retention/protection of selected shrub species.
- 5.1.8 Woodland shall be created through a mixture of new planting and natural generation. To provide new woodland, trees will be planted in random formation, and ground flora species introduced to supplement natural colonisation. Woodland plots will have scalloped edges where possible.
- 5.1.9 All new woodland will undergo initial thinning as required, then selected areas will be coppiced or pollarded on rotation, with a section cut every winter. Pollarding shall be used where there is a means to prevent browsing of the regrowth by deer. Existing mature or veteran trees shall be retained and not removed, pollarded or coppiced.
- 5.1.10 Thinning, pollarding or coppicing operations will aim to maintain visual screening or continuity of habitat corridors as much as possible while balancing the objective to provide light to ground flora and bushy re-growth;
- 5.1.11 Selected woodland within highways verge and associated land shall have minimal intervention. Minimal-intervention plots shall only require removal of non-native invasive plants as required.
- 5.1.12 Dead wood within woodland will be left in situ and not disturbed as much as possible to provide habitat for invertebrates.
- 5.1.13 New woodland will be protected from browsing deer by means of appropriate fencing until established. Areas required for dense visual screening will be permanently protected from deer browsing to maintain a low canopy and shrub layer.
- 5.1.14 Individual specimens of the early-flowering species cherry plum will be planted at the edge of and within woodland in order to provide an early food resource for invertebrates as well as dead wood habitat when aged.

Targets

- 5.1.15 The targets for woodland are:
- To provide an effective visual screen to sensitive receptors within 15 years.
 - To create diverse woodland with a range of native woody species with affinities to local woodlands. Primary target species include hornbeam, hawthorn and hazel to be in keeping with local woodland. Ash is not recommended for use in planting due to the risk of importing ash dieback disease and the ability of the species to readily colonise.

- At least one of the following target National Vegetation Classification (NVC)⁴ communities should be present or developing: W8 *Fraxinus excelsior-Acer campestre-Mercurialis perennis* (ash-field maple-dog's mercury) woodland, and W10 *Quercus robur-Pteridium aquilinum-Rubus fruticosus* (pedunculate oak-bracken-bramble) woodland.

5.1.16 An illustrative species mix for woodland planting is provided in Table 5.1 below.

Table 5.1: Illustrative planting mix for woodland creation

Common name	Scientific name
Pedunculate Oak	<i>Quercus robur</i>
Hornbeam	<i>Carpinus betulus</i>
Field Maple	<i>Acer campestre</i>
Hazel	<i>Corylus avellane</i>
Hawthorn	<i>Crataegus monogyna</i>
Elder	<i>Sambucus nigra</i>
Wild Cherry	<i>Prunus avium</i>
Spindle	<i>Euonymus europaeus</i>
Cherry plum	<i>Prunus cerasifera</i>
Dog rose	<i>Rosa canina</i>

Prescriptions

5.1.17 The following management prescriptions are proposed for woodland creation.

- New woodland will be created using a mixture of suitable native species.
- New woodland will undergo establishment period maintenance (see Appendix A of this document for outline specification).
- All new woodland will be thinned out by removal of 15% of trees in the first 5-8 years. Thinning shall be carried out in winter by hand using chainsaws. Weak, damaged or irregular growth trees shall be selected for removal. Existing mature or veteran trees shall be retained.
- Following thinning, woodland on the highways verge or associated land will have minimal intervention except removal of non-native invasive plants as required. Fallen and standing dead wood within woodland shall be left in situ.
- All new woodland shall be protected from deer browsing by appropriate exclusion fencing.

⁴ The National Vegetation Classification is a standard technique for the description of native British vegetation types, described in Rodwell J.S (Ed.) (1990 et seq.) *British Plant Communities Volumes 1-5*. Cambridge University Press.

- New woodland created on the western side of the loop road (Management Plot reference W1, refer to Table 6.1 and the Landscape and ecology management areas drawings in Appendix B) will be coppiced or pollarding on rotation, with one fifth cut each year annually in winter. Coppicing/pollarding shall commence 5-10 years after planning/regeneration of trees. Coppicing or pollarding shall be carried out by hand using chainsaws.
- Where pollarding is used, trees shall be cut on first occasion at 2 m height, and thereafter any regrowth shall be trimmed back to the same point.
- Where coppicing is used, trees shall be cut on first occasion 200 mm height, and thereafter any regrowth shall be cut back to the same point.

5.2 Dense scrub

Mitigation/compensation context

5.2.1 New areas of dense scrub will provide mitigation and compensation for effects on biodiversity resources, in particular:

- Compensation for loss of habitat from within the Ingrebourne Valley SMI
- Mitigation/compensation for loss of habitat from the motorway verge and elsewhere outside the SMI
- Mitigation/compensation for loss of habitat for great crested newt, bats, birds and priority invertebrates

Locations

Within highways verge and associated land

5.2.2 Dense scrub will be created in selected areas on new earthworks and elsewhere within the new highway boundary of the Scheme. Dense scrub will be located on the margins of woodland blocks.

Ecological compensation areas

5.2.3 Dense scrub will be created in selected areas in ECA B.

Objectives

- Provide a range of successional scrub habitats, from occasional scattered scrub in a mosaic with grassland grading to more dense scrub habitats where there is a transition to woodland.
- Improve biodiversity, through providing a diversity of species and structure, which will enhance feeding and shelter opportunities of invertebrates and in turn for other species such as great crested newts, reptiles, birds and bats.
- Control of non-native invasive species.

Management approach

- 5.2.4 Dense scrub shall be formed by a mixture of new planting and natural generation. To provide new scrub by planting, shrubs will be planted in random formation, and ground flora species introduced to supplement natural colonisation.
- 5.2.5 Selected areas within ECA B shall be planted to form blocks of dense scrub. These blocks shall be coppiced on rotation, with a section cut each winter.
- 5.2.6 Smaller patches of scattered scrub within grassland areas of ECA B will be allowed to form dense scrub as part of a mosaic of grassland of varying structure (see below), scattered and dense scrub. These smaller blocks will be periodically cleared on rotation as part of grassland management.
- 5.2.7 Selected scrub on woodland edge within highways verge and associated land shall be coppiced on rotation, with a section cut every winter, to maintain gradation of structure.
- 5.2.8 Individual specimens of the early-flowering species cherry plum will be planted within dense scrub in order to provide an early food resource for invertebrates as well as dead wood habitat when aged.
- 5.2.9 Dense scrub areas will be protected from deer browsing until established.

Targets

- 5.2.10 The targets for dense scrub are:
- To create patches of mixed species dense scrub within grassland or at the margins of woodland within 10 years. Primary target species include hawthorn, blackthorn and bramble. Scrub shall be considered to be dense scrub when shrub plants form a connecting canopy.
 - At least one of the following target National Vegetation Classification (NVC) communities should be present or developing: W21 *Crataegus monogyna*-*Hedera helix* (hawthorn-ivy) scrub, W22 *Prunus spinosa*-*Rubus fruticosus* (blackthorn-bramble) scrub, W23 *Ulex europaeus*-*Rubus fruticosus* (gorse-bramble) scrub, and W24 *Rubus fruticosus*-*Holcus lanatus* (bramble-Yorkshire fog) scrub.
 - Target proportion of dense scrub in ECA B: 15%.
 - Target proportion of dense scrub on woodland edge within highways verge and associated land: 10% of total plot area.
- 5.2.11 An illustrative species mix for scrub planting is provided in Table 5.2 below.

Table 5.2: Illustrative planting mix for dense scrub

Common name	Scientific name
Hawthorn	<i>Crataegus monogyna</i>
Blackthorn	<i>Prunus spinosa</i>
Cherry plum	<i>Prunus cerasifera</i>

Common name	Scientific name
Dog rose	<i>Rosa canina</i>

Prescriptions

- 5.2.12 The following management prescriptions are proposed for dense scrub creation.
- Selected areas of grassland with scattered scrub within ECA B shall be enclosed, removed from grassland management and protected from deer browsing to allow natural regeneration of scrub.
 - Select areas of woodland edge with the highways verge and associated area shall be enclosed, removed from grassland management and protected from deer browsing to form into dense scrub. Scalloped edges to be created.
 - Coppicing will commence 5 years after enclosure of dense scrub blocks.
 - Dense scrub within ECA B shall be coppiced on rotation, with one fifth cut a year, on a 5 year cycle. Coppicing shall be carried out by hand using chainsaws.
 - Dense scrub on woodland edges within highways verge and associated areas shall be coppiced on rotation, with one fifth cut a year, every 5 years. Coppicing shall be carried out by hand using chainsaws.
 - Where coppicing is used, trees shall be cut on first occasion 200 mm height, and thereafter any regrowth shall be cut back to the same point.
 - Invasive, non-native species (see Appendix A) will be controlled to prevent further spread and removed/eradicated as much as possible.

5.3 Dry wildflower grassland

Mitigation/compensation context

- 5.3.1 New and restored areas of dry wildflower grassland will provide mitigation and compensation for effects on biodiversity resources, in particular:
- Compensation for loss of habitat from within the Ingrebourne Valley SMI.
 - Mitigation/compensation for loss of habitat from the motorway verge and elsewhere outside the SMI.
 - Mitigation for temporary damage during the construction phase.
 - Mitigation/compensation for loss of habitat for reptiles (in margins), bats and priority invertebrates.

Locations

Highways verge and associated land

- 5.3.2 Dry wildflower grassland will be created in selected areas on new earthworks and elsewhere within the new highway boundary of the Scheme.
- 5.3.3 The surrounding margin of attenuation ponds will be utilised for dry wildflower grassland creation.

Ecological compensation areas

- 5.3.4 Dry wildflower grassland shall be the primary habitat of ECA A, and a component of ECA D.

Objectives

- Provide a species-rich grassland habitat of native grasses and wildflowers, with a mosaic of structure.
- Create transitional habitat grading from grassland to more dense scrub habitats where adjacent to dense scrub or woodland.
- Improve biodiversity, through providing a diversity of species and structure, which will enhance feeding and shelter opportunities of invertebrates and in turn for other species such as reptiles, birds, bats and small mammals.
- Control of invasive plant species.

Management approach

- 5.3.5 Dry wildflower grassland will be created from a combination of seeding and reinstatement of existing grassland where this remains flowing construction.
- 5.3.6 Following establishment, dry wildflower grassland shall be mown annually or every three years. Mowing shall aim to create a variety of structure and sward height by variations in the mowing frequency and location each year. Management shall aim to create the following grassland structural types:
- Meadow (mown annually)
 - Margin (one third mown every year on rotation)
- 5.3.7 The margin will be left where grassland is adjacent to other habitats and will be mown less frequently than the main grassland area. Margins will remain undisturbed other than when mown to allow a refuge for invertebrates and other animals.
- 5.3.8 Invasive plants shall be treated where present, with the aim of eradicating non-native goldenrod from grassland areas as much as possible.

Targets

5.3.9 The targets for dry wildflower grassland are:

- To create semi-open diverse grassland habitat with a range of native species within 5 years. Primary target species include sheep's fescue, common knapweed and wild carrot.
- Grassland types include meadow and margin types. Margins should be approximately 5 m in width.
- At least one of the following target National Vegetation Classification (NVC) communities should be present or developing: MG1 *Arrhenatherum elatius* (false oat-grass) grassland, MG5 *Cynosurus cristatus*-*Centaurea nigra* (crested dog's-tail-common knapweed) grassland and MG6 *Lolium perenne*-*Cynosurus cristatus* (perennial rye-grass-crested dog's-tail) grassland.
- Target quantity of scattered scrub within plot (not including dense scrub areas): 0%

5.3.10 An illustrative species mix for dry wildflower grassland is provided in Table 5.3 below.

Table 5.3: Illustrative seeding mix for dry wildflower grassland

Common name	Scientific name
Red fescue	<i>Festuca rubra</i>
Meadow foxtail	<i>Alopecurus pratensis</i>
Yorkshire fog	<i>Holcus lanatus</i>
Common bent	<i>Agrostis capillaris</i>
Creeping bent	<i>Agrostis stolonifera</i>
Sweet vernal grass	<i>Anthoxanthum odoratum</i>
Crested dog's-tail	<i>Cynosurus cristatus</i>
Ox-eye daisy	<i>Leucanthemum vulgare</i>
Common knapweed	<i>Centaurea nigra</i>
Common cat's-ear	<i>Hypochaeris radicata</i>
Wild carrot	<i>Daucus carota</i>
Musk mallow	<i>Malva moscata</i>
Meadow vetchling	<i>Lathyrus pratensis</i>
Tufted vetch	<i>Vicia cracca</i>
Common vetch	<i>Vicia sativa</i>
Cowslip	<i>Primula veris</i>

Prescriptions

5.3.11 The following management prescriptions are proposed for dry wildflower grassland creation.

- Dry wildflower grassland shall be created within ECA A and ECA D through a combination of reinstatement and seeding using a mixture of suitable native species.
- Dry wildflower grassland habitat shall be created on the new earthworks, around new attenuation ponds, and elsewhere within the new highway boundary of the Scheme through seeding using a mixture of suitable native species.
- Dry wildflower grassland plots shall be sub-divided into central meadow and margin areas. Margins shall be located adjacent to dense scrub, woodland, hedgerow habitats, or rivers.
- Meadow areas shall be mown once annually.
- One third of margin areas shall be mown every year on rotation.
- All mowing operations shall be undertaken in between late August and early October during dry weather.
- Where possible, cuttings shall be left lying for 3-4 days to allow seeds to ripen and drop. Cuttings shall be removed from the plot for composting off-site.
- Invasive, non-native species (see Appendix A) will be controlled to prevent further spread and removed/eradicated as much as possible.

5.4 Dry tussocky grassland with scattered scrub

Mitigation/compensation context

5.4.1 New and restored areas of dry tussocky grassland with scattered scrub will provide mitigation and compensation for effects on biodiversity resources, in particular:

- Compensation for loss of habitat from within the Ingrebourne Valley SMI
- Mitigation/compensation for loss of habitat from the motorway verge and elsewhere outside the SMI
- Mitigation for temporary damage during the construction phase
- Mitigation/compensation for loss of habitat for great crested newt, reptiles, bats and priority invertebrates

Locations

Ecological compensation areas

5.4.2 Dry tussocky grassland shall be the primary habitat of ECA B.

Objectives

- Provide a species-rich tussocky grassland habitat of native grasses and wildflowers, with a mosaic of structure, and occasional scattered native scrub species.
- Create transitional habitat grading from tussocky grassland to more dense scrub habitats where adjacent to dense scrub or woodland.
- Improve biodiversity, through providing a diversity of species and structure, which will enhance feeding and shelter opportunities for invertebrates and in turn for other species such as great crested newts, reptiles, birds, bats and small mammals.
- Control of invasive plant species.

Management approach

- 5.4.3 Dry tussocky grassland will be created from a combination of seeding and reinstatement/management of existing grassland where this remains following construction.
- 5.4.4 Following establishment, dry tussocky grassland shall be mown every 5 years on rotation. Mowing shall aim to create a variety of structure and sward height by variations in the mowing frequency and location each year. Management shall aim to create the following grassland structural types:
- Scattered scrub will be cleared from mown areas with each mowing operation.
 - Invasive plants shall be treated where present, with the aim of eradicating non-native goldenrod from grassland areas as much as possible.
- 5.4.5 Dry tussocky grassland shall remain undisturbed other than when mown to allow a refuge for great crested newts, invertebrates and other animals.

Targets

- 5.4.6 The targets for dry tussocky grassland are:
- To create tussocky grassland habitat with a range of native species within 10 years. Primary target species include false oat-grass, tufted hair-grass, tall fescue, common knapweed, oxeye daisy.
 - At least one of the following target National Vegetation Classification (NVC) communities should be present or developing: MG1 *Arrhenatherum elatius* (false oat-grass) grassland, MG9 *Holcus lanatus-Deschampsia cespitosa* (Yorkshire fog-tufted hair-grass) grassland.
 - Target quantity of scattered scrub within plot (not including dense scrub areas): 5%
- 5.4.7 An illustrative species mix for dry tussocky grassland is provided in Table 5.4 below.

Table 5.4: Illustrative seeding mix for dry tussocky grassland

Common name	Scientific name
Red fescue	<i>Festuca rubra</i>
Tall fescue	<i>Schedonorus arundinacea</i>
Tufted hair-grass	<i>Deschampsia cespitosa</i>
Meadow foxtail	<i>Alopecurus pratensis</i>
Yorkshire fog	<i>Holcus lanatus</i>
Common bent	<i>Agrostis capillaris</i>
Creeping bent	<i>Agrostis stolonifera</i>
Sweet vernal grass	<i>Anthoxanthum odoratum</i>
Crested dog's-tail	<i>Cynosurus cristatus</i>
Ox-eye daisy	<i>Leucanthemum vulgare</i>
Common knapweed	<i>Centaurea nigra</i>
Wild carrot	<i>Daucus carota</i>
Musk mallow	<i>Malva moscata</i>
Meadow vetchling	<i>Lathyrus pratensis</i>
Tufted vetch	<i>Vicia cracca</i>
Common vetch	<i>Vicia sativa</i>
Cowslip	<i>Primula veris</i>

Prescriptions

5.4.8 The following management prescriptions are proposed for dry tussocky grassland creation and management.

- Dry tussocky grassland shall be created within ECA B through a combination of reinstatement and seeding using a mixture of suitable native species.
- Dry tussocky grassland within ECA B shall be mown on a long-rotation, cut every 5 years, with one fifth of the area of grassland cut each year.
- Mowing shall be undertaken in October or November during dry weather to avoid times when amphibians and reptiles are active.
- Cutting of dry tussocky grassland shall be undertaken using a cut and collect mowing machine where possible. If mechanical collection of cuttings is not possible then cuttings shall be raked off and removed from the plot for composting off-site.
- Where possible, cuttings shall be left lying for 3-4 days to allow seeds to ripen and drop.

- Invasive, non-native species (see Appendix A) will be controlled to prevent further spread and removed/eradicated as much as possible.

5.5 Marshy grassland

Mitigation/compensation context

- 5.5.1 New areas of marshy grassland created where land is to be lowered to provide additional flood storage capacity will provide mitigation and compensation for effects on biodiversity resources. In particular:
- Compensation for loss of habitat from within the Ingrebourne Valley SMI and river corridors.
 - Mitigation/compensation for loss of habitat for great crested newt, bats and priority invertebrates.

Locations

Ecological Compensation Areas

- 5.5.2 Marshy grassland shall be located within lower areas of floodplain in ECA A, ECA B and ECA D.

Objectives

- Provide species-rich marshy grassland habitat of native grasses and wildflowers.
- Improve biodiversity, by providing a range of plant species not currently present at these locations, and provide a habitat for specialist invertebrates, great crested newts and reptiles; and new foraging opportunities for birds, bats and small mammals.
- Control of invasive plant species.

Management approach

- 5.5.3 Marshy grassland will be created by seeding following construction of flood plain compensation areas.
- 5.5.4 Following establishment, marshy grassland shall be mown annually, to provide a meadow grassland structural type.
- 5.5.5 Scattered scrub will be cleared from marshy grassland areas with each mowing operation.
- 5.5.6 Invasive plants shall be treated where present, with the aim of eradicating non-native goldenrod from grassland areas as much as possible.

Targets

5.5.7 The targets for marshy grassland are:

- To create open marshy grassland habitat with a diverse range of native species within 5 years. Primary target species include marsh marigold, lesser pond sedge, meadow foxtail and tufted hair-grass.
- At least one of the following target National Vegetation Classification (NVC) communities should be present or developing: MG4 *Alopecurus pratensis-Sanguisorba officinalis* (meadow foxtail-great burnet) grassland, MG8 *Cynosurus cristatus-Caltha palustris* (crested dog's-tail-marsh marigold) grassland, MG9 *Holcus lanatus-Deschampsia cespitosa* (Yorkshire fog-tufted hair-grass) grassland, MG10 *Holcus lanatus-Juncus effusus* (Yorkshire fog-soft rush) rush-pasture, MG13 *Agrostis stolonifera-Alopecurus geniculatus* (Creeping bent-marsh foxtail) grassland, or MG23 *Juncus effusus/acutiflorus-Galium palustre* (soft rush/sharp-flowered rush-marsh bedstraw) mire.
- Target quantity of scattered scrub within plot: 0%.

5.5.8 An illustrative species mix for marshy grassland is provided in Table 5.5 below.

Table 5.5: Illustrative seeding mix for marshy grassland

Common name	Scientific name
Sharp-flowered rush	<i>Juncus acutiflorus</i>
Soft rush	<i>Juncus effusus</i>
Tufted hair-grass	<i>Deschampsia cespitosa</i>
Meadow foxtail	<i>Alopecurus pratensis</i>
Yorkshire fog	<i>Holcus lanatus</i>
Hairy sedge	<i>Carex hirta</i>
Brown sedge	<i>Carex disticha</i>
Marsh marigold	<i>Caltha palustris</i>
Marsh ragwort	<i>Jacobaea aquatica</i>
Saw-wort	<i>Serratula tinctoria</i>
Meadowsweet	<i>Filipendula ulmaria</i>
Wild angelica	<i>Angelica sylvestris</i>
Marsh thistle	<i>Cirsium palustre</i>

Prescriptions

5.5.9 The following management prescriptions are proposed for marshy grassland creation and management.

- Marshy grassland shall be created within ECA A, ECA B and ECA D by seeding using a mixture of suitable native species.

- Marshy grassland shall be mown once annually, between late August and early October during dry weather.
- Where possible, cuttings shall be left lying for 3-4 days to allow seeds to ripen and drop. Cuttings shall be removed from the plot for composting off-site.
- Invasive, non-native species (see Appendix A) will be controlled to prevent further spread and removed/eradicated as much as possible.

5.6 Wildlife ponds

Mitigation/compensation context

5.6.1 New wildlife ponds and existing pond management will provide mitigation and compensation for effects on biodiversity resources. In particular:

- Compensation for loss of habitat from within the Ingrebourne Valley SMI; and
- Mitigation/compensation for loss of habitat for great crested newt.

Locations

Ecological compensation areas

5.6.2 New wildlife ponds will be created in ECA B (Management Plots reference EP2 and EP3, refer to Table 6.1 and the Landscape and ecology management areas drawings in Appendix B), and the existing pond within ECA B (EP1) will be enhanced and managed.

Objectives

- Provide two new ponds suitable for great crested newt breeding.
- Maintain the existing pond suitable for great crested newt breeding.
- Improve biodiversity, by providing a range of plant species not currently present within ponds, and provide additional habitat for specialist invertebrates and new foraging opportunities for birds and bats.
- Control of invasive plant species.

Management approach

5.6.3 Minimal management shall be undertaken other than periodic clearance of invasive weeds or inundations of reeds or removal of silt build up.

5.6.4 Clearance of vegetation shall take into account the presence of great crested newts and carried out sensitively for this species. No dredging of ponds shall be undertaken unless an assessment on the impact on great crested newts has been carried out and a European Protected Species licence obtained if necessary.

Targets

5.6.5 The targets for wildlife ponds are:

- Two new permanent ponds to be created with a range of native marginal vegetation species. Target species: reed canary-grass, water mint, gypsywort, sneezewort, meadowsweet, wild angelica.
- Target extent of emergent vegetation (reeds, etc.): maximum 20%.
- Target extent of scattered scrub: maximum 15% around margins.

5.6.6 An illustrative species mix for wildlife pond margins is provided in Table 5.6 below.

Table 5.6: Illustrative planting mix for wildlife pond margins

Common name	Scientific name
Sharp-flowered rush	<i>Juncus acutiflorus</i>
Soft rush	<i>Juncus effusus</i>
Tufted hair-grass	<i>Deschampsia cespitosa</i>
Yorkshire fog	<i>Holcus lanatus</i>
False fox-sedge	<i>Carex otrubae</i>
Lesser pond-sedge	<i>Carex acutiflorus</i>
Marsh marigold	<i>Caltha palustris</i>
Saw-wort	<i>Serratula tinctoria</i>
Meadowsweet	<i>Filipendula ulmaria</i>
Wild angelica	<i>Angelica sylvestris</i>
Marsh thistle	<i>Cirsium palustre</i>

Prescriptions

5.6.7 The following management prescriptions are proposed for pond creation and management.

- New ponds shall be created within ECA B.
- Pond margins shall be planted using a mixture of suitable native species.
- Inundations of reeds shall be cleared every 5-10 years in winter (or more frequently as required).
- Invasive, non-native species (see Appendix A) will be controlled to prevent further spread and removed/eradicated as much as possible.

5.7 River corridor

Mitigation/compensation context

5.7.1 Modifications to sections of the Weald Brook and Ingrebourne River are proposed to include the creation of meanders, backwaters and other natural features and management of trees along the river corridor. These works and management of the river corridor habitat will provide:

- Mitigation/compensation for loss of shading and loss of the river habitat generated by bridge crossings and culvert extensions.
- Mitigation/compensation for loss of habitat for otter and bats.

Locations

Ecological compensation areas

5.7.2 River realignment and management are proposed along Weald Brook and Ingrebourne River (ECA C).

Objectives

- Provide new river habitat diverse in form and natural features, with a mosaic of open and wooded sections, and diverse aquatic, emergent and marginal vegetation.
- Enhance existing habitat by creating more natural river features and more diversity of vegetation structure.
- Maintain habitat corridor used by otter.
- Maintain open water in new backwaters.
- Control invasive species.

Management approach

5.7.3 Blocks of the riparian zone of the Weald Brook and Ingrebourne River within ECA C shall be coppiced on rotation, with a section cut each winter.

5.7.4 Existing mature or veteran trees, or trees with features suitable for roosting bats, or with deadwood suitable for invertebrates, shall be retained and not removed or coppiced.

5.7.5 Coppicing operations will aim to maintain continuity of habitat corridors as much as possible while balancing the objective to provide light to the riverbank and vigorous re-growth.

5.7.6 Backwaters will be desilted to retain open water on rotation.

Targets

5.7.7 The targets for river realignment are:

- A river form with meanders, bends, pool and riffle sequences, and backwaters. Banks with a range of native marginal plants, some areas suitable for nesting kingfishers.
- Scattered groups of trees along the river banks with a variety of structure and height, retaining suitable habitat corridor for bats. Target species: alder, grey willow, crack willow.
- Backwaters with still or slow moving open water. These provide refuges for aquatic biota such as fish fry and an environment favoured by aquatic plants favouring slow or still water.

Prescriptions

5.7.8 The following management prescriptions are proposed for river modifications and management.

- New sinuous form and backwaters shall be created on the Weald Brook and Ingrebourne River.
- New backwaters shall be planted using a mixture of suitable native species or allowed to colonise naturally.
- Excess silt will be removed from new backwaters every 5 years in winter to maintain open water.
- Clearance of inundations of reeds from backwaters shall be undertaken every 5-10 years in winter as required.
- Riverbank trees and shrubs within ECA C shall be coppiced or pollarded on rotation, with one fifth cut each year annually in winter. Coppicing or pollarding shall be carried out by hand using chainsaws.
- Where pollarding is used, trees shall be cut on first occasion at 2 m height, and thereafter any regrowth shall be trimmed back to the same point.
- Where coppicing is used, trees shall be cut on first occasion 200 mm height, and thereafter any regrowth shall be cut back to the same point.
- Invasive, non-native species (see Appendix A) will be controlled to prevent further spread and removed/eradicated as much as possible.

5.8 Hedgerows

Mitigation/compensation context

5.8.1 New hedgerows will provide mitigation and compensation for effects on biodiversity resources, in particular:

- Mitigation/compensation for loss of habitat from the motorway verge and elsewhere outside the SMI.
- Mitigation for temporary damage during the construction phase.

- Mitigation/compensation for loss of commuting corridors used by bats and great crested newt.

Locations

Ecological Compensation Areas

- 5.8.2 Existing hedgerow will be enhanced on the western boundary of ECA B.

Objectives

- Provide connections between new and existing woodland and hedgerow.
- Provide additional visual screening of the Scheme for sensitive receptors.
- Improve biodiversity, through providing a diversity of species and structure, which will enhance feeding and shelter opportunities of invertebrates and in turn for other species such as great crested newts, reptiles, birds and bats.
- Integrate existing mature and veteran trees.

Management approach

- 5.8.3 New hedgerow shall be created to fill gaps in existing hedgerows through a mixture of new planting and natural generation.
- 5.8.4 Following establishment, hedgerow trees will undergo initial thinning as required, then trimmed on rotation, with a section cut every winter, in order to promote bushy regrowth. In relation to hedgerow management, existing mature trees, or trees with features suitable for roosting bats, or with deadwood suitable for invertebrates, shall be retained and not removed, pollarded or coppiced.
- 5.8.5 New hedgerow plants shall be protected from browsing deer until established.

Targets

- 5.8.6 The target for hedgerow creation is to establish hedgerow with a range of native woody species with affinities to local hedgerows, within 15 years. Primary target species include hornbeam, hawthorn, spindle and field maple. Ash is not recommended for use in planting due to the risk of importing ash dieback disease and the ability of the species to readily colonise.
- 5.8.7 An illustrative species mix for hedgerow planting is provided in Table 5.7 below:

Table 5.7: Illustrative planting mix for hedgerows

Common name	Scientific name
Hawthorn	<i>Crataegus monogyna</i>
Blackthorn	<i>Prunus spinosa</i>
Hornbeam	<i>Carpinus betulus</i>
Spindle	<i>Euonymus europeaus</i>
Field maple	<i>Acer campestre</i>
Dog rose	<i>Rosa canina</i>

Prescriptions

- 5.8.8 The following management prescriptions are proposed for hedgerows.
- New hedgerows will be created using a mixture of suitable native species.
 - New hedgerows will undergo establishment period maintenance (see Appendix A of this document for outline specification).
 - Hedgerow plants will be protected from deer browsing.
 - Invasive, non-native species (see Appendix A) will be controlled to prevent further spread and removed/eradicated as much as possible.

5.9 Individual specimen trees

Mitigation/compensation context

- 5.9.1 For each veteran tree lost, eight individual specimen trees of the same native species will be planted with space around them to develop into an open crown. As one veteran pedunculate oak and one veteran ash would be lost to the Scheme, 16 trees will be planted. This will include eight pedunculate oak and, as it is not recommended to plant ash due to ash dieback, eight hornbeam trees. Hornbeam has been selected to replace ash as there are older specimens of this species at the edge of Alder Wood, in nearby ancient woodland, and it is currently not under threat of disease or damage from pests.

Locations

- 5.9.2 The locations of individual specimen trees will be determined during detailed design of the landscape scheme. Locations will be selected that are accessible for monitoring and future management and maintenance. They shall not be located near to carriageway or boundaries where they may be subject to routine and unsensitive management. They may be located within open situations or within woodland or boundary features.

Objectives

- 5.9.3 For individual trees (eight pedunculate oak and eight hornbeam) to be planted and maintained in a manner which allows them space to mature and develop an open crown. Extra heavy standard trees will be planted.

Management approach

- 5.9.4 The individual specimen tree planting will be protected from browsing deer by means of appropriate fencing or guard until established.
- 5.9.5 Regular checks and formative pruning will be carried out as necessary by arboriculture specialist during establishment and throughout the management period.
- 5.9.6 Adjacent trees will be managed to provide sufficient space for individual specimen trees to grow and develop.

Targets

- 5.9.7 The target is for eight pedunculate oak and eight hornbeam trees to be maintained in a manner which allows them space to mature and develop an open crown.

Prescriptions

- 5.9.8 The following management prescriptions are proposed for planting of individual specimen trees:
- Location of individual specimen tree planting shall be determined based on accessibility and reducing risk of unsympathetic management.
 - Individual specimen tree planting shall undergo establishment period maintenance (see Appendix A of this document for outline specification).
 - Individual specimen trees shall be protected from browsing deer by means of appropriate fencing or guards until established.
 - Following establishment period, individual specimen trees shall be assessed every five years by an arboriculture specialist and any required pruning or maintenance of individual trees (such as removal of guards) shall be carried out as necessary.
 - Management of adjacent trees shall be carried out to maintain sufficient space for individual specimen tree growth.

5.10 Hibernacula

Mitigation/compensation context

- 5.10.1 Hibernacula suitable for use by hibernating great crested newts or reptiles shall be provided as mitigation/compensation for loss of habitat for great crested newt and reptiles.

Locations

Ecological compensation areas

- 5.10.2 Hibernacula will be created within ECA B.

Objectives

- 5.10.3 To provide suitable hibernation sites for great crested newt and reptiles to provide shelter in the winter.

Management approach

- 5.10.4 Hibernacula shall be constructed to suitable design using materials reclaimed during construction. Following creation, hibernacula will require no maintenance, unless damaged.
- 5.10.5 A suitable design of hibernacula will be developed during the detailed design stage.

Targets

- 5.10.6 The target for new hibernacula to be used by great crested newts and reptiles.

Prescriptions

- 5.10.7 The following management prescriptions are proposed for hibernacula:
- New hibernacula will be created using materials (bricks, stone, rubble and wood) reclaimed during construction.
 - Hibernacula require minimal management and they shall only be disturbed if they lose their intended function to act as a suitable site for hibernating newts and reptiles.
 - If, through damage or deterioration, hibernacula lose their intended function they shall be repaired with similar suitable materials or re-built.

5.11 Dead wood features

Mitigation/compensation context

- 5.11.1 To compensate for the loss of dead wood habitat and veteran trees, dead wood features will be created. This will include:
- Habitat for stag beetle (dead wood trunks implanted 1/3 into ground to provide standing dead wood above and below ground).
 - Retained felled trees repositioned into a range of situations from shady situation to full sun to benefit a range of invertebrates.
 - In ECA B, piles of deadwood or small clusters of standing deadwood posts in sunny situations. This desiccated deadwood resource will benefit stem-nesting bees and wasps.
 - Planting of individual cherry plum trees in woodland and scrub (refer to Sections 5.1 and 5.2) to provide a continuity of dead wood resources. This species grow fast and start to die comparatively young. When old, they provide a similar rot type to other, slower growing species such as oaks.

Locations

- 5.11.2 The locations of these dead wood features will be determined during detailed design of the landscape scheme. These will be included in ECA A, ECA B and ECA D, in retained woodland and scrub habitats (such as the woodland along Weald Brook within ECA C, and in newly planted woodland such as W1).
- 5.11.3 Individual specimens of cherry plum will be included in tree and scrub planting within ECAs, at the edge of planted woodland, edge of retained woodland and on highways verge and associated land.

Objectives

- 5.11.4 To provide suitable dead wood features in a range of situations from damp shady situations to full sun to benefit the widest range of invertebrates possible.

5.11.5 To provide a long-term continuity of dead wood resources.

5.11.6 To provide habitat for stag beetle.

Management approach

5.11.7 Felled trees and limbs will be retained in as large a single unit as possible, as large volume pieces of wood remain ecologically viable for a much longer timeframe than sectioned-up material. These felled trees will not be cut up into rings or sawn up and stacked into log piles.

5.11.8 Creating standing dead wood where 1/3 is buried into the ground will ensure that dead wood is provided below ground.

5.11.9 Following creation, dead wood features will require no maintenance. Maintenance activities taking place within habitat where these features are placed must ensure they are protected, and not moved or damaged. Changing the location orientation of dead wood resources can lead to the loss of invertebrates using them.

Targets

5.11.10 The target for is for dead wood habitat to be used by a variety of invertebrates.

Prescriptions

5.11.11 The following management prescriptions are proposed for dead wood features:

- Dead wood features will be created from trees felled during construction (see 5.11.7 above).
- Following creation, dead wood features shall be left undisturbed, and not moved or damaged during management and maintenance activities.
- Dead wood features shall be marked on site plans to ensure they are protected.
- Additional dead wood habitat shall be created in a variety of locations from trees or limbs felled during long-term management activities (such as thinning and coppicing).

6. Outline management plan

Table 6.1: Outline management plan by location

6.1.1 Details of management locations, objectives, targets and prescriptions are found in Section 5. The maintenance contractor is considered to be Highways England maintenance agent.

Location	Management feature	Attributes to measure against the targets	Management plots	Management prescriptions	Detail	Timescale	Responsibility
Highways verge and associated land	Woodland	Number of species Target species/habitat Protection of mature/veteran trees Quantity of dead wood habitat Screening effectiveness	W1-W14	Establishment period maintenance ⁵	Maintenance tasks	5 year establishment period	Principal Contractor
				Thinning	Thin by 15% on close of canopy	Within first 5-8 years	Operation & Maintenance Contractor
			W2-W14	Minimal intervention.		Following thinning	Operation & Maintenance Contractor
			W1	Pollarding or coppicing on rotation.	Cut one fifth each year on rotation in winter	Annual after 5-10 years	Operation & Maintenance Contractor
	Individual specimen trees (as compensation for loss of veteran trees)	Protection against browsing Crown spread	W1-W14	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Thinning of surrounding trees	Thin to maintain space for specimen growth	As required following establishment	Operation & Maintenance Contractor

⁵ Refers to the contracted 5-year period where the Principal Contractor is responsible for monitoring the establishment of new planting and seeding and replacing defects.

Location	Management feature	Attributes to measure against the targets	Management plots	Management prescriptions	Detail	Timescale	Responsibility
	Dead wood features	Continuity of dead wood resources	W1	Non-intervention	Leave undisturbed	Throughout	Principal Contractor Operation & Maintenance Contractor
	Dense scrub	Number of species Target species/habitat Extent Function as woodland edge	G2 G6-8G10 G12 G13	Selected woodland edge managed to form dense scrub. Coppicing on long rotation	Coppice one fifth of dense scrub within these plots in winter	Every 5 years	Principal Contractor during the establishment period. Operation & Maintenance Contractor following handover
	Dry grassland (wildflower)	Number of species Target species/habitat Presence of margin Quantity of scattered scrub	G2 G6-8 G10-G13	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Mowing (meadow)	Cut and collect late Aug-early Oct.	Annual following establishment	Principal Contractor Operation & Maintenance Contractor
				Mowing (margins)	One third cut and collected late Aug-early Oct	Every year on rotation following establishment	Principal Contractor Operation & Maintenance Contractor

Location	Management feature	Attributes to measure against the targets	Management plots	Management prescriptions	Detail	Timescale	Responsibility
Attenuation pond surrounds	Dry grassland (wildflower)	Number of species Target species/habitat Quantity of scattered scrub	G4 G9	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Mowing (whole plot)	Cut and collect late Aug-early Oct.	Annual following establishment	Principal Contractor Operation & Maintenance Contractor
ECA A	Dry grassland (wildflower)	Number of species Target species/habitat Presence of margin Quantity of scattered scrub	G1	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Mowing (meadow)	Cut and collect late Aug-early Oct.	Annual following establishment	Principal Contractor Operation & Maintenance Contractor
				Mowing (margins)	One third cut and collected late Aug-early Oct	Every year on rotation following establishment	Principal Contractor Operation & Maintenance Contractor
	Dense scrub	Number of species Target species/habitat Extent Function as woodland edge	G1	Selected woodland edge will be allowed to form dense scrub. Coppicing on long rotation	Coppice half of dense scrub within plot	Every 5 years	Principal Contractor during the establishment period. Operation & Maintenance Contractor following handover

Location	Management feature	Attributes to measure against the targets	Management plots	Management prescriptions	Detail	Timescale	Responsibility
	Marshy grassland	Number of species Target species/habitat Hydrology Quantity of scattered scrub	MG1	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Mowing (whole plot)	Cut and collect in late Aug-early Oct.	Annual following establishment	Principal Contractor Operation & Maintenance Contractor
	Individual specimen trees (location to be determined)	Protection against browsing Crown spread	ECA A	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Thinning of surrounding trees (if present)	Thin surrounding trees (if present) to maintain space for specimen growth	As required following establishment	Operation & Maintenance Contractor
	Dead wood features	Continuity of dead wood resources	ECA A	Non-intervention	Leave undisturbed	Throughout	Principal Contractor Operation & Maintenance Contractor
	ECA B Dry grassland (tussocky) with scattered scrub	Number of species Target species/habitat Presence of margin Quantity of scattered scrub	G5	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Mowing on rotation	Cut and collect one fifth of plot in Oct-Nov	Annual following establishment	Principal Contractor

Location	Management feature	Attributes to measure against the targets	Management plots	Management prescriptions	Detail	Timescale	Responsibility
					during dry weather.		Operation & Maintenance Contractor
	Dense scrub	Number of species Target species/habitat Extent Function as woodland edge	G5	Selected patches of scattered scrub will be allowed to form dense scrub (15% of plot). Coppicing on long rotation.	Coppice half of dense scrub within plot	Every 5 years	Principal Contractor Operation & Maintenance Contractor
	Marshy grassland	Number of species Target species/habitat Hydrology Quantity of scattered scrub	MG2	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Mowing (whole plot)	Cut and collect late Aug-early Oct.	Annual following establishment	Principal Contractor Operation & Maintenance Contractor
	Ponds	Permanent ponds with a range of native marginal vegetation species. Number of species Target species/habitat Hydrology Extent of emergent vegetation and scrub	P1 P2 P3	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Pond clearance	Clearance of invasive weeds or inundations of reeds	Every 5-10 years as required	Operation & Maintenance Contractor
	Hedgerows	Number of species Target species Connectivity	ECA B	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor

Location	Management feature	Attributes to measure against the targets	Management plots	Management prescriptions	Detail	Timescale	Responsibility
		Screening effectiveness		Trimming on rotation.	Cut/trim one fifth each year on rotation in winter	Annual following handover	Operation & Maintenance Contractor
	Hibernacula	Condition of constituents Effectiveness for maintaining hibernation conditions	ECA B	Minimal intervention	If damaged, then re-build	Throughout	Principal Contractor Operation & Maintenance Contractor
	Individual specimen trees (location to be determined)	Protection against browsing Crown spread	ECA B	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Thinning of surrounding trees (if present)	Thin surrounding trees (if present) to maintain space for specimen growth	As required following establishment	Operation & Maintenance Contractor
	Dead wood features	Continuity of dead wood resources	ECA B	Non-intervention	Leave undisturbed	Throughout	Principal Contractor Operation & Maintenance Contractor

Location	Management feature	Attributes to measure against the targets	Management plots	Management prescriptions	Detail	Timescale	Responsibility
Weald Brook & Ingrebourne River ECA C	River corridor	Number of species Target species Presence of suitable features for kingfishers, water voles and otters Tree height and structure Presence of invasive weeds Depth of silt in backwaters Extent of emergent vegetation in backwaters	ECA C	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Coppicing on rotation	Coppice one fifth of bankside trees each year on rotation in winter	Annual following handover	Operation & Maintenance Contractor
				Maintenance of backwaters	Removal of excess silt and clearance of invasive weeds or inundations of reeds in winter	Silt removal every 5 years as required Reeds removed every 5-10 years as required	Operation & Maintenance Contractor
	Individual specimen trees (location to be determined)	Protection against browsing Crown spread	ECA C	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Thinning of surrounding trees (if present)	Thin surrounding trees (if present) to maintain space for specimen growth	As required following establishment	Operation & Maintenance Contractor

Location	Management feature	Attributes to measure against the targets	Management plots	Management prescriptions	Detail	Timescale	Responsibility
	Dead wood features	Continuity of dead wood resources	ECA C	Non-intervention	Leave undisturbed	Throughout	Principal Contractor Operation & Maintenance Contractor
ECA D	Dry grassland (wildflower)	Number of species Target species/habitat Presence of margin Quantity of scattered scrub	G3a G3b	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Mowing (meadow)	Cut and collect late Aug-early Oct.	Annual following establishment	Principal Contractor Operation & Maintenance Contractor
				Mowing (margins)	One third cut and collected late Aug-early Oct	Every year on rotation following establishment	Principal Contractor Operation & Maintenance Contractor
	Marshy grassland	Number of species Target species/habitat Hydrology Quantity of scattered scrub	MG3a MG3b MG3c	Establishment period maintenance	Maintenance tasks	5 year establishment period	Principal Contractor
				Mowing (whole plot)	Cut and collect late Aug-early Oct.	Annual following establishment	Principal Contractor Operation & Maintenance Contractor
	Dead wood features	Continuity of dead wood resources	ECA D	Non-intervention	Leave undisturbed	Throughout	Principal Contractor Operation & Maintenance Contractor

Location	Management feature	Attributes to measure against the targets	Management plots	Management prescriptions	Detail	Timescale	Responsibility
All locations	All features	Distribution of invasive, non-native species (Goldenrod and Himalayan balsam)	All plots	Control of non-native plants	Species removed and controlled to prevent spread.	Annually throughout establishment period and following handover	Principal Contractor Operation & Maintenance Contractor

7. Outline monitoring specifications

7.1 Habitat monitoring approach

- 7.1.1 Monitoring will be undertaken during the construction and operational phases to assess the progress towards the targets of the management features outlined in Table 6.1. Monitoring shall provide information to determine whether certain targets have been met or missed, and whether maintenance operations or remedial actions are required. Table 6.1 provides a list of attributes against each management feature that will be measured against the targets during monitoring.
- 7.1.2 During construction, monitoring will include that detailed in the Outline CEMP.
- 7.1.3 Monitoring for establishment of newly created habitats will follow the establishment maintenance specifications produced during detailed design and will take the form of quarterly inspection in the first two years, followed by annual inspections in the following three years after seeding/planting.
- 7.1.4 Monitoring of habitats following establishment will take the form of annual monitoring.
- 7.1.5 Table 7.1 below gives a draft monitoring schedule for all landscape and ecology features during the establishment period and ongoing operation phase of the Scheme.

Table 7.1: Outline monitoring schedule

Monitoring method	Timescale	Responsibility
Establishment inspections following completion of mitigation works	Quarterly first 2 years Annually next 3 years	Principal Contractor (PC)
Walkover survey	Annually	PC (establishment period) Operation & Maintenance Contractor (following handover)

- 7.1.6 The Principal Contractor and Operation and Maintenance Contractor will appoint suitably qualified persons (i.e. an appropriately qualified landscape management consultant) to undertake monitoring and report on progress towards the targets.
- 7.1.7 If necessary, the findings of monitoring may result in corrective actions being required or the prescriptions for a management feature or the targets themselves may need to be modified.

7.2 Species monitoring approach

- 7.2.1 Species monitoring requirements shall take into account the conditions of protected species licences. The monitoring approach will be agreed with Natural England, London Borough of Havering and Essex County Council.

Great crested newts

- 7.2.2 Monitoring will include any required under the Natural England European Protected Species (EPS) licence required for construction of the Scheme. This will detail the frequency and type of monitoring required, and measures of success.

Bats

- 7.2.3 Construction and operation of the Scheme will change the habitat availability in terms of foraging opportunities for bats. To monitor the success of habitat reinstatement and creation on foraging bats, a monitoring strategy will be developed including, pre-construction, during construction and post construction surveys. These surveys will cover Weald Brook (and what will be ECA A), woodland edges (The Grove and Alder Wood) and ECA B. Post construction surveys will cease when it has been established that the mix of species and abundance of bats using these habitats is similar to that in the pre-construction survey.
- 7.2.4 If an EPS licence for bats is required (due to loss or disturbance to bat roosts), monitoring requirements as set out in the EPS licence will be included in the LEMP which will be developed through the detail design and construction stages by the Principal Contractor.

Other species

- 7.2.5 Should pre-construction survey work, or survey work carried out during the construction period determine that monitoring is required for other species (e.g. otter), these requirements will be set out in the LEMP developed by the Principal Contractor.

Appendices

Appendix A. Outline management specifications

A.1 Establishment period maintenance for new planting

- 7.2.6 During the initial five-year establishment period the restored habitat, and the newly created habitat will be maintained by the Principal Contractor. This will include carrying out the following maintenance operations:
- A 1 m diameter weed-free ring shall be maintained around each planting station.
 - Trees and shrub planting which has failed to establish shall be replaced in the next suitable planting season.
 - Grow cones or spiral guards shall be checked.
 - Grow cones or spiral guards shall be removed once planting has grown out of cones and threat from deer browsing or rabbit grazing is reduced
 - Where necessary, suitable fencing will be used to protect planting from deer browsing.
 - Grass and low vegetation within planting plots shall be mown/trimmed twice annually or as per establishment requirements for that type of grassland.

A.2 Treatment of invasive non-native species

- 7.2.7 Chemical or mechanical treatment and removal of invasive non-native plant species shall be carried out where found within all areas. Chemical treatment shall include selective application of herbicides. Mechanical treatment shall include digging up or scraping of topsoil where the plant(s) is present.
- 7.2.8 The following species are considered to be invasive non-native plants:
- Early goldenrod (*Solidago gigantea*)
 - Canadian goldenrod (*Solidago canadensis*)
 - Himalayan balsam (*Impatiens glandulifera*)

Appendix B. Landscape and ecological management areas drawings

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NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH PRELIMINARY ENVIRONMENTAL DESIGN (FIGURE 2.2, APPLICATION DOCUMENT TR010029APP/6.2)

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GENERAL

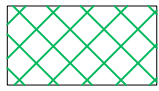


DCO BOUNDARY

ECOLOGY



ECOLOGICAL COMPENSATION AREA (ECA)



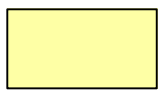
RETAINED WOODLAND



MARSHY GRASSLAND (MG)



WOODLAND (W)



WILDFLOWER GRASSLAND (G)



TUSOCKY GRASSLAND/ SCRUB (G)



PROPOSED HIBERNACULA



INDIVIDUAL TREE PLANTING



PROPOSED OTTER FENCING



PROPOSED ECOLOGICAL PONDS



EXISTING PONDS

ECOLOGICAL COMPENSATION AREAS

ECA A

AREAS G 1 + MG 1 + W 14

ECA B

AREAS G 5 + MG 2

ECA C

RIVER CORRIDOR + AREA OF RIPARIAN TREE MANAGEMENT

ECA D

AREAS G 3a + G 3b + MG 3a + MG 3b+ MG 3c

DRAINAGE



RETAINED EXISTING WATERCOURSES



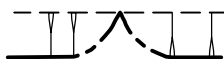
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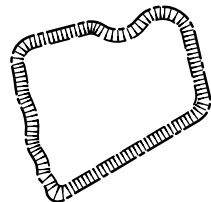


CADENT LHP GAS PROPOSED CORRIDOR


HIGHWAYS



PROPOSED EARTHWORK SLOPE



DEPOSIT OF SURPLUS CONSTRUCTION MATERIAL

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ECA A

W 13

ECA C

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MG 1

G 8

ECA A

MG 1

ECA C

ECA A

G 1

ECA D

MG 3c

G 3a

MG 3a

MG 3b

G 3b

ECA C

G 2

W 4

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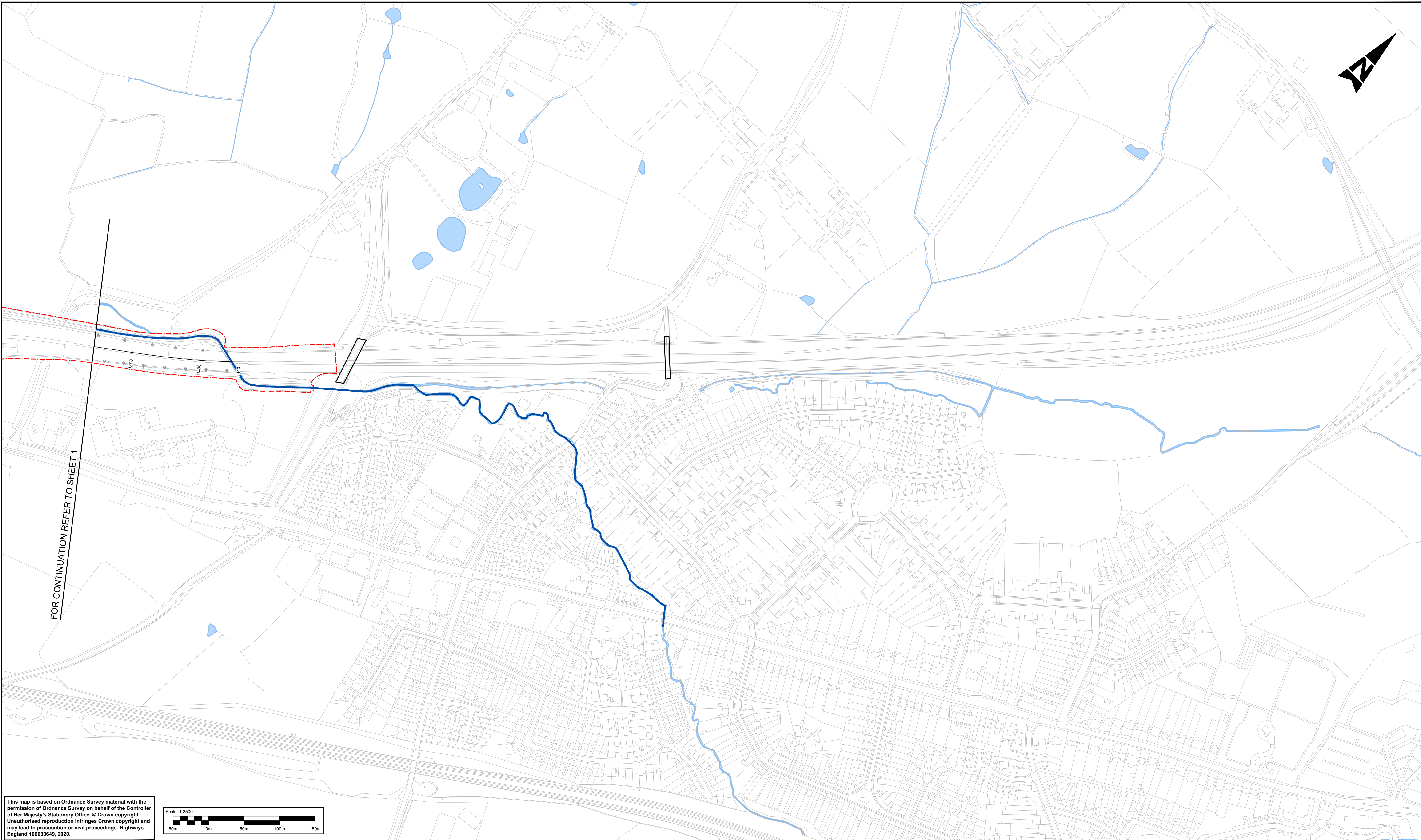
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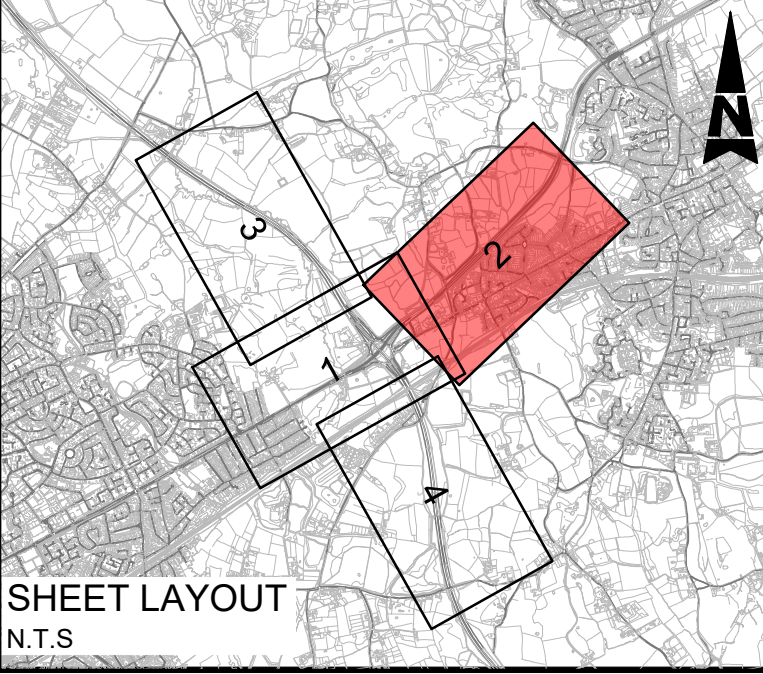
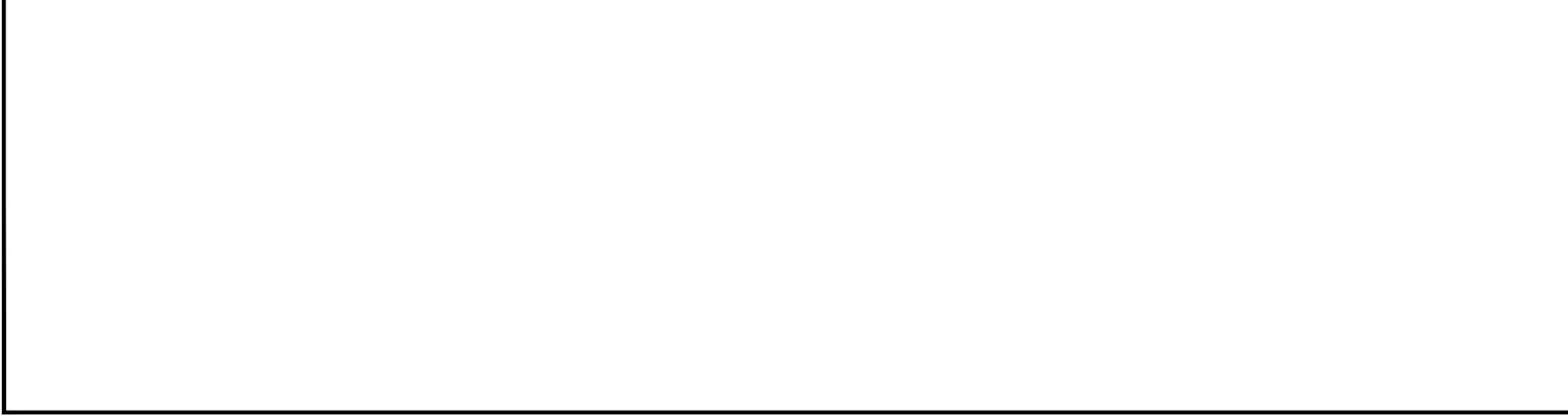
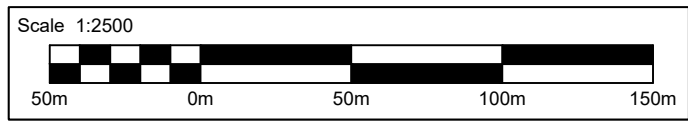
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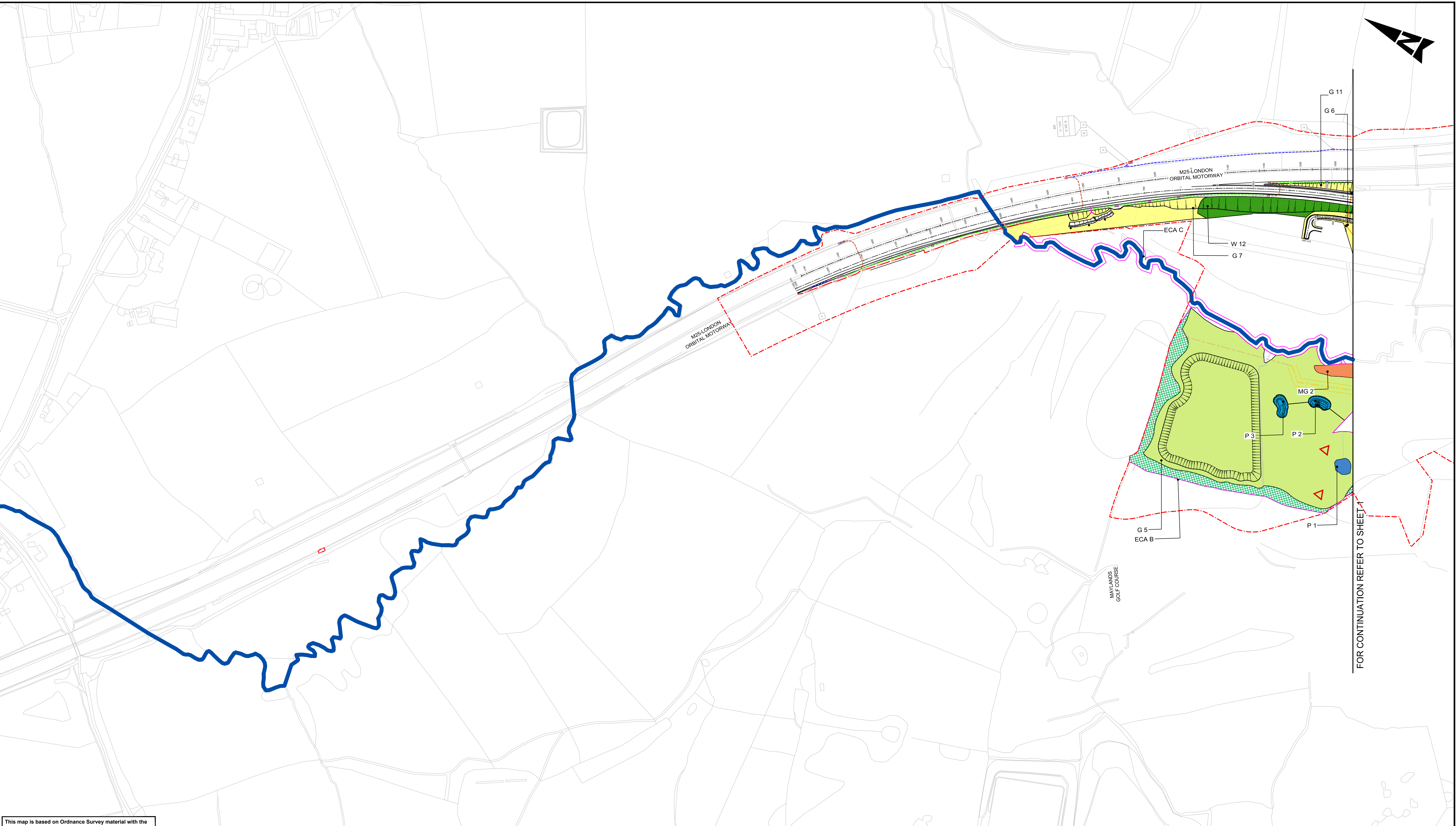
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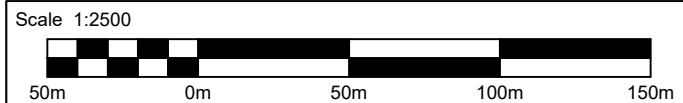
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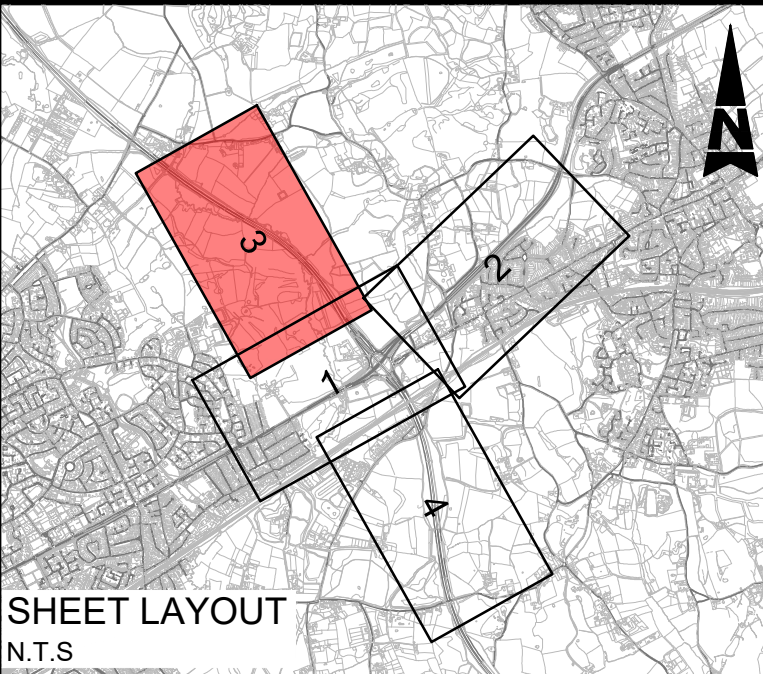
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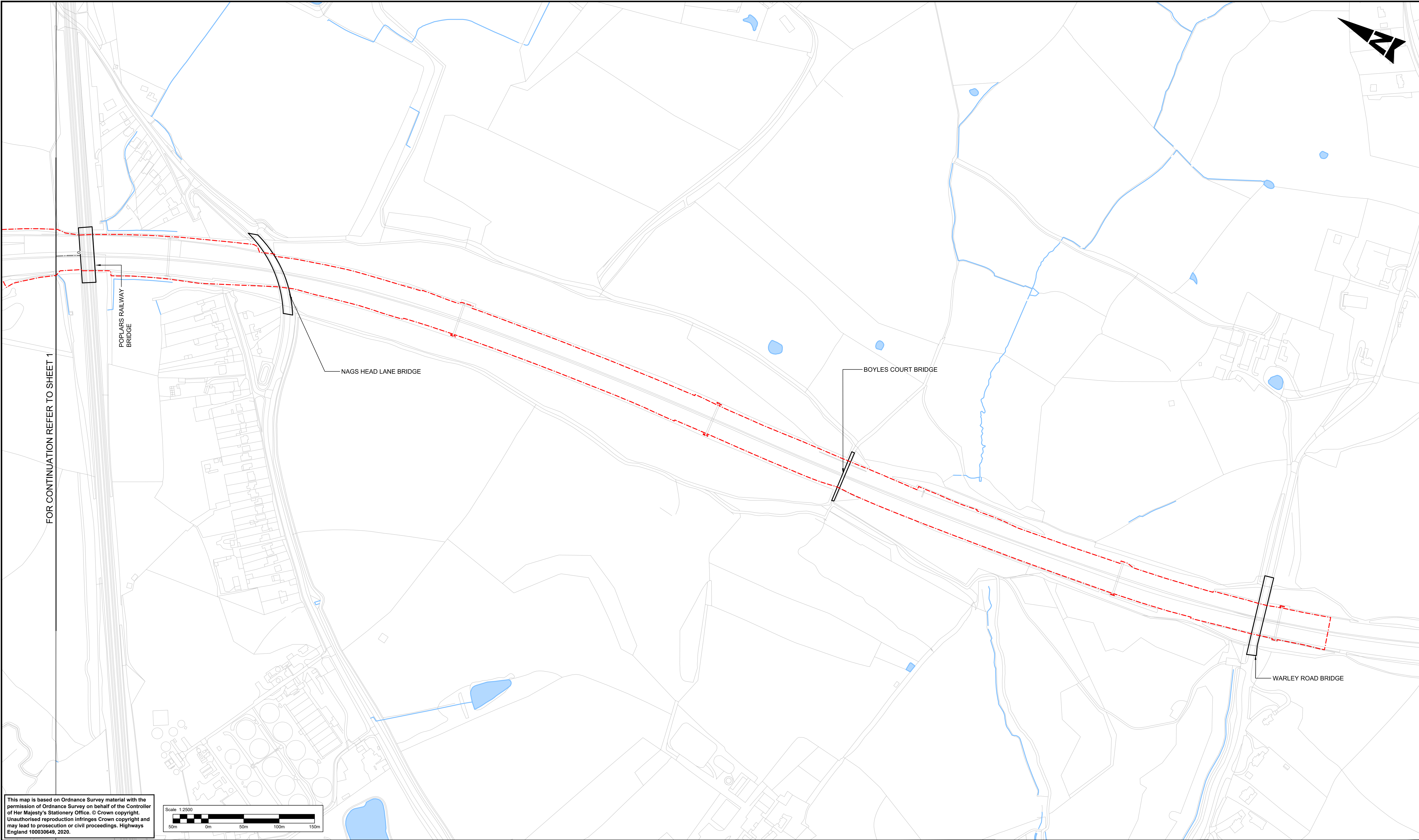


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