Hoo Peninsula Strategic Environmental Programme Topic Paper

Submission Document

Medway Council

Regulation 22
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Contents

1 Introduction

1.1 Definition and purpose

1.1.1 Topic papers set out written material produced by the local planning authority to be submitted with a local plan for examination.

1.1.2 The purpose of this Topic Paper is to explain the proposal for a Strategic Environmental Programme to safeguard environmental assets on the Hoo Peninsula in the context of planned growth.

1.2 Context

1.2.1 The Hoo Peninsula is a distinctive part of Medway, which strongly contrasts with the large urban area to the south. The rural peninsula has a high proportion of land of international and national importance for nature. The Thames Estuary and Marshes Special Protection Area and Ramsar sites fringe the west and north of the peninsula and the Medway Estuary and Marshes Special Protection Area and Ramsar sites are to the east and south. There are also a number of Sites of Special Scientific Interest (SSSI) and a National Nature Reserve.

1.2.2 The Hoo Peninsula also has an important economic role, notably in the energy sector, with key employment areas at Kingsnorth and Grain. The peninsula villages, particularly in the more accessible locations to the west and south, have expanded in recent years. The spatial strategy in the new Medway Local Plan proposes significant growth on the Hoo Peninsula, providing for residential and commercial development. This recognises the potential for strengthening the sustainability of the peninsula's communities through additional services and employment opportunities, and providing for different development needs in the spatial strategy.

1.2.3 Work on the Medway Local Plan has for some time identified the role of the Hoo Peninsula in a development strategy. The Council recognises that development in this location, particularly at the scale of planned growth, requires sensitivity in considering the impacts on the natural environment, specifically the designated sites.

1.2.4 In consultation with Natural England, the Council has identified a requirement for a strategic approach to manage development and mitigate impacts on the natural environment. This is set out as a policy requirement in the Local Plan Policy S2: Conservation and Enhancement of the Natural Environment:

The Council will work in partnership with Natural England, environmental organisations and communities to establish and implement a strategic environmental programme on the Hoo Peninsula. This will provide a strategic approach to protecting designated sites, specifically Chattenden Woods and Lodge Hill SSSI, and the Medway Estuary and Marshes SPA, Ramsar site and SSSI. A coordinated programme of evidence-based measures will include land management and habitat restoration and creation, buffers to sensitive sites, securing the landscape, a nature-

based approach to flood and water management, education and wardening, and provision of recreational resources away from sensitive locations. Developers of sites on the Hoo Peninsula will be required to contribute to the implementation of the strategic environmental programme, proportionate to the scale and nature of the development, and its proximity to sensitive sites.

1.2.5 This has been considered in the Sustainability Appraisal and Habitats Regulations Assessment that inform the Medway Local Plan, and is a key matter in the Statement of Common Ground with Natural England.

1.3 HIF Strategic Environmental Management Scheme (SEMS)

1.3.1 The Council's approach to a Strategic Environmental Programme builds on the evidence and development work previously undertaken in relation to planning for growth on the Hoo Peninsula. This was prepared through the Housing Infrastructure Fund (HIF) investment programme for a Strategic Environmental Management Scheme (SEMS).

1.3.2 The HIF programme sought to invest in an integrated set of measures to address the potential impacts of development on designated sites on the Hoo Peninsula, and the strategic mitigations would facilitate the delivery of development.

1.3.3 SEMS involved producing an evidence based approach to mitigation. This included a Cumulative Ecological Impact Assessment in 2021. This assessment considered the potential impacts of the proposed development strategy at the time, and how these could be mitigated. The mitigations were presented as recommendations for integrated measures to be implemented through a strategic programme.

1.3.4 The Hoo Peninsula Cumulative Ecological Impact Assessment, 2021 is set out at Appendix 1 for information.

1.3.5 An overview of the SEMS programme is set out at Appendix 2 for information.

1.3.6 The funding for the wider HIF programme was withdrawn in 2023, but the Council has continued to work on the delivery of components of the SEMS programme, such as Deangate Community Parkland.

1.3.7 Further work, as recommended by Natural England, was undertaken in relation to assessing the potential impacts from development in the vicinity of the Lodge Hill and Chattenden Woods SSSI, and mitigation measures. This Nightingale Impact Assessment is set out at Appendix 3 for information.

2 Natural England Advice

2.1 Representations on Regulation 19 Draft Local Plan

2.1.1 Natural England submitted representations on the Pre-Submission Draft Medway Local Plan in August 2025. (E.148). Natural England gave general support for the aims and intentions of the environmental policies in the plan, but identified the need for further clarity and strengthening policy wording to help clarify how development would conserve and enhance Medway's rich environmental heritage.

2.1.2 The comments referred to the Hoo Peninsula Strategic Environmental Programme:

Natural England strongly supports the evidence gathering approach the Council has undertaken to considering the ecological effect of development allocations to designated sites and the strategic approach mitigation through their Cumulative Ecological Impact Assessment, and associated Nightingale Impact Assessment, in recent years but are concerned this has not been included within the Local Plan.

2.1.3 Further comments sought clarity as to the avoidance and mitigation measures to be secured and evidence of their effectiveness, and Natural England welcomed the opportunity to further work with the Council to try and resolve this matter.

2.1.4 Revised wording to Policy S2 was proposed:

Development on the Hoo Peninsula and at Chattenden will need to comply with the Hoo Peninsula Strategic Environmental Mitigation and Management Programme which will be agreed by a partnership including the Council, Natural England environmental organisations and communities. This will secure and implement a strategic approach to conserving and enhancing designated sites, wider biodiversity and areas of significant flood risk.

This will provide a strategic approach to protecting and enhancing designated sites and areas of significant flood risk, either now or in the future. Development should support the conservation and enhancement of the Chattenden Woods and Lodge Hill SSSI, and the Medway Estuary and Marshes SPA, Ramsar site and SSSI.

A coordinated programme of evidence-based measures will include avoidance a mitigation measures for direct and indirect impacts and landscape scale nature recovery. This will include, for example, land management and habitat restoration and creation, buffers to sensitive designated sites, securing the landscape, a nature-based approach to flood and water management, education and wardening, and provision of recreational resources away from sensitive locations. These will be required to ensure that impacts to the designated sites are avoided or fully mitigated. Developers of sites on the Hoo Peninsula will be required to contribute to the implementation of the strategic environmental programme, proportionate to the scale and nature of the development,

and its proximity to sensitive sites with funding secured in-perpetuity for ongoing management and monitoring.

2.1.5 The Council welcomes the advice of Natural England and has met with officers to further discuss the plan's proposed policies and the Strategic Environmental Programme. The Council supports the proposed modifications to policy wording in the plan through the examination process.

2.1.6 The Council has agreed to publish the Hoo Peninsula Cumulative Ecological Impact Assessment, and associated Nightingale Impact Assessment, as part of the work on the Strategic Environmental Programme. These are appended to this topic paper.

3 Proposed Strategic Environmental Programme

3.1 Programme Development and Implementation

3.1.1 In discussion with Natural England, the Council set up a partnership workshop for the Hoo Peninsula Strategic Environmental Programme in August 2025. This involved representatives from Natural England, the Environment Agency, environmental organisations such as RSPB, Kent Wildlife Trust, developers and landowners of promoted sites on the Hoo Peninsula, the North Kent Marshes Internal Drainage Board, Farm Clusters and Council officers and the Portfolio Holder for Climate Change and Strategic Regeneration. The workshop discussed existing initiatives and plans and the opportunities to collaborate on the design and implementation of a new strategic environmental programme for the Hoo Peninsula.

3.1.2 There was wide support for a strategic programme that builds on earlier work in the SEMS programme, with key interventions at Deangate and Cockham Community Parklands and Hoo Wetlands, with wider connectivity and measures. The new programme is positioned in an updated context of environmental strategies, plans and programmes, including the Kent and Medway Local Nature Recovery Strategy, Biodiversity Net Gain, Whose Hoo Heritage Lottery Fund partnership and the Chalk to Coast North Kent nature recovery corridor programme.

3.1.3 The Council will set up a partnership group with representatives from Natural England, the wider environmental sector and developers and landowners to oversee the commissioning and development of a strategic environmental programme. This will include an updated evidence base; a review of the SEMS programme to confirm the appropriate measures to address the impacts of planned growth; and a costed programme that will be used to secure developer contributions.

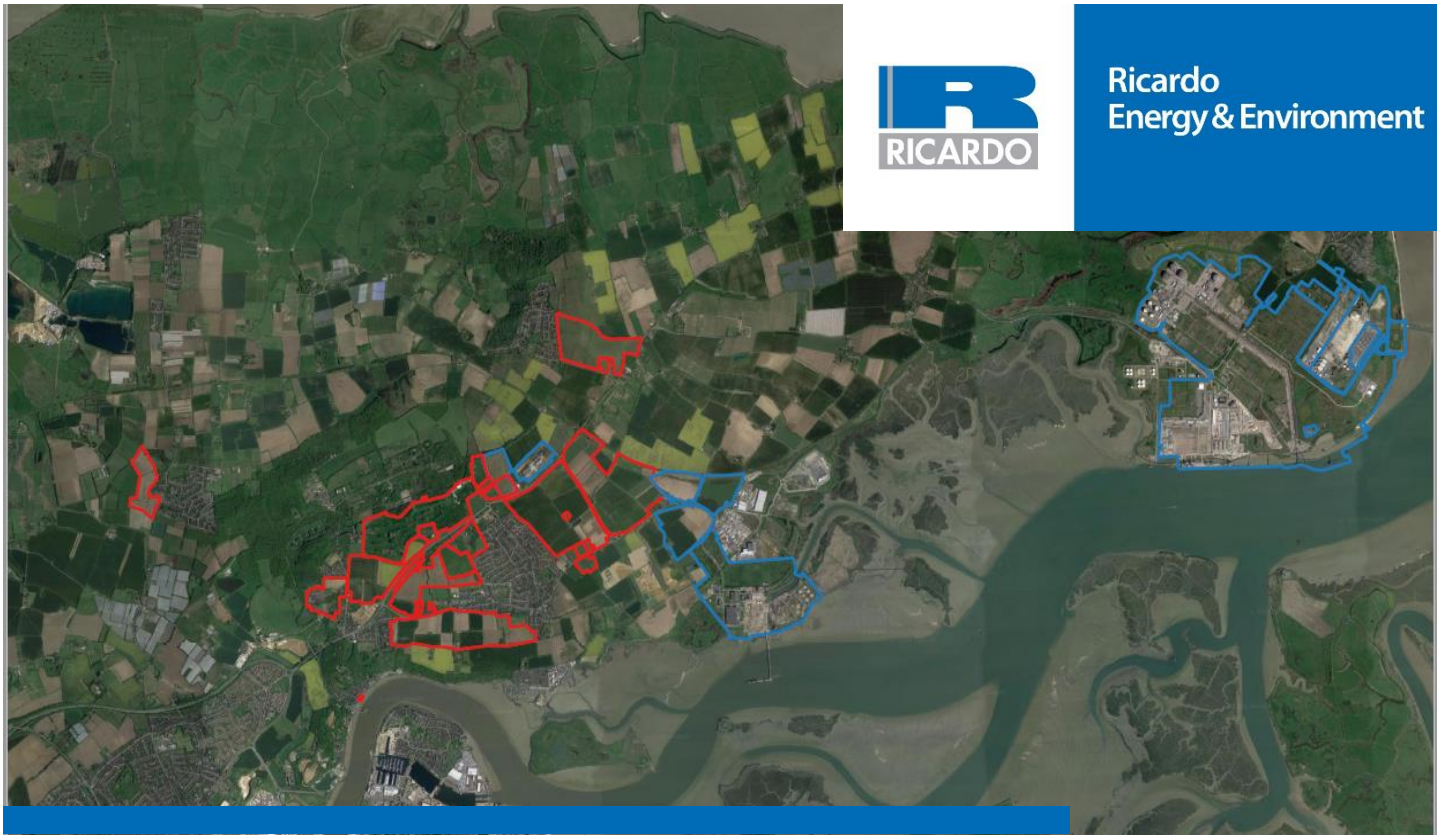
3.2 Partnership working and governance

3.2.1 The Council is setting up a partnership structure for a Hoo Peninsula Strategic Environmental Programme, with a working group leading on the commissioning of evidence and work programme development, having reference to a wider stakeholder partnership. Meetings will be held in early 2026 where terms of reference and a work programme will be agreed.

3.2.2 The Council will progress this work in agreement with Natural England.

4 Appendices

1. Hoo Peninsula Cumulative Ecological Impact Assessment, 2021
2. An overview of the HIF Strategic Environmental Management Scheme
3. Nightingale Impact Assessment



Ricardo
Energy & Environment

Hoo Peninsula CEcIA

Cumulative Ecological Impact Assessment

Report for Medway Council Unitary Authority
ED13710100

Customer:

Medway Council Unitary Authority

Customer reference:

ED13710100

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Executive summary

Medway Council is keen to understand the cumulative effects on protected or otherwise notable sites, habitats and species from potential developments arising from potential allocations in order to develop an effective strategic framework for ecological mitigation, compensation and enhancement. Ricardo Energy and Environment were commissioned to undertake a strategic Cumulative Ecological Impact Assessment (CEcIA), which is reported here.

This report assesses, at a broad strategic scale, the potential biodiversity impacts (direct and indirect) from development of various parcels of land in the Hoo Peninsula as identified by Medway Council. These potential developments include residential, employment and transport (road and rail) infrastructure development. This work is part of a Strategic Environmental Management Scheme (SEMS) to be delivered through the UK Government's Housing Infrastructure Fund (HIF) aimed at supporting iterative master-planning.
The objectives of this study are to:

1. Collate and use existing ecological data to assess the potential cumulative biodiversity impacts of development within all of the potential land allocated for residential, employment and transport uses (with associated community services).

2. Develop a broad-scale framework for impact mitigation, compensation and biodiversity enhancement sufficient to address the potential cumulative impacts identified under objective 1, taking account of other, related initiatives.

The brief for this report was put together by Medway Council in consultation with Natural England and the Hoo Consortium – a testament to the need to ensure the report meets its objectives. During its development, the report has also been subject to stakeholder workshops. These were attended by developers, land promoters and ecologists / wildlife conservation organisations including Natural England and the Royal Society for the Protection of Birds (RSPB). Any relevant ecological data held by stakeholders was shared with Ricardo, which enabled the development of a robust and informed framework (strategy) comprising a suite measures which demonstrate:

- Avoidance of adverse impacts where possible;
- Mitigation for impacts that cannot be avoided, which would include:
    - Minimising (or reducing) what cannot be avoided;
    - Remedying (or restoring) what cannot be reduced; and
- Compensating for what cannot be avoided or mitigated.

In keeping with current planning guidance and forthcoming legislation, the CEcIA goes on to also consider the provision of habitat enhancement to achieve an overall net gain for biodiversity within the peninsula. The National Planning Policy Framework is of particular relevance, requiring plans and planning applications to minimise impacts on, and provide net gains for, biodiversity, including by establishing and protecting coherent ecological networks.

To strengthen the proposed framework, and in the absence of design detail during writing, the CEcIA has considered a theoretical 'worst-case scenario' for the potential developments linked to residential and employment growth i.e. that development occupies the entire land allocation boundary with no habitat features being retained. In reality, this will not be the case. It is recognised that current and future master-planning will reduce the areas of habitat loss through avoidance and incorporation of new green spaces that provide habitat within the allocations. The use of a worst-case scenario simply allows the CEcIA to ensure that any strategic framework for avoidance, mitigation, compensation and enhancement has the capacity to cope with a full range of cumulative impact scenarios.

At this strategic scale avoidance relates to whether the potential allocated land lies outside of any sites designated for nature conservation. Furthermore, the potential allocations as reviewed fall largely within either intensive arable/horticultural land uses, or previously developed land, although the CEcIA recognises the biodiversity value that can often exist within the latter category. Further avoidance of impacts and mitigation focus primarily on addressing indirect disturbance and damage of important features outside of the potential allocations.

Where all reasonable efforts to avoid and mitigate are insufficient to remove significant adverse effects, then compensation for residual adverse effects must be provided. Compensation measures considered here are generally in the form of habitat creation and/or enhancement outside of the allocations, (on the basis that any such measures inside of the allocation boundaries constitute mitigation).

The CEcIA looks not only at the cumulative impacts of the development allocations acting together, but also at the different types of impact combining to cause cumulative effects. This is to identify those effects that could act together to lead to an overall combined effect greater than the sum of its constituent parts.

In the absence of any mitigation and compensation, the CEcIA has identified potential adverse effects on biodiversity that could be significant at the international, national, regional, county and local levels, depending on the importance of the affected features. Impacts of international and national significance relate largely to indirect effects beyond the allocation boundaries such as recreation, noise, lighting, pollution and cat predation on internationally and nationally designated sites, which have a strong presence in the Hoo Peninsula. Without any mitigation or compensation, there is also potential for direct effects of national significance on the larger employment allocations due to loss of important invertebrate habitat on previously-developed (i.e. 'brownfield') land.

In relation to mitigating and compensating the worst-case potential impacts from the potential development, the map below captures the CEcIA's informed response to the available data, existing strategic initiatives and national planning policy.

These mapped areas for biodiversity would serve to:

- Provide strategic mitigation and compensation for potential residential allocation impacts to designated sites, particularly relating to cat predation, recreational pressure, noise and lighting.
- Provide habitat compensation required to achieve no net loss of biodiversity (as measured by DEFRA's Biodiversity Units)
- Provide a net gain in Biodiversity Units
- Provide a strengthened habitat network with improved connectivity for species resilience.
- Help to realise the opportunity identified within the North Kent Marshes BOA
- Provide alternative greenspace (where appropriate) to prevent significant recreational disturbance of designated sites.
- Help address air quality impact through the filtering and absorption effects of natural vegetation.
- Reduce rapid runoff of precipitation, thus reducing flood risk, maintaining wetlands and protecting watercourses from pollution.
- Reduce the number and significance of identified adverse effects arising from development.

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1 Introduction

1.1 Background

This report assesses, at a broad strategic scale, the potential biodiversity impacts (direct and in-direct) of development of potential allocations of land in the Hoo Peninsula. These potential developments include residential, employment and transport (road and rail) infrastructure development. The potential land allocations for these developments have been mapped by Medway Council, and provided to Ricardo Energy & Environment ('Ricardo') in stages up to the 2nd September 2020.

Medway Council and key stakeholders, including Natural England, non-governmental conservation organisations and developers, are keen to understand the potential cumulative effects of such proposed development allocations on protected or otherwise notable sites, habitats and species in order to develop an effective strategic framework for ecological mitigation, compensation and enhancement. To do this, Medway Council has commissioned Ricardo to undertake a broad-scale, strategic Cumulative Ecological Impact Assessment (CEcIA), which is reported here.

This work is part of a Strategic Environmental Management Scheme (SEMS) to be delivered through the UK Government's Housing Infrastructure Fund (HIF), and it is aimed at supporting iterative master-planning. It also informs the evidence base for the emerging Medway Local Plan. The Council has identified that land on the Hoo Peninsula has the potential to form part of the spatial strategy to meet development needs. It recognises the sensitivity of the local environment, and that the plan must demonstrate that development can be delivered sustainably and not damage important ecology. This report will be used to inform the content of the draft Local Plan.

1.2 Objectives

The objectives of this study are to:

1. Collate and use existing ecological data, where available, to assess the potential cumulative biodiversity impacts of development within all of the potential land allocated for residential employment, associated community/commercial and transport uses.
2. Develop a broad-scale framework for impact mitigation, compensation and biodiversity enhancement sufficient to address the potential cumulative impacts identified under Objective 1, taking account of other, related initiatives.

1.3 Report structure

This CEcIA is based on professional good-practice guidance and is structured as follows:

- **Section 1** Introduces the CEcIA and provides the context of the assessment;
- **Section 2** describes the methodology used for the assessment and any relevant limitations;
- **Section 3** provides a summary of the baseline ecological features of importance against which impacts are assessed. It also ascribes a level of importance for biodiversity conservation to each feature;
- **Section 4** assesses the unmitigated cumulative effects of the combined potential developments on key ecological features, taking account of likely construction and operational impacts;
- **Section 5** reviews existing frameworks and associated areas of land identified by others for mitigation, compensation and enhancement to determine their ability to fully address the nature and scale of cumulative potential impacts and the requirement for biodiversity net gain;
- **Section 6** builds on existing approaches reviewed in Section 5 to recommend a composite framework that includes additional or alternative mitigation, compensation and enhancement

measures at the broad strategic scale that are required to address cumulative potential impacts and the requirement for biodiversity net gain.

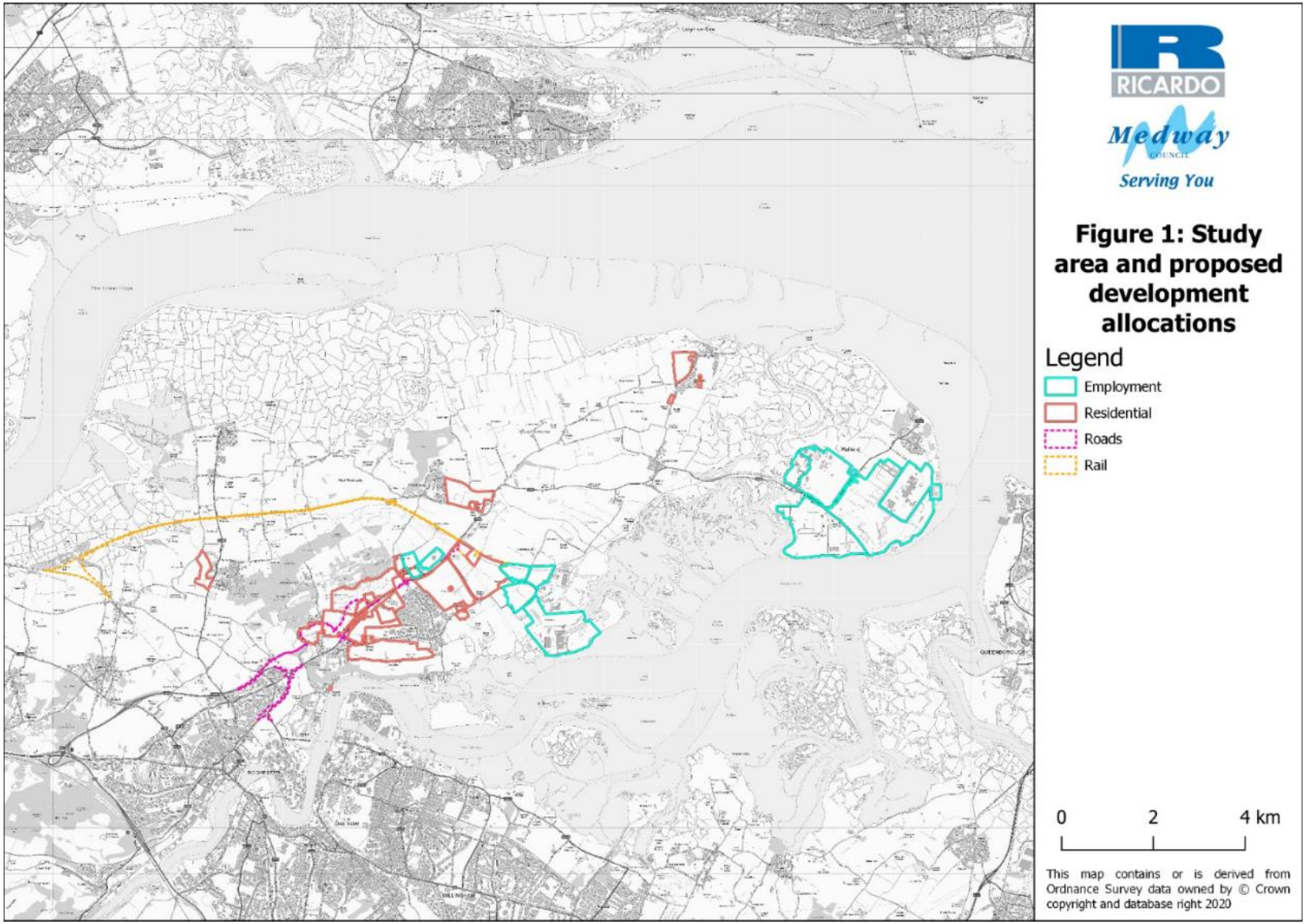
1.4 Study area

The study area for this CEcIA is the Hoo Peninsula (see **Figure 1**), which is situated within the Medway unitary authority in south-east England. The Hoo Peninsula is an area of land on the north coast of Kent, bounded by the Thames Estuary on its north and north-west sides, and by the Medway Estuary on its south and east sides. It is joined to the mainland on its south-west side.
This is mostly an open and relatively remote landscape characterised by grazing marsh associated with wetlands. Fields are bounded by creeks and ditches – many of which have a long history, creating a distinctive pattern. These landscape features support salt marsh and intertidal mudflats stretching from the River Thames estuary in the west to the Swale Estuary in the east. Settlements and roads are limited in this area. There are low but prominent hills typically with settlements or copses of trees. Saltmarsh extends inland along creeks and drainage dykes and in places grazing marsh has been converted to arable cultivation.

It is a largely farmed, rural landscape with limited, small settlements, the most significant of which is the village of Hoo St. Werburgh. It is this village that much of the potential housing development and associated transport infrastructure assessed by this study is focussed around. There are also existing industrial areas on the coastline of the peninsula to the east of Hoo St. Werburgh, notably Grain and Kingsnorth, which are focal points for new, employment-related development assessed by this study. Other potential development allocations include those at smaller villages such as Cliffe Woods, High Halstow and Allhallows.

The potential development land allocations subject to this CEcIA are shown on **Figure 1**.

Figure 1 – The study area and proposed development allocations



1.5 Relevant legislation, policies and guidance

1.5.1 Legislation

1.5.1.1 Wildlife and Countryside Act 1981 (as amended)

This Act provides for designation and protection of Sites of Special Scientific Interest (SSSI), which are areas that represent the most valuable habitats in the UK for nature conservation. The Act also provides protection for certain rare or threatened species and prohibits, or controls releases of non-native invasive species into the natural environment.

It also provides a mechanism for making potential wildlife offences legal through the granting of licences by the appropriate authorities (Natural England in England).

1.5.1.2 Conservation of Habitats and Species Regulations 2017 (as amended) [the 'Habitats Regulations']

These Regulations are the principal means by which the European Habitats Directive and the Birds Directive are transposed in England and Wales. They provide for the designation and protection of a network of 'European Sites' (also termed Natura 2000 sites), including Special Areas of Conservation (SAC) and Special Protection Areas (SPA).

The Regulations also provide legal protection for certain rare or threatened species of European concern known as European Protected Species (EPS). However, potential EPS offences can be made lawful through the granting of licences (EPS Mitigation Licence) by the appropriate authorities (Natural England in England).

1.5.1.3 National Parks and Access to the Countryside Act 1949 (as amended)

This Act provides for the designation of National Nature Reserves (NNR) which are managed to conserve their habitats or for scientific study of the habitats and species represented within them. In addition, they may be managed to provide public recreation that is compatible with their natural heritage interests. The Act also provides for designation of Local Nature Reserves (LNRs) by local authorities. LNRs are managed for nature conservation and provide opportunities for research and education, or simply enjoying and having contact with nature.

1.5.1.4 Natural Environment & Rural Communities (NERC) Act 2006

The NERC Act places a duty on public bodies and statutory undertakers to ensure due regard to the conservation of biodiversity. Section 41 requires the Secretary of State, as respects England, to publish a list of species and habitats which are of 'principal importance for the purpose of conserving biodiversity'. These lists generally reflect the species and habitats previously listed as priorities under the UK Biodiversity Action Plan.

1.5.1.5 Marine and Coastal Access Act (2009)

This Act provides for the designation of Marine Conservation Zones (MCZ). They protect nationally important marine wildlife, habitats, geology and geomorphology. The Marine Conservation Zone Project concerns the selection of MCZs in English inshore waters and offshore waters next to England, Wales and Northern Ireland. Sites are selected to protect not just the rare and threatened, but the range of marine wildlife.

1.5.2 National Policy

1.5.2.1 National Planning Policy Framework

This framework was last updated in 2019 and sets out the view of central Government on how planners should balance nature conservation with development. Within the NPPF, Chapter 15 (Paragraphs 170 to 183) is of particular relevance and requires plans and planning applications to minimise impacts on, and provide net gains for, biodiversity, including by establishing and protecting coherent ecological networks.

In addition, Paragraph 176 confirms that the following should be afforded the same protection as sites that are included within the definition at Regulation 8 of the Conservation of Habitats and Species Regulations 2017 (SACs, Sites of Community Importance, SPAs and any relevant Marine Sites): -

- Potential SPAs and possible SACs;
- Listed or proposed Ramsar sites; and
- Sites identified, or required, as compensatory measures for adverse effects on SACs, SPAs, potential SPAs, possible SACs, and listed or proposed Ramsar sites.

1.5.2.2 Biodiversity 2020: A strategy for England's wildlife and ecosystem services

This biodiversity strategy for England builds on the Natural Environment White Paper and the earlier UK Biodiversity Action Plan. It provides a comprehensive picture of how Government is implementing our international and EU commitments and sets out the strategic direction for biodiversity policy in England up to 2020. Although the period of this strategy has reached its terminal year, the principles remain highly relevant and reflect other, current policy.

1.5.3 Emerging local policy

Medway Council sets out its emerging policy approach to nature conservation in its Local Plan 2012-2035 Development Strategy Regulation 18 consultation report (2018), as follows:

1.5.3.1 Policy NE 1: Sites of international importance for nature conservation

This draft policy confirms that SACs, SPAs and Ramsar sites require the highest level of protection from development that could damage the features of the designated areas. No development will be permitted which may have an adverse effect on the integrity of an SAC, SPA or Ramsar site, alone or in combination with other plans or projects, as it would not be in accordance with the Habitats Regulations and the aims and objectives of this emerging Local Plan. This policy also states that the council will work with other local planning authorities in north Kent to contribute to the delivery of the North Kent Strategic Access Management and Monitoring Strategy (SAMMS): a scheme to address potential damage from population increases on the designated SPA and Ramsar habitats of the Thames, Medway and Swale Estuaries and Marshes. Development within 6km of these designated sites that has the potential to generate additional visits to these areas will be required to make a defined tariff contribution to a strategic package of measures agreed by the SAMMS Project Board.

1.5.3.2 Policy NE2: Conservation and Enhancement of the Natural Environment

This draft policy states that the council will promote the conservation and enhancement of biodiversity in Medway, by restricting development that could result in damage to other designated wildlife areas such as Sites of Special Scientific Interest, Local Nature Reserves, Local Wildlife Sites and a Marine Conservation Zone. The council will also pursue opportunities to strengthen biodiversity networks (see Policy NE5 below).

1.5.3.3 Policy NE5: Securing strong Green Infrastructure

This draft policy states that the council will protect the network of green infrastructure across rural and urban Medway. The highest protection will be given to securing the interests of designated sites of international importance as a Special Protection Area, Ramsar site and/or Special Area of Conservation. A high level of protection from damaging impacts of development will be given to Sites of Special Scientific Interest and Ancient Woodland. The council will consider the need to protect the special features of Regionally Important Geological Sites, Local Wildlife Sites and Local Nature Reserves.

Wider components of the green infrastructure network will be protected in line with the analysis and strategy set out in the emerging Green Infrastructure Framework. New development should provide for green infrastructure that supports the successful integration of development into the landscape, and contributes to improved connectivity and public access, biodiversity, landscape conservation, design, management of heritage features, recreation and seeks opportunities to strengthen the resilience of the natural environment. The council will expect development proposals to demonstrate that they are designed to be resilient and adaptable to the future impacts of climate change, in strengthening ecological networks. The council will promote the extension of the green infrastructure network through setting criteria for the establishment and maintenance of Local Green Spaces.

2 Methodology

2.1 Data collation and review

2.1.1 Ecological baseline

Information provided by third parties, including publicly available information and databases, has been used to review ecological data pertinent to the scheme. Records of protected and notable species, habitats and designated site boundaries within the Hoo Peninsula were obtained from Kent & Medway Biological Record Centre (KMBRC) and Natural England in March 2020. Bird records were obtained from the Royal Society for the Protection of Birds (RSPB) in April 2020 and from the British Trust for Ornithology (BTO) in September 2020. An information request was also sent out to all stakeholders (listed above) in relation to any specific ecological records or reports associated with potential development sites or sites designated for nature conservation within the Hoo Peninsula. Ecological reports were received for sites: Chattenden Barracks (and the adjacent Chattenden Woods and Lodge Hill SSSI), Kingsnorth Power Station, Land West of Hoo, Land at Roper's Lane and High Halstow.

Georeferenced data from the above sources was added to a GIS project using QGIS software before being refined in the following ways:

- Low-resolution data (e.g. recorded to only 4-figure grid references) was removed
- Old, 'historic' records (pre-2005) were removed
- Data that has been superseded by more current or more accurate data was removed
- Separate data-sets of the same species or habitat were combined
- Removal of anomalous data

Additional sources of information assessed as part of the desk study included: published literature; nature conservation databases; records and schedules relating to environmental designations; national and local policy documentation; historic and current mapping, recent aerial photography and websites such as Multi-Agency Geographical Information for the Countryside (MAGIC) and the Kent Landscape Information System (KLIS).

2.1.2 Evolving mitigation strategies

2.1.2.1 Strategic Environmental Management Scheme (SEMS)

Medway Council has obtained £14.35m funding for the delivery of SEMS within the Hoo Peninsula. This funding has been secured to enable the delivery of strategic environmental mitigation projects for the potential new housing, focusing on providing appropriate access to open spaces and protected areas, creating new habitat and a programme of awareness raising. Consultation with Medway Council provided its views on possible SEMS greenspace locations to help inform the CEcIA. These were consistent with aspirations set out in the Council's 'Planning for Growth on the Hoo Peninsula' consultation document (March 2020).

2.1.2.2 Habitats Regulations Assessment (HRA)

Medway Council is currently in the process of developing a new Local Plan to run from 2021 to 2037 which will replace the 2003 Medway Local Plan. Current timescales are for the new Local Plan to be

adopted in 2022. As part of the Local Plan process, an HRA has been commissioned to assess the impacts of providing homes and supporting infrastructure on internationally-designated sites. The HRA is currently ongoing and any proposed mitigation or compensation for likely significant effects on internationally-designated sites was not available in time to inform this CEcIA.

2.1.2.3 Green and Blue Infrastructure Plan

Medway Council is currently in the process of developing a Green and Blue Infrastructure Framework, which aims to support the delivery of the Local Plan. The overall aim of the plan is to improve and develop the green infrastructure across Medway, including the Hoo Peninsula, by providing functional green space such as Nature Recovery Networks, sustainable drainage schemes (SuDS) and green infrastructure such as green roofs. Whilst the CEcIA was being undertaken, the green and blue infrastructure plan was in an early stage of development, therefore no specific data was available to inform the CEcIA. However, an early map had been developed looking at potential connectivity routes throughout the peninsula. Although this map shows only broad, early-stage thinking, it was informed by previous studies such as the Hoo Peninsula Green Cluster Study (2009), the North Kent Biodiversity Opportunity Area (BOA) and local knowledge of the Hoo Peninsula. This map was used, as appropriate, to inform the CEcIA.

2.1.2.4 RSPB's Hoo Peninsula Nature Recovery Network

The RSPB have been developing a map showing where they believe the best opportunities for large-scale habitat creation and restoration are on the Hoo Peninsula. These habitat opportunities are focused on two broad habitat types: woodland with scrub, where the principal beneficiary would be nightingale, and wetlands focused on supporting breeding waders. This proposed network has been used, where appropriate, to inform this CEcIA.

2.2 Assessment

2.2.1 Guidelines

The cumulative assessment was undertaken in broad accordance with CIEEM (2018) '*Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine'* version 1.1.The guidelines set out the following processes for assessment: -

- Identification of important (or 'notable') ecological features that may be affected by impacts associated with a scheme. These may be important by virtue of their rarity, threatened status and/or legal protection;
- Identification of the nature conservation importance of each potentially important ecological feature that is present within a site and adjacent areas which may be affected by a development (i.e. the ecological zone of influence of the scheme);
- Identification of potential effects, based on the nature of the construction and operation phases of a proposed scheme;
- Determining the geographic level at which an effect will be significant, based on the interaction between the characteristics of the effect and the nature conservation importance of the feature likely to be affected;

- Identifying mitigation and, if required, compensation measures that are proposed to avoid, reduce or offset significant adverse effects; and
- Determining residual effects on features once proposed mitigation measures have been taken into account, and any necessary compensation measures.

An ecologically significant effect is defined as: *'an impact (negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area'* (CIEEM, 2018).

In order to assess the effects of any project on flora and fauna, it is important to recognise that a proposed scheme can affect ecological features not only within the land-take required for that scheme but also those located off site, directly and indirectly. As a result, for the purposes of the assessment for this scheme, each impact assessment for the important ecological features considers a 'zone of influence'. This is the maximal extent to which any element of the scheme could significantly impact a feature as long as the link between the source of impact, an impact pathway and a feature is maintained.

2.2.2 Valuation of Features

The CIEEM impact assessment guidelines advocate an approach to the valuation of ecological features using a geographical framework, where the importance or potential importance of an ecological resource or feature should be determined within a defined geographical context.

The guidelines suggest a range of geographical parameters and the ones chosen for this assessment are: -

- International (e.g. Europe)
- National (e.g. England)
- Regional (e.g. South-east region)
- County (e.g. Kent)
- Local (e.g. Medway)
- Negligible (i.e. insignificant in the context of this assessment)

The assigning of a geographical framework has been based on available guidance and information, professional judgement and peer review. The evaluation categories used, and example criteria are presented in **Table 1** below.

Table 1 Evaluation Categories (CIEEM, 2018) and Example Criteria

Geographic Importance	Example Criteria
International	Internationally significant populations of European Protected Species (Annexe IV), Annexe II species, or species otherwise formally deemed to be rare and threatened in Europe or globally (e.g. International Union for the Conservation of Nature (IUCN) 'red-listed'), the loss of which would significantly change the species' overall conservation status (i.e. range, abundance, population trend) at the European scale. A population that would meet the published selection criteria as a qualifying feature for designation of a SAC. An internationally designated site or candidate site, i.e. a SPA, proposed SPA (pSPA), SAC, candidate SAC (cSAC), Ramsar site, or an area which would meet the published selection criteria for such designation.

	Other significant areas of Annex I priority habitats listed in the Habitats Directive, the loss of which would significantly change the overall range and area at the European scale in the long term.
National	Nationally significant populations of species identified in the Natural Environment and Rural Communities (NERC) Act 2006 Section 41 as being of principal importance for the conservation of biodiversity in England, or otherwise formally deemed to be nationally rare and threatened (e.g. 'red-listed'), the loss of which would significantly change the species' overall conservation status (i.e. range, abundance, population trend) at the national scale. A population that would meet the published selection criteria as a qualifying feature of a SSSI. A nationally designated site, i.e. SSSI, NNR or discrete area which would meet the published selection criteria for national designation (e.g. SSSI selection guidelines). A significant area of a non-designated habitat type identified in the NERC Act 2006, Section 41 as being of principal importance for the conservation of biodiversity in England, the loss of which would significantly change the overall range and area of that habitat at the national scale in the long term. Such habitat should be a major component of areas that are at near-equivalence to SSSIs, meeting most of the published SSSI selection criteria.
Regional	Regionally significant populations of species identified in the NERC Act 2006 Section 41 as being of principal importance for the conservation of biodiversity in England, or otherwise formally deemed to be nationally rare and threatened (e.g. 'red-listed'), the loss of which would significantly change the species' overall conservation status (i.e. range, abundance, population trend) at the regional scale. A significant area of a non-designated habitat type identified in the NERC Act 2006, Section 41 as being of principal importance for the conservation of biodiversity in England, the loss of which would significantly change the overall range and area of that habitat at the regional level in the long term. Significant areas of semi-natural ancient woodland that do not meet the national importance criteria (above) should be considered at this scale due to the irreplaceable nature of such habitat.
County	Significant populations of species identified in the NERC Act 2006 Section 41 as being of principal importance for the conservation of biodiversity in England, or otherwise formally deemed to be nationally rare and threatened (e.g. 'red-listed'), or priority species in the County Biodiversity Action Plan (BAP) the loss of which would significantly change the species' overall conservation status (i.e. range, abundance, population trend) at the County scale. Sites formally recognised by local authorities, e.g. Local Wildlife Site (LWS) or considered to meet published ecological selection criteria for such designation. A significant area of a non-designated habitat type identified in the NERC Act 2006, Section 41 as being of principal importance for the conservation of biodiversity in England, the loss of which would significantly change the overall range and area of that habitat at the county scale in the long term. Very small areas of semi-natural ancient woodland that do not meet the national or regional value criteria (above) should be considered at this scale due to the irreplaceable nature of such habitat. A significant area of key habitat identified in the County BAP.
Local	Significant populations of species identified in the NERC Act 2006 Section 41 as being of principal importance for the conservation of biodiversity in England, or otherwise formally deemed to be nationally rare and threatened (e.g. 'red-listed'),

	or priority species in the County BAP the loss of which would significantly change the species' overall conservation status (i.e. range, abundance, population trend) at the district scale. Sites formally recognised by local authorities, e.g. Sites of Borough Importance for Nature Conservation (Borough/Local SINC), LNRs, or considered to meet published ecological selection criteria for such designation. A significant area of a non-designated habitat type identified in the NERC Act 2006, Section 41 as being of principal importance for the conservation of biodiversity in England, the loss of which would significantly change the overall range and area of that habitat at the district scale in the long term. A significant and viable area of habitat identified in the District BAP.
Negligible	Species populations of limited ecological importance due to their size, composition or lack of threat/rarity. The loss of such features would have no discernible impact on the species'/habitat's overall range and conservation status at any formal administrative scale in the long term. Areas of habitat of limited ecological importance due to their size, species composition or lack of threat/rarity. The loss of such features would have no significant impact on the habitat's overall range and conservation status at any administrative scale in the long term.

Only habitats and species considered to be of at least local importance will be assessed within this assessment. Features of negligible importance are scoped out of the assessment.

The only exception to this is where a habitat or species has been afforded a level of legal protection that requires it to be considered more fully, irrespective of that feature's assumed ecological importance (e.g. badger). This has been made clear whenever this occurs.

2.2.3 Significance Criteria

Once the feature has been assigned a geographic level of importance, the next stage is to assess the significance of any predicted impact(s) to that feature. The CIEEM impact assessment Guidelines advise that the determination should simply be whether a given impact will be ecologically significant or not at the geographic level of importance assigned to that feature. This means that the level of impact significance cannot be higher than the geographic importance of the feature.

However, it is sometimes possible that an impact may not be significant at the feature's given level of importance due to its low magnitude, duration, etc., but may be significant at a lower geographic scale. For example, the effects of an impact on a species of county importance may not be discernible or significant at the county scale but may be felt at the district (i.e. local) scale. Where this is the case, it is stated in the assessment.

It is important to note that the CIEEM impact assessment Guidelines do not recommend assigning any other terms to the impact significance such as 'high', 'moderate' or 'low', such as are found within other aspects of Environmental Impact Assessment (EIA).

To determine likely significance of impact, the following parameters may be used: -

- Impact type - direct or indirect, positive or adverse (negative);
- Magnitude of impact – the 'amount' or intensity of an impact. This may sometimes be synonymous with 'extent' (see below) for certain impacts, such as habitats loss. For mortality it may be the number of individuals killed;

- Extent of impact – the area over which the impact will be felt;
- Duration of impact – how long it will occur. CIEEM Guidelines suggest that ecological impact durations should be described in terms of ecological characteristics (e.g. species lifecycles / longevity) rather than human timeframes. Therefore, for this assessment, short-term is up to one (breeding / wintering, etc.) season, medium-term is a typical reproductive lifespan (in the wild), and long-term is over several generations. A permanent impact is one where no reasonable chance of recovery / restoration is evident within the foreseeable future;
- Timing of impact – when it will occur, taking particular note of seasonality;
- Frequency of impact – how often it will occur; and
- Reversibility of impact – a reversible impact is one from which spontaneous / natural recovery is possible; or for which effective mitigation is both possible and an enforceable commitment to deliver this mitigation can be made.

It should be noted that for a broad, strategic study such as this CEcIA, accurate quantification of the above parameters is often not possible. An attempt has been made to do so for the extent of direct habitat loss, but even this can only be done for a worst-case scenario until detailed surveys, master-plans and designs are available. Therefore, any descriptions of impacts will tend to be broad estimates and indicative only for strategic planning purposes.

2.3 Mitigation and compensation

Mitigation for identified impacts will be based on a 'hierarchy' of mitigation options, starting with the most desirable approach (avoidance):

- Avoid adverse impacts where possible;
- Mitigate for what cannot be avoided, which would include:
    - Minimise (or reduce) what cannot be avoided;
    - Remedy (or restore) what cannot be reduced; and
- Compensate for what cannot be avoided or mitigated.

Note that compensation is normally regarded as separate from mitigation, with the former being required when the above measures still result in a significant residual impact. Compensation measures are often employed off site, when on-site mitigation measures are not feasible or likely to be successful.

It should be noted that failure to fully mitigate any identified adverse effects on the integrity of internationally-designated sites (e.g. SPA and Ramsar sites) would require a plan or project to be taken through HRA Stage 3 (assessment of alternatives) and Stage 4 (proving Imperative Reasons of Overriding Public Importance (IROPI)) before compensation could be considered. Therefore, ***the habitat compensation suggested in this report does not include that which may be required for Habitats Regulations derogation purposes following a successful IROPI case.***

The council has followed national planning policy for the mitigation hierarchy in preparing the new local plan. It has considered a wide range of development locations and approaches to meeting its defined growth needs, including a housing need of over 28,000 homes in the plan period. These options have been set out in Regulation 18 consultation documents supporting the preparation of the draft plan. The accompanying work on site assessment, as outlined in iterative updates to the

Strategic Land Availability Assessment has highlighted a number of constraints to identifying sufficient land to meet challenging growth needs.

The council has promoted urban regeneration as the core component of its emerging growth strategy but identified that this could not provide for the quantum and mix of development needed over the plan period, particularly in meeting such a high housing target. Further consideration was given to land in suburban and rural locations, where effective mitigation could be delivered to address constraints. This wide scoping review included a range of sites on the Hoo Peninsula and considered the use of employment sites at Kingsnorth and Grain, new settlements and village extensions to the east and west of the peninsula, as well as growth around Hoo and neighbouring settlements. The assessment work considered the potential for impacts on designated habitats. The sites identified as potential allocations have emerged from a process of avoiding the most sensitive sites and locations on the Hoo Peninsula, before considering the potential for mitigation. These issues are considered in more detail in the Sustainability Assessment (SA) and HRA informing the draft local plan.

The measures described in this report, therefore, seek to reduce, remedy or compensate for those impacts that could not be avoided through such planning measures.

Mitigation for the site preparation and construction phase assumes that a competent contractor will be used who is familiar with, and will adhere to, industry-standard environmental safeguards.

In particular, it is assumed that industry-standard measures for reducing or eliminating noise, dust, water pollution, silt run-off, etc. will be implemented. It also assumes that robust measures and equipment for dealing with any unexpected pollution events will be in place at all times.

Mitigation will aim to be proportionate to impacts, but will recognise that where uncertainty of effect exists, a more precautionary approach may be required to minimise risk of failure.

2.4 Biodiversity Net Gain

In line with Government guidance, local planning policy and ecological good practice (see **Section 1**), the CEcIA will seek to go beyond simply mitigating significant impacts and identify practical biodiversity enhancements that can be delivered through the development process. Such Biodiversity Net Gain is also likely to become a legal requirement for development once the Environment Bill has become an Act of Parliament.

Enhancement measures can include the provision of new habitats, provision of new habitat features and the improved management of existing habitats which will result in a net benefit to biodiversity, over and above the measures required to mitigate and compensate for the impacts of a proposed scheme.

DEFRA's Biodiversity Metric 2.0 Calculation Tool was utilised to calculate the biodiversity units present on site. This tool quantifies each habitat type into 'units' based on a number of factors, including habitat distinctiveness, area, condition, ecological connectivity and strategic significance. Further details on each of these factors is provided below.

2.4.1 Distinctiveness

Each UK Habitat category is automatically assigned a distinctiveness score by the metric tool (see **Table 2**), which is based on an assessment of the habitat type's features, including species richness, rarity, percentage of habitat protected within Sites of Special Scientific Interest (SSSIs) (the less protected the higher the distinctiveness) and the capability of the habitat to support rare species which may not be found in other habitat types.

Table 2 Distinctiveness categories (Natural England, 2019c)

Category	Score	Example of habitat type
Very High	8	Priority habitats as defined in Section 41 of the Natural Environment and Rural Communities (NERC) Act that are highly threatened, internationally scarce and require conservation action e.g. blanket bog
High	6	Priority habitats as defined in Section 41 of the NERC Act requiring conservation action e.g. lowland fens
Medium	4	Semi-natural vegetation not classed as a priority habitat e.g. hazel scrub
Low	2	Semi-natural or modified vegetation not classed as a priority habitat and of lower relative value to most wildlife e.g. temporary grass and clover ley; intensive orchard; rhododendron scrub
Very Low	0	Habitats and land cover or little or no value to wildlife e.g. hardstanding or sealed surface

2.4.2 Condition

Normally, the condition of each habitat type is assessed against specific requirements listed within the guidance documents. These requirements are specific to each habitat type and relate to physical characteristics, structural attributes, typical species present and positive and negative indicators, such as the presence of invasive species. See **Table 3** below.

Table 3 Condition categories (Natural England, 2019c)

Category	Multiplier
Good	3
Fairly good	2.5
Moderate	2
Fairly poor	1.5
Poor	1
N/A - Agriculture	1
N/A - Other	0

For the purposes of this CEcIA, the lack of data on baseline habitat condition means that habitat condition is assumed to be 'moderate' in all cases, thus holding this variable constant.

2.4.3 Ecological connectivity

Each habitat type is assessed for its connectivity to other surrounding similar semi-natural habitats, which could enable the movement of species throughout the wider environment (see **Table 4**).

For the purposes of this CEcIA, the lack of data on baseline habitat connectivity means that habitat connectivity is assumed to be 'medium' in all cases, thus holding this variable constant. Table 4 Connectivity categories (Natural England, 2019c)

Category	Multiplier
High connectivity	1.15
Medium connectivity	1.1
Low connectivity	1

2.4.4 Strategic significance

Strategic significance is measured at a landscape scale, taking into consideration local plans for green infrastructure and biodiversity, national character areas and national objectives. This category

gives value to habitats that are situated within optimal locations which could enable biodiversity objectives to be met (see **Table 5**).

For the purposes of this CEcIA, strategic significance is assumed to be 'medium' in all cases, thus holding this variable constant. Table 5 Strategic significance categories (Natural England, 2019c)

Category	Multiplier	Point applied to calculation	
		Pre-impact	Post-impact
High strategic significance Within an area formally identified as being of good environmental potential in local policy	1.15	Yes	Yes
Medium strategic significance Good environmental potential but not in an area formally identified as being of good environmental potential in local policy	1.1	Yes	Yes
Low strategic significance Low environmental potential and not in an area formally identified as being of good environmental potential in local policy	1	Yes	Yes

2.4.5 Temporal risk

Temporal and difficulty multipliers are automatically applied to the biodiversity unit calculation in the case of habitat creation, restoration, or enhancement in order to take into account the time it will likely take to achieve the target condition and how difficult it will be to achieve the desired result. This gives some weighting to the level of uncertainty that these factors create.

There can be a negative impact on biodiversity for a period of time whilst newly created or enhanced habitat is establishing to its required level of maturity. The temporal risk accounts for this time lag.

Table 6 Temporal risk multipliers (Natural England, 2019b)

Time to Target Condition (years)	Time to Target Multiplier
30	0.343
20	0.49
10	0.7
5	0.837
1	0.965
0	1

2.4.6 Difficulty risk

The metric considers how difficult it is to create or restore different habitat types and applies a multiplier to account for the uncertainty of achieving the target state.

Table 7 Difficulty Categories (Natural England, 2019c)

Difficulty of Creation Category	Difficulty of Creation Multiplier
Very High	0.1
High	0.33
Medium	0.67
Low	1

2.4.7 Spatial risk

Compensatory habitat created at a greater distance from the site of habitat loss will deplete a local area of natural habitat, risking reduced habitat connectivity and limiting available food sources for a variety of wildlife. As all compensatory habitat discussed in this CEcIA is within the Local Planning Authority (LPA), a multiplier of 1 is used in all cases (see **Table 8**).

Table 8 Spatial risk categories (Natural England, 2019b)

Local Risk Category	Spatial Risk Multiplier
Compensation inside LPA, or deemed to be sufficiently local to site of biodiversity loss	1
Compensation outside LPA of impact site but in neighbouring LPA	0.75
Compensation outside LPA of impact site and beyond neighbouring LPA	0.5

2.5 Consultation

From the outset, this study has involved consultation with Natural England, non-governmental conservation organisations and a group of other stakeholders who have an active interest or are directly involved in the future development within the Hoo Peninsula known as the 'Hoo Consortium'. The Hoo Consortium consists of: Redrow, Gladman, Church Commissioners for England, Taylor Wimpey and Dean Lewis Estates. Two workshop meetings were also arranged: one within the first month of the project, one during early CEcIA development and one shortly before the final submission date. The Hoo Consortium attended these workshops along with representatives from the RSPB, Environment Agency, Homes England, Kent Wildlife Trust, Barton Wilmore and Uniper. The aim of the workshops was to present key information developed for the CEcIA and get opinions from the stakeholders regarding methodology and results. Information and feedback gathered during the workshops were then incorporated into the CEcIA.

Separate technical meetings were also held in early 2021 with the RSPB, Kent Wildfowling and Conservation Association and Natural England. There were also meetings with Homes England's ecological consultants to discuss issues related specifically to the Chattenden Woods and Lodge Hill SSSI.

2.6 Limitations

This CEcIA study did not include any first-hand survey. This report uses recent (unconfirmed) records of species and habitats obtained from third parties such as the local biological records centre, the BTO and project stakeholders. The absence of records cannot be relied upon to confirm absence of a species or habitat. Often, the absence of records is a result of under-recording within the given data-search area.

Habitat data used for this study is largely based on county-wide strategic survey undertaken up to 2012. Therefore, it is at least eight years old and, for some areas, may not reflect the current land-use and habitat. However, there was an element of 'ground-truthing' through meetings with key stakeholders with local knowledge, and for some sites, more recent survey data was made available by project stakeholders and used.

This report deals with matters of legal significance but does not constitute professional legal advice. The Client may wish to seek professional legal interpretation of the relevant wildlife legislation cited in this document, which is summarised in Section 1.

3 Baseline information

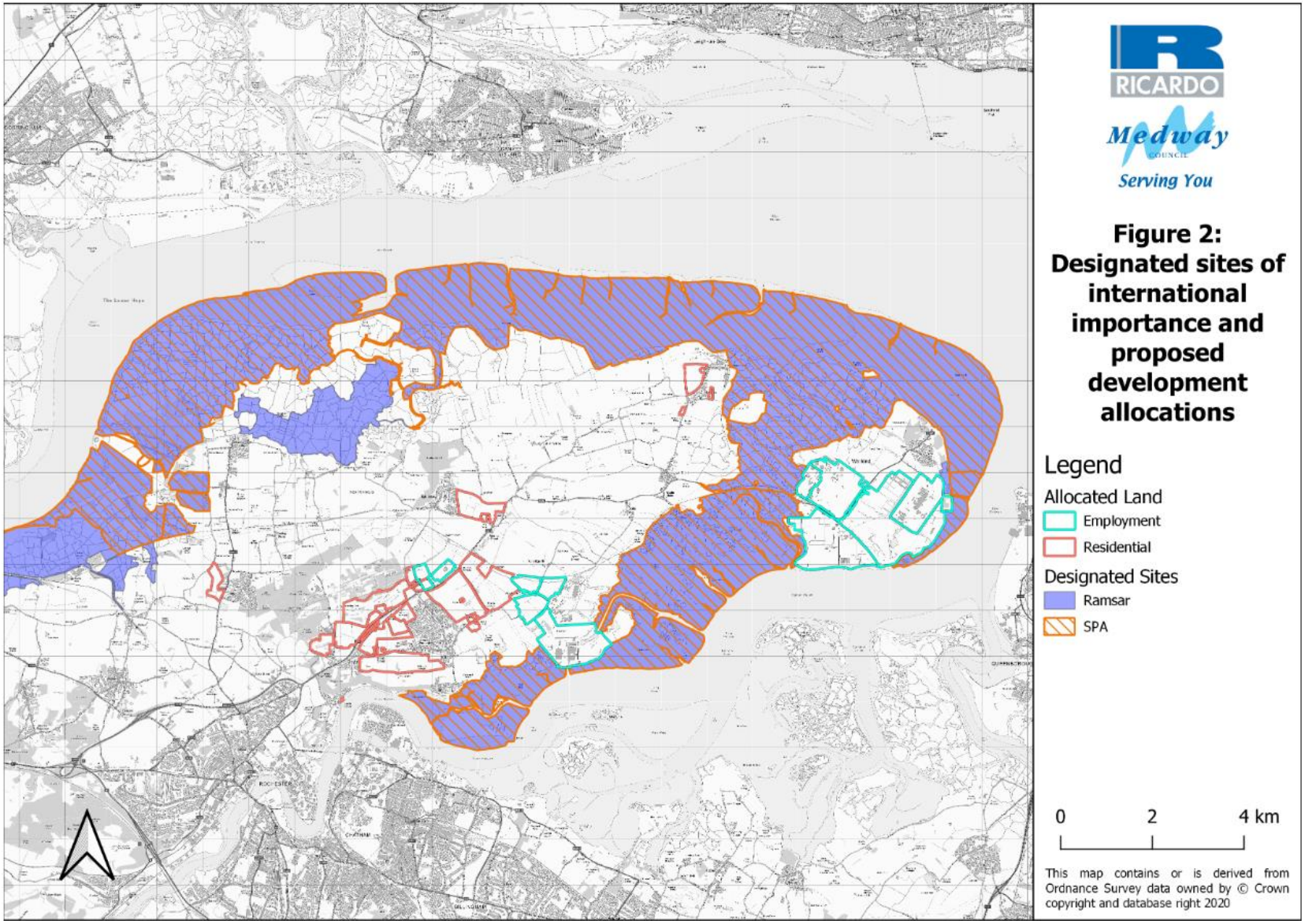
3.1 Designated sites

Designated sites represent the most important areas of habitat found within the Hoo Peninsula and are therefore deemed worthy of some form of legal and formal policy protection. Such sites are designated through different legislative and policy instruments at different geographical levels; such levels reflecting their relative importance. It should be noted that for certain mobile species that are qualifying features of these sites (e.g. birds), land outside of the designated area may also provide a crucial supporting role to the populations using the designated site. Such land is termed “functionally linked land” and is also considered in this assessment.

3.1.1 Sites of international importance

The North Kent Marshes are designated, almost in their entirety, as SPA and/or Ramsar, and are of international importance for breeding and overwintering bird populations and other wetland features. Virtually the whole of the Hoo Peninsula is either within an SPA/ Ramsar site or within 2km of one as shown in **Figure 2** below.

Figure 2 Designated sites of international importance and proposed development allocations



A brief description of these internationally designated sites is provided below.

3.1.1.1 Thames Estuary and Marshes SPA/Ramsar site

The Thames Estuary and Marshes SPA is a wetland of European importance comprising a mosaic of intertidal habitats, saltmarsh, coastal grazing marshes, saline lagoons and chalk pits. The site provides wintering and breeding habitats for important assemblages of wetland bird species, particularly wildfowl and waders as well as supporting migratory birds on passage. The site forms part of the wider Thames Estuary together with other classified SPAs in both Essex and Kent.

The qualifying features of the SPA are the following overwintering and passage birds:

- hen harrier *Circus cyaneus* (wintering)
- avocet *Recurvirostra avosetta* (wintering)
- dunlin *Calidris alpina alpine* (wintering)
- knot *Calidris canutus islandica* (wintering)
- black-tailed godwit *Limosa limosa islandica* (wintering)
- grey plover *Pluvialis squatarola (wintering)*
- redshank *Tringa totanus tetanus* (wintering)
- ringed plover *Charadrius hiaticula* (on passage)
- An assemblage of 75,019 overwintering waterfowl (including the above species)

The qualifying features of Thames Estuary and Marshes Ramsar site that are additional to those already listed above for the SPA are:

- more than 20 Red Data Book invertebrates
- least lettuce *Lactuca saligna*
- slender hare's-ear *Bupleurum tenuissimum*
- divided sedge *Carex divisa*
- sea barley *Hordeum marinum*
- Borrer's saltmarsh-grass *Puccinellia fasciculata*
- dwarf eelgrass *Zostera noltei*

3.1.1.2 Medway Estuary and Marshes SPA/Ramsar site

The Medway Estuary and Marshes Special Protection Area is a wetland of European importance comprising a mosaic of intertidal flats, saltmarsh, and coastal grazing marshes. The site provides wintering and breeding habitats for important assemblages of wetland bird species, particularly wildfowl and waders as well as supporting migratory birds on passage.

The qualifying features of the SPA are the following breeding, overwintering and passage birds:

- avocet (wintering and breeding)
- dark-bellied Brent goose *Branta bernicla bernicla* (wintering)
- dunlin (wintering)
- grey plover (wintering)
- knot (wintering)
- little tern *Sterna albifrons* (breeding)

- pintail *Anas acuta* (wintering)
- redshank (wintering)
- ringed plover (passage)
- shelduck *Tadorna tadorna* (wintering)
- an assemblage of 65,496 overwintering waterfowl

The qualifying features of Medway Estuary and Marshes Ramsar site that are additional to those already listed above for the SPA are:

- at least 12 Red Data Book wetland invertebrates
- curved hard-grass *Parapholis incurva*
- annual beard-grass *Polypogon monspeliensis*
- sea clover *Trifolium squamosum*
- small goosefoot *Chenopodium chenopodioides*
- golden samphire *Inula crithmoides*
- perennial glasswort *Salicornia perennis*
- one-flowered glasswort *Salicornia pusilla*
- sea barley
- Borrer's saltmarsh-grass
- slender hare's-ear

3.1.1.3 Functionally-linked land (relating to SPA/Ramsar birds)

As mentioned above, land outside of the designated areas may also provide a crucial supporting role to the qualifying birds populations using the designated site. This functionally-linked land can, in theory, be identified from records of the relevant bird species observed using these non-designated areas surrounding the designated sites. In practice, this depends on there being sufficient recording effort in such areas.

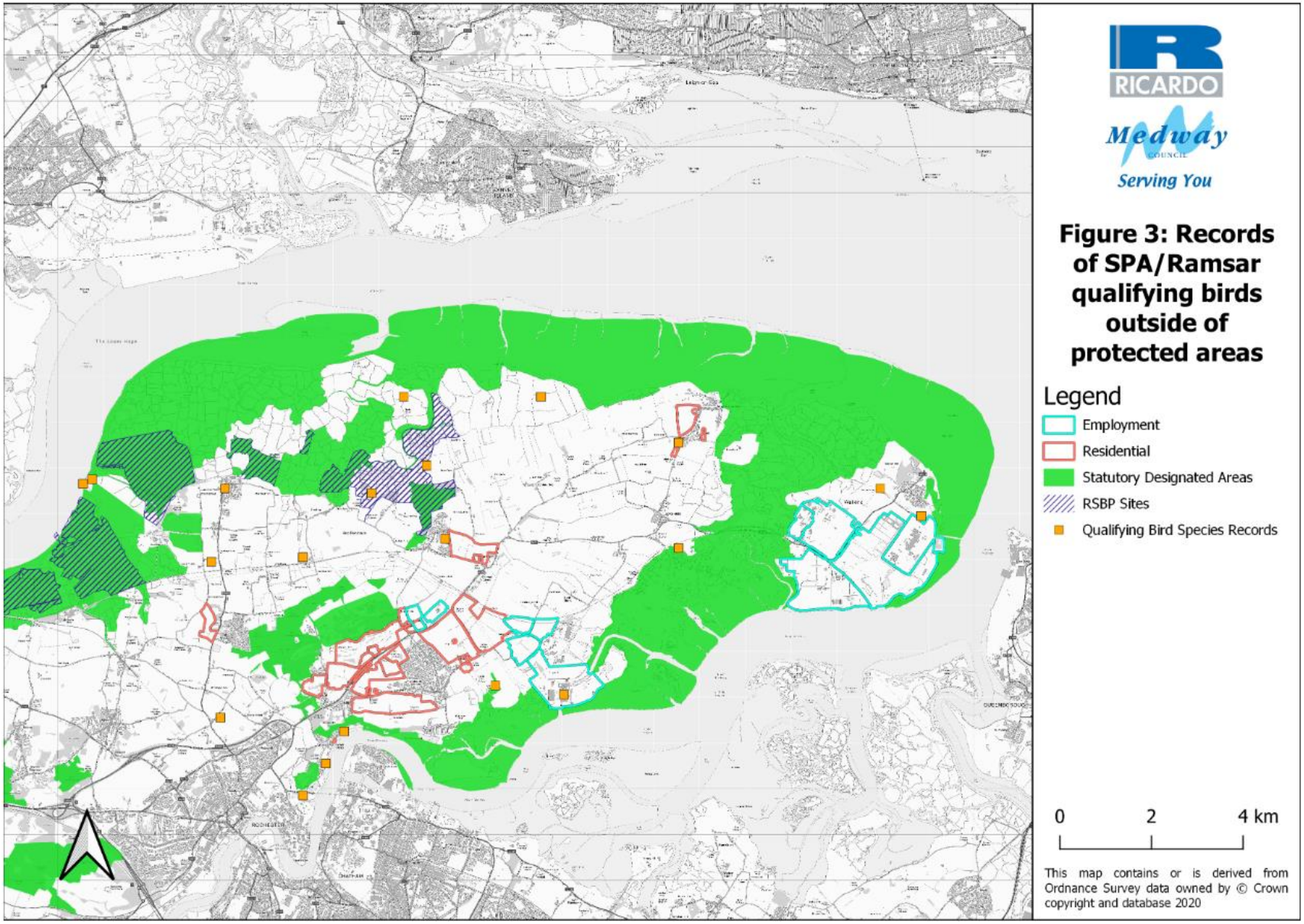
It is clear from the data, and the management of the reserve for bird conservation, that the areas of RSPB reserve that fall outside of the SPA/Ramsar boundary (see **Figure 3**) are likely to be functionally linked land.

Available records of SPA and Ramsar qualifying birds located outside of statutory designated sites and RSPB reserves are also shown in **Figure 3**. It is not clear if the pattern reflects recording effort or actual pattern of use by the qualifying birds. Interestingly, only one set of these records (pertaining to grey plover, redshank, shelduck and hen harrier) lies within any of the development allocations: namely the Kingsnorth industrial site. A few others are situated adjacent to, but outside of, the allocations. The rest are some distance away.

A complicating factor in interpreting these data is that a single grid-reference location is given for each set of bird records, indicating that this was the position of the observer, rather than the birds themselves. It is therefore difficult to draw conclusions about any such areas being functionally-linked land for a designated site.

Due to the paucity of data that can help identify functionally-linked land outside of the designations and reserves, until further survey and Habitats Regulations Assessment can prove otherwise, it should be assumed that any areas of grazing marsh habitat on the Hoo Peninsula (see **Figure 6**) could serve as functionally-linked land, as could any other open grassland or arable land adjacent to the designations and reserves.

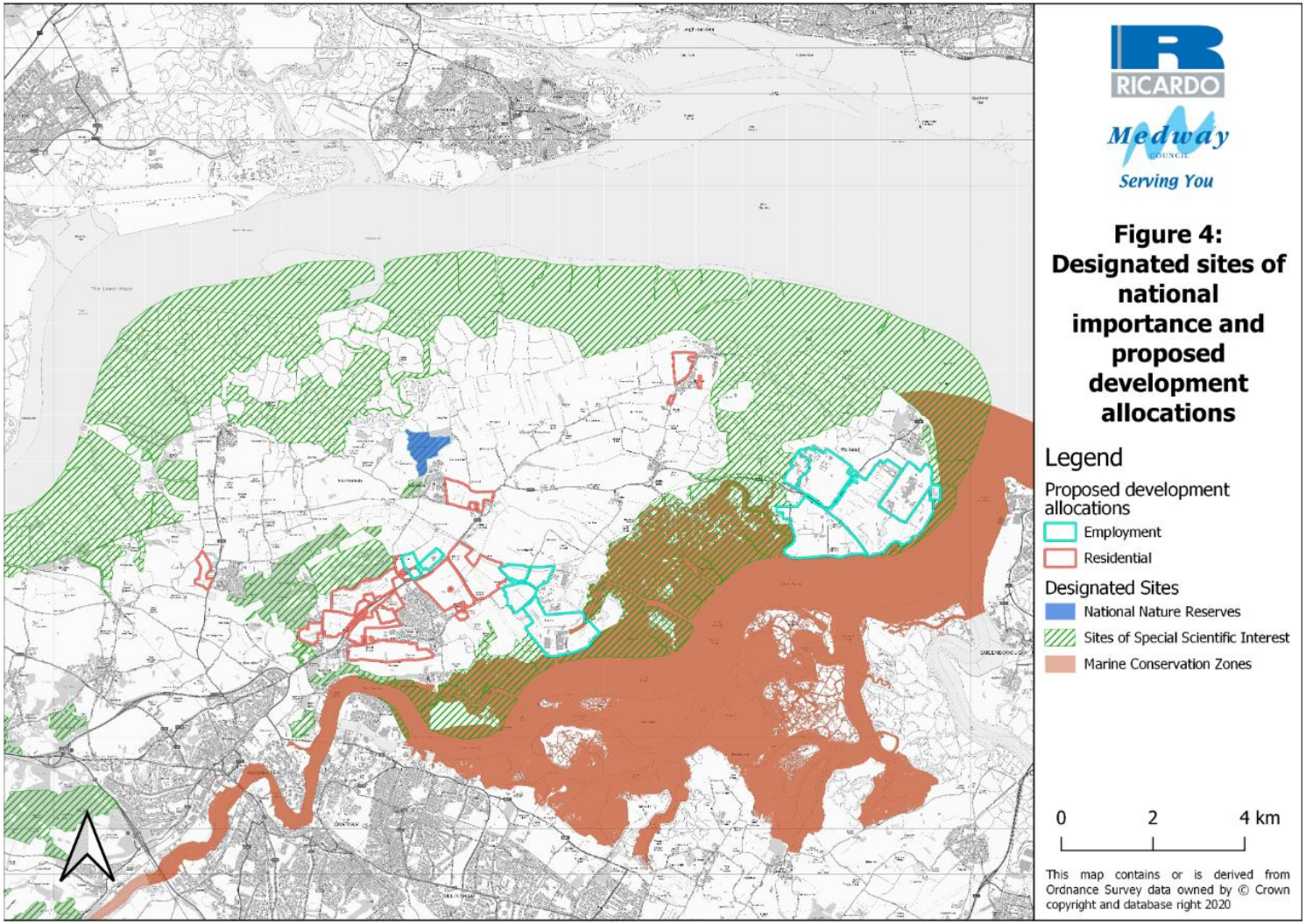
Figure 3 Records of SPA/Ramsar qualifying birds outside of protected areas



3.1.2 Sites of National Importance

There are several SSSIs designated for their biodiversity in the Hoo Peninsula as shown in **Figure 4** below.

Figure 4 Designated sites of national importance and proposed development allocations



These include those that overlap and underpin the internationally designated sites along the coast as described above in Section 3.1.1, i.e.:

3.1.2.1 South Thames Estuary and Marshes SSSI

An extensive mosaic of grazing marsh, saltmarsh, mudflats and shingle characteristic of the estuarine habitats of the north Kent marshes. Freshwater pools and some areas of woodland provide additional variety and complement the estuarine habitats. The site supports outstanding numbers of waterfowl with total counts regularly exceeding 20,000. Many species regularly occur in nationally important numbers and some species regularly use the site in internationally important numbers. The breeding bird community is also of particular interest. The diverse habitats within the site support a number of nationally rare and scarce invertebrate species and an assemblage of nationally scarce plants.

3.1.2.2 Medway Estuary and Marshes SSSI

The Medway Estuary and Marshes form the largest area of intertidal habitats which have been identified as of value for nature conservation in Kent and are representative of the estuarine habitats found on the North Kent coast. A complex of mudflats and saltmarsh is present with in places grazing marsh behind the sea walls which is intersected by dykes and fleets. The area holds internationally important populations of wintering and passage birds and is also of importance for its breeding birds. An outstanding assemblage of plant species also occurs on the site.

Local SSSIs also include those with more terrestrial interests and which stand separately to the international sites:

3.1.2.3 Tower Hill to Cockham Wood SSSI

This site contains woodland representative of that on Tertiary deposits in Kent and supports a rich insect fauna.

3.1.2.4 Chattenden Woods and Lodge Hill SSSI

This SSSI comprises a mosaic of habitats, including ancient and other long-established semi-natural woodland (predominantly W10 pedunculate oak *Quercus robur* – bracken *Pteridium aquilinum* – bramble *Rubus fruticosus* woodland) , scrub, and unimproved neutral grassland (MG5 crested dog's-tail *Cynosurus cristatus* – common knapweed *Centaurea nigra* grassland). It also supports an important population of breeding nightingales *Luscinia megarhynchos*.

3.1.2.5 Northward Hill SSSI

The most important feature of this site is the heronry which at over 200 the pairs is the largest in Britain. There is a diverse breeding bird community and the insect fauna is also of interest particularly moths and butterflies. The site consists of mixed deciduous woodland and scrub with some open areas of grassland and bracken. A number of small ponds are present and also a few open ditches. Northward Hill SSSI is also overlapped by a National Nature Reserve (NNR): High Halstow NNR.

The marine zone adjacent to the Hoo Peninsula on its east side includes:

3.1.2.6 Medway Estuary Marine Conservation Zone (MCZ)

This marine site is designated for a range of estuarine habitats as well as for the tentacled lagoon worm *Alkmaria romijni*.

3.1.3 Sites of local (unitary authority) importance

The Hoo Peninsula contains relatively few non-statutory Local Wildlife Sites (LWS) as shown in **Figure 5** below.

Figure 5 Designated sites of local importance and proposed development allocations

These locally important sites include:

3.1.3.1 Grain Pit

This site contains considerable areas of reedbed and this, along with other habitats such as open water, scrub, grassland, saltmarsh and mudflat, support three Kent Red Data Book birds. The site is adjacent to the South Thames Estuary and Marshes SSSI.

3.1.3.2 Cliffe Pools

This site is designated within the South Thames Estuary and Marshes SSSI (plus SPA/Ramsar designations), so its interests have already been covered in Sections 3.1.1 and 3.1.2 above.

3.1.3.3 Canal and Grazing Marsh, Higham

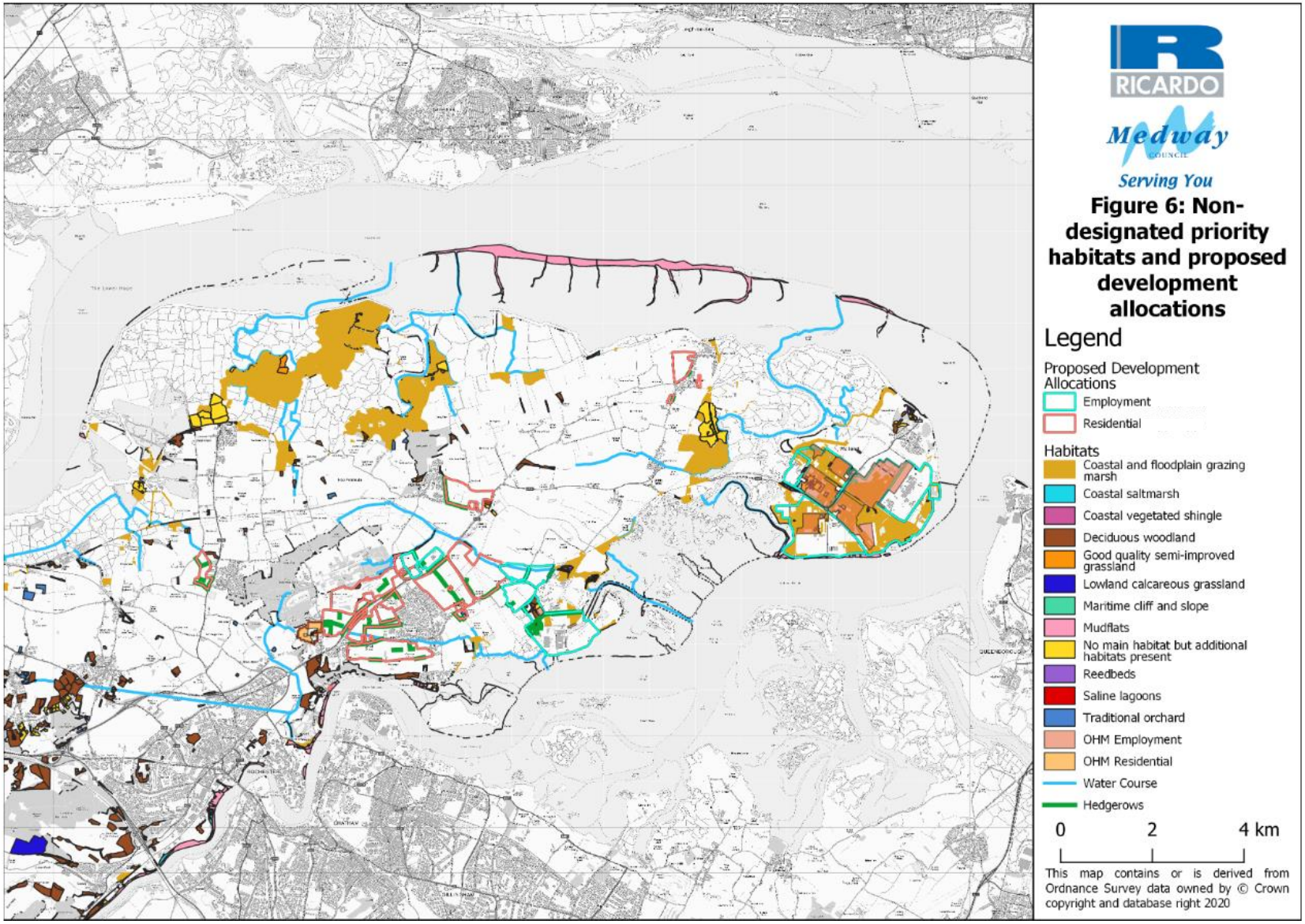
This site contains grazing marsh, dykes, sea wall, saltmarsh and a canal. The site is adjacent to the South Thames Estuary and Marshes SSSI. This site is situated outside of the Medway boundary.

3.2 Non-designated Priority Habitats

Non-designated priority habitats provide the principal resource for maintaining and increasing biodiversity beyond designated site boundaries, such as in the wider countryside and around settlements. For reasons given below in Section 3.3, alongside designated sites, they are normally a good basis for spatial planning for biodiversity. This is because they have been strategically mapped over several decades across the entire peninsula. Therefore, their recorded presence is not biased towards sporadic, non-uniform and incomplete recording effort, as is often the case with species.

Most of the peninsula's priority habitats are located within the designated sites discussed above; relatively limited areas of such habitats exist outside of these. This reflects the intensive agricultural use of most non-designated land in the area. **Figure 6** below shows priority habitats located outside of designated sites.

Figure 6 Non-designated priority habitats and proposed development allocations



Around the peninsula, there are some significant areas of grazing marsh priority habitat that are situated adjacent to, and sometimes surrounded by, designated grazing marsh. There are also some potential small reedbeds associated with these wider wetlands. These non-designated wetland habitats are likely to be important for wetland bird species additional to the qualifying features of the designations. Breeding waders such as lapwing and redshank use both designated and non-designated grazing marsh and other wet grassland in spring-summer. Therefore, non-designated wetland habitat that may not be 'functionally-linked' to the qualifying populations of the SPA/Ramsar sites may nevertheless be important for a wider range of important wetland bird populations.

Adjacent to these coastal marsh habitats are significant areas of open mosaic habitat on previously developed land (also known as 'brownfield' land), notably at the Isle of Grain, Kingsnorth and also further inland at Chattenden Barracks. Owing to the thin, nutrient-poor substrates colonised by a diverse flora, along with some patches of open bare ground, this habitat mosaic provides good conditions for a diverse invertebrate assemblage to form, particularly in the warm climate of south-east England. Up to 15% of all rare and scare invertebrates in the UK have been recorded at brownfield sites and at least 40 species are wholly confined to this habitat. Typical taxa include bees (e.g. brown-banded and shrill carder), solitary wasps, jumping spiders and a range of beetles. It can also be highly suitable for reptile species, as well as bats and birds that feed on invertebrates and use old or derelict buildings for nesting and roosting (e.g. black redstart). Near freshwater bodies, amphibians may also make use of such habitat, including pools that can form on such land.

Grain alone is one of the largest areas of open mosaic habitat in south-east England. Therefore, open-mosaic habitat within the study area is considered to be of up to national importance for biodiversity, as previously concluded in EIA for development proposals at Grain (e.g. National Grid).

Further inland, apart from the open mosaic habitat at Chattenden Barracks, the recorded priority habitats mainly comprise very small areas of deciduous woodland and possibly a few, small traditional orchards of mostly local importance. Where the woodland is identified as being ancient in origin, it should be regarded as being of at least regional importance due to its irreplaceability (e.g. at Haven Street, Sharnal Street and Bell Wood near Fenn Street).

Although mapped priority habitats are notably scare here, reflecting the intensive agricultural land use, important linear habitat features such as species-rich hedgerows, arable headlands/margins and small watercourses will be present, as will other small priority features such as ponds. Such habitats within the study area are also considered to be of local importance for biodiversity.

3.3 Key Notable Species

Obtaining an accurate distribution of notable species across the entire Hoo Peninsula is highly problematic, as the available species records are likely to reflect recording effort, with a bias towards designated sites and previously-surveyed developments, more than actual distribution. Only a broad-scale systematic survey across the whole peninsula would provide a clear distribution pattern that could be relied on for peninsula-wide spatial planning. Put another way, the absence of a record for any particular species does not equate to the absence of that species if the habitat is suitable for it. Basing development planning on existing species records alone would be risky for notable species that are likely to be present but unrecorded. It may even place unfair constraints on development allocations that happen to be near to well-recorded areas, on the potentially false assumption that these are 'core' areas for such species.

Therefore, in such circumstances where most species records reflect heterogenous recording effort, species records should be used with care and coupled with assumed presence in other suitable habitats, unless clearly proven otherwise. This inevitably leads to a habitats-based approach to spatial planning, as (unlike species) habitats have been strategically recorded across the whole study area, albeit over eight years ago.

Therefore, only a brief overview of key protected and notable species found within the Hoo Peninsula is provided below, with an emphasis on the habitats these species rely on but less emphasis on specific record locations.

3.3.1 Flora

Limited biological records of notable flora within Hoo Peninsula were returned by KMBRC and include several that are recorded in more than one location:

- Strawberry Clover *Trifolium fragiferum* – found in shore-side grasslands such as grazing marsh.
- Sea wormwood *Seriphidium maritimum* - found in drier parts of salt marshes in sand and shingle.
- Golden samphire – found on sea cliffs, coastal rocky locations and drier saltmarsh. A qualifying feature of the Medway Estuary and Marshes Ramsar site (see **Section 3.1**)
- Divided sedge – found in brackish ditches, dune-slacks and damp grasslands near the sea such as grazing marsh. A qualifying feature of the Thames Estuary and Marshes Ramsar site (see **Section 3.1**)

It is clear from this list that many of the rarer species recorded within Hoo Peninsula are associated with the habitats of coastal designated sites and therefore already receive significant protection and opportunity for appropriate habitat management.

There are relatively few records of invasive non-native plant species in the Hoo Peninsula, but this probably reflects low recording effort. A good proportion of these scant records are for invasive aquatic plants found in standing water habitats (e.g. the water fern *Azolla filiculoides* and Nuttal's waterweed *Elodea nuttallii*), but notable terrestrial invasives such as Japanese knotweed *Fallopia japonica* have also been recorded.

3.3.2 Invertebrates

Biological records of notable invertebrate species returned by KMBRC include several species of carder bee (e.g. *Bombus sylvarum, B. humilis, B. ruderarius, B. muscorum*). The shrill carder bee *B. sylvarum* is particularly threatened, and the Thames marshes provide one of only two strongholds in England for this species. It relies on tussocky grassland with abundant wildflowers as is found within the coastal grazing marshes and associated sea embankments.

KMBRC records suggest that two notable butterfly species are relatively widely distributed around the peninsula's coastal grazing marsh locations: wall *Lasiommata megera* and small heath *Coenonympha pamphilus.*

KMBRC records indicate that stag beetle *Lucanus cervus* has been recorded in several locations in and around settlements such as Cliffe Woods and Wainscott. Its larva relies on decaying wood under the ground, so dead standing trees and tree stumps are important.

The Chattenden Woods and Lodge Hill SSSI supports a wide taxonomic range of invertebrates and includes substantial lists for some important groups. Of the recorded inventory, at least 334 species have at least one formal status (National Red Data Book or Nationally Scarce, Kent Red Data Book or Scarce, or Section 41). Scarce species are widespread within the SSSI. They are concentrated in the fauna of grassland and other open habitats, with much smaller, though important components in pools and wetland and in woody vegetation; the interest in the latter being associated more with dead wood than with living foliage. The site supports the nationally scarce moths: white-barred knot-horn *Elegia similella*, carrot seed moth *Sitochroa palealis* and lichen crest *Dichomeris alacella*, and also stag beetle.

Other habitats that are important for invertebrate diversity include woodland and open mosaic habitats on previously developed ('brownfield') land, both of which are found on the Hoo Peninsula**. Section 3.2** has already established that the invertebrate fauna of open mosaic habitats within the potential allocation could be of national importance for biodiversity.

3.3.3 Birds

The notable bird species populations and assemblages on the Hoo Peninsula are mostly associated with the designated sites and are described in **Section 3.1**. These bird features of designated sites fall into two broad categories:

- Waterfowl and other wetland birds associated with the Thames and Medway Marshes SPA/Ramsar sites.
- Birds breeding in SSSI woodland and scrub, notably nightingale and heron.

Additional to, and outside of, the designations, a variety of farmland birds are important for wider biodiversity, particularly since the UK has seen a marked decline in many farmland bird species. These are defined as species feeding in open farmland during the breeding season, even though they may nest in woods and hedges. Between 1970 and 2007, the following species declined by more than 50% according to British Trust for Ornithology (BTO) monitoring:

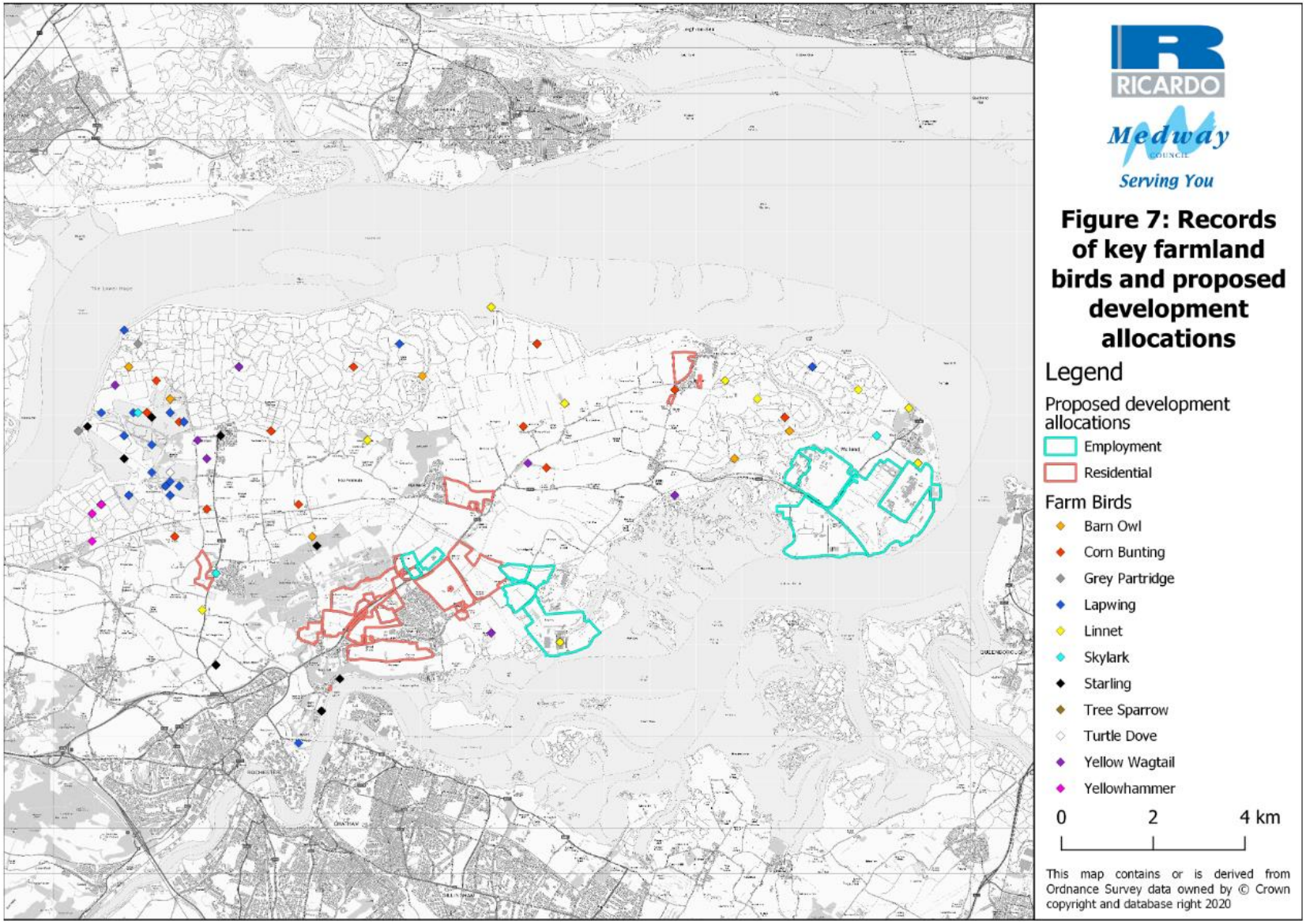
- Tree sparrow
- Corn bunting
- Turtle dove
- Grey partridge
- Yellow wagtail
- Starling
- Linnet
- Lapwing
- Yellowhammer
- Skylark

In recognition of these declines, these species are listed under Section 41 of the NERC Act as species of principal importance for biodiversity (see **Section 1.5**). Such species also provide a useful indicator of general biodiversity in the wider countryside (not just designated sites) because birds are near the top of the food chain and trends have been well monitored by the BTO.

It should be noted that all wild breeding birds and their active nests are legally protected from damage under the Wildlife and Countryside Act (see **Section 1.5**). Furthermore, those species listed on Schedule 1 of the Act are additionally protected from disturbance whilst nesting, such as the barn owl *Tyto alba*, which is also an important bird of farmland.

A map showing records of farmland birds in the Hoo Peninsula is provided in **Figure 7** below. Again, many of these records are within the designated sites discussed in **Section 3.1**. This could be due to quality of habitat, but equally could simply reflect recording effort.

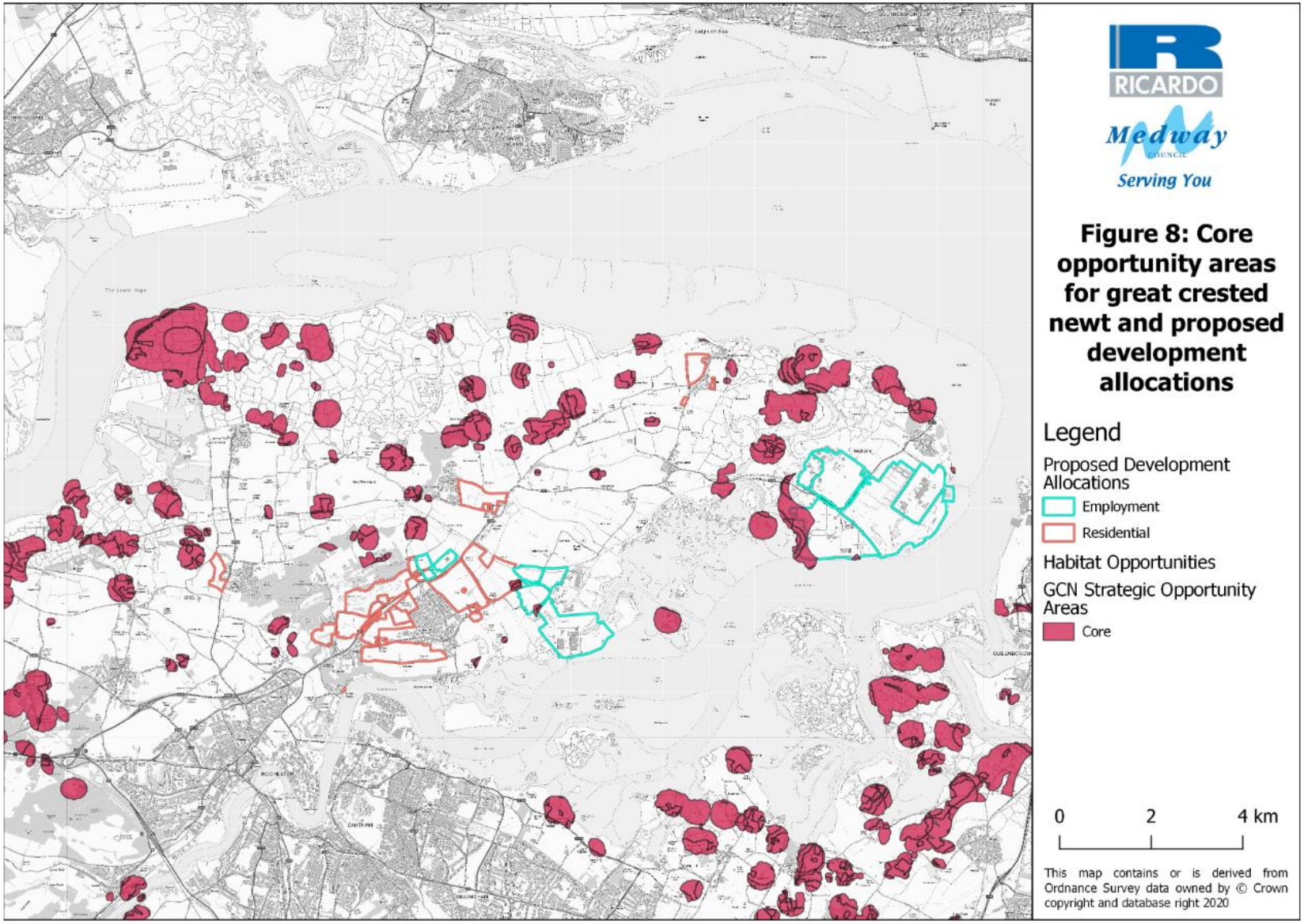
Figure 7 Records of key farmland birds and proposed development allocations



3.3.4 Amphibians

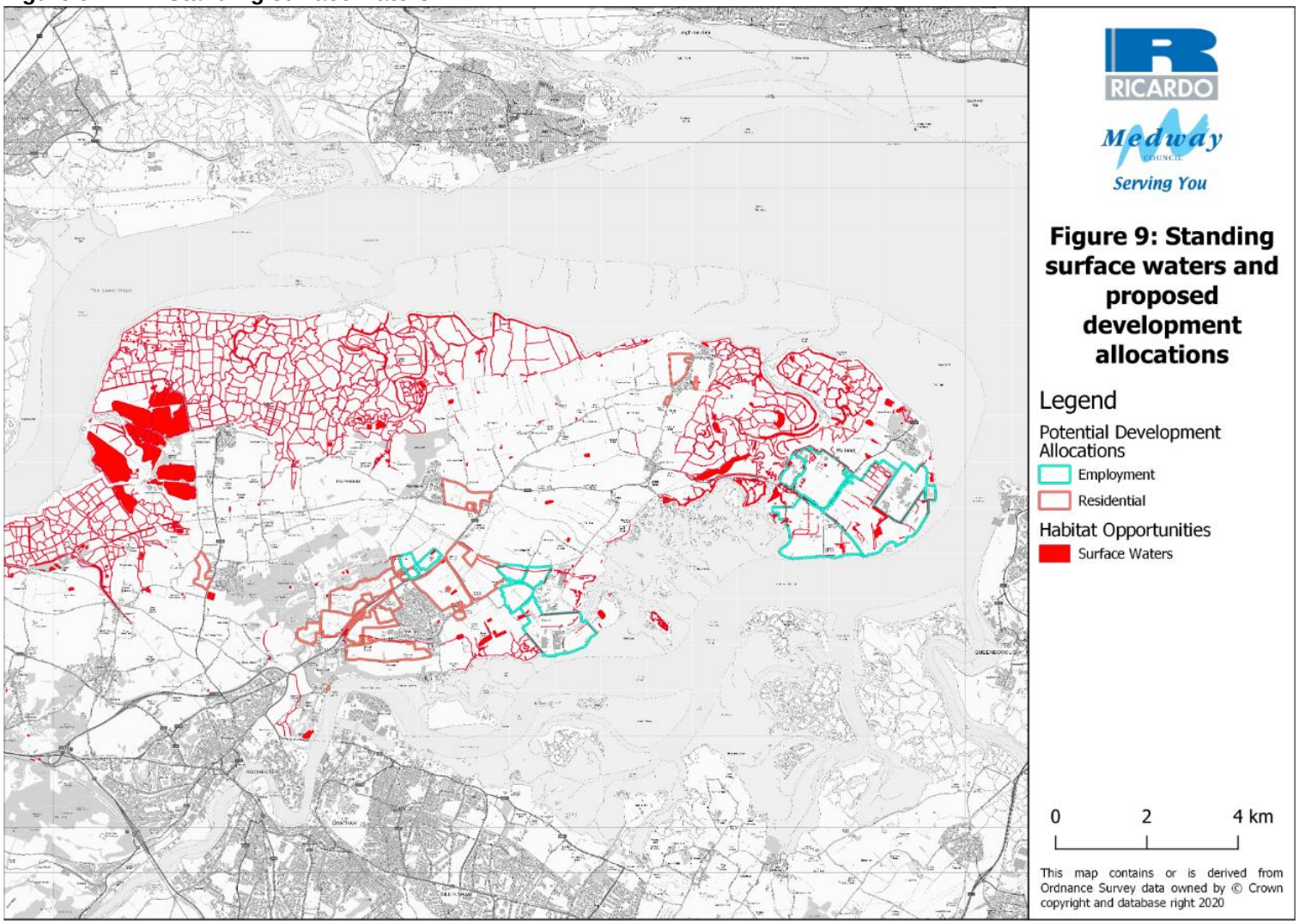
Of the amphibian species likely to be found within the Hoo Peninsula, by far the most notable and protected is the great crested newt *Triturus cristatus*, a European Protected Species. The distribution of records of this species often reflect surveys undertaken for development projects, due to its high level of legal protection. This appears to be the case in the Hoo study area. Chattenden Woods and Lodge Hill SSSI is noted as supporting a meta-population of great crested newt, but there are very few other records around the peninsula. An alternative measure of potential distribution would be the Strategic Opportunity Areas for great crested newts developed by Natural England. This dataset identifies areas where the addition of new ponds would benefit Great Crested Newt populations. The core areas shown in **Figure 8** contain a pond density of 2+ ponds and are located within a 1km square where great crested newt presence has been predicted.

Figure 8 Core opportunity areas for great crested newt and proposed development allocations



Great crested newts are normally found within 250m of their breeding ponds and ditches but can use habitat up to 500m away or more. Therefore, their distribution is closely linked with the distribution of suitable ponds and ditches (see **Figure 9**) with accessible semi-natural terrestrial habitat within 250m radius. For the purposes of this assessment, great crested newts should be assumed to be in such habitats unless proven otherwise through recent survey.

Figure 9 Standing surface waters



Another notable amphibian recorded in Hoo Peninsula that receives much less legal protection is the common toad *Bufo bufo,* which has broadly similar habitat requirements to great crested newt but is generally more widespread. Common toad is a NERC Act species of principal importance (see **Section 1.5**).

As the habitats of such notable amphibians is not confined to the designated sites within the Hoo Peninsula, these species can serve as useful indicators of wider biodiversity.

3.3.5 Reptiles

All native reptile species in the UK receive some degree of protection under the Wildlife and Countryside Act 1981 (as amended) and are also NERC Act species of principal importance for biodiversity (see **Section 1.5**). As would be expected in south-east England, the more common reptile species' records are widely distributed on the Hoo Peninsula. Again, such records and absences of records probably reflect survey effort, often for developments, rather than actual distribution. In the study area, there are records of the four common species: adder, grass snake, slow worm and common (or viviparous) lizard. The Chattenden Woods and Lodge Hill SSSI has been extensively surveyed recently (2016) and supports exceptional populations of common lizard, slow worm and grass snake, and low number of adders.

These reptiles will use a range of habitats that provide opportunity for foraging, basking, resting, hibernation and cover from predators. Often these requirements are best found in habitat mosaics that provide areas of cover and prey items such as long grass, scrub and woodland together with adjacent open areas for basking. In the case of grass snake, waterbodies containing amphibian prey can also be important.

Reptile populations can be assumed to be present in most vegetated habitats in this region, apart from the most intensively cultivated or intensively sheep-grazed/mown. However, whilst arable land is often considered unsuitable, the uncultivated margins of arable fields can provide suitable habitat. Likewise, tightly-grazed pasture can be bordered by more suitable, longer vegetation along ditch-banks and hedgerows. For these reasons, reptiles can also serve as a useful indicator of wider biodiversity in the rural landscape.

3.3.6 Mammals

3.3.6.1 Bats

All species of bats in the UK are European Protected Species (see **Section 1.5**) and therefore are afforded the highest level of legal protection. This protection includes the animals themselves and their roosts. Several species of bat are also NERC Act species of principal importance (see **Section 1.5**). Bats are a good indicator of general habitat quality in the landscape, as they rely on a variety and abundance of insect prey from different habitats and a network of structurally diverse habitat corridors between their roosts and feeding areas.

Mature trees, as found in woodland, hedges, shelterbelts, gardens and parklands are important natural features for providing roost sites for many species. Tree lines and woodland edges also provide valuable commuting and foraging locations for bats. Other habitats that also sustain abundant invertebrate prey are important, such as waterbodies and species-rich grasslands.

Several bat species and roost-types have been recorded across the Hoo Peninsula, with a significant cluster of records in the Lodge Hill and Chattenden Woods SSSI, reflecting both survey effort and habitat quality. Survey results undertaken for Defence Infrastructure Organisation (DIO) from 2016 indicate that at least eleven species of bat occur within this SSSI including: common pipistrelle, soprano pipistrelle, Nathusius pipistrelle, brown long-eared bat, noctule, Leisler's bat, serotine, Daubenton's, Natterer's, whiskered bat and Brandt's bat. High quality foraging and commuting habitat for bats is present across the SSSI, within areas of woodland, scrub, grassland and over water bodies, most of which remains unlit by artificial lighting. The SSSI contains a large number of built structures with the potential to support roosting bats, 40 of which have been confirmed to support at least 51 roosts, with a further five structures possibly supporting roosts (unconfirmed). Surveys identified 443 trees on the site with the potential to support roosting bats, 15 of which were confirmed to support 17 bat roosts during the 2016 survey. Therefore, this designated site is of particular known importance for bats.

The Kent Nature Partnership's Biodiversity Opportunity Area Statement for the North Kent Marshes states that the Hoo Peninsula is an important area for serotine bats *Eptesicus serotinus*. This species flies at treetop height and around lamp posts to hunt for flies, moths and chafers within 2km of its roosts. Serotines tend to roost and hibernate in older buildings and chimneys and are rarely found in trees.

3.3.6.2 Water vole

The water vole is legally protected through the Wildlife and Countryside Act and listed as a species of principal importance under the NERC Act 2006 (see **Section 1.5**). The North Kent Marshes, including the Hoo Peninsula's marshes, are a regional and national stronghold for the species, and there are multiple records within the marshland designated sites due to their extensive network of ditches and drains. Away from the marshes, where watercourses tend to be more isolated, linear features, the species is more susceptible to predation by invasive North American mink. However, given the local prevalence of the species, all watercourses within the peninsula should be assumed to contain water voles unless proven otherwise through recent survey.

3.3.6.3 Brown hare

The brown hare *Lepus europaeus* is listed as a species of principal importance under the NERC Act 2016 (see **Section 1.5**). It is a species associated with a mosaic of farmland habitats and is known to utilise open habitats as well as woodland and scrub. There are several records of this species within the designated grazing marshes of the Hoo Peninsula, but it is likely to be more widespread than this.

3.3.6.4 Harvest mouse

The harvest mouse *Micromys minutus* is listed as a species of principal importance under the NERC Act (see **Section 1.5**). It lives in long tussocky grassland, reedbeds, hedgerows, farmland and around woodland edges, and has been recorded in several locations in the Hoo Peninsula.

3.3.6.5 Hedgehog

The hedgehog *Erinaceus europaeus* is listed as a species of principal importance under the NERC Act (see **Section 1.5**). and has been recorded in several locations in the Hoo Peninsula in and around settlements. They utilise a broad range of habitats such as hedges, fields and woodlands as well as less-manicured gardens within areas of built development, which have become an increasing stronghold for the species possibly due to less predation from badgers and fewer impacts from intensive cropping.

4 Cumulative Impact Assessment

4.1 Effects during construction

4.1.1 Direct habitat loss and physical damage

Based on the proposed development allocation boundaries supplied by Medway Council for this study, and using county-wide habitat survey data from 2012 supplemented with more recent survey data for some development sites (see **Section 2.1**), there is potential for direct loss and/or damage of the following habitats as shown in **Table 9**. It must be noted that this is very much a precautionary, 'worst-case' scenario, as it is recognised that current and future master-planning will almost certainly reduce the areas of habitat loss through avoidance and incorporation of new green spaces that provide habitat within the allocations.

It should also be noted that the areas given below are approximate estimates based mostly on eight year old county-wide survey data and has been rounded to the nearest 0.1 ha. Nevertheless, these data, with their likely error margins, are considered appropriate and useful for interpretation at the broad, strategic scale of this CEcIA. At the project master-planning and project-level EcIA stage, updated habitat surveys will be necessary to provide current and accurate data for those projects' ecological impact assessments.

Table 9 - Estimated maximum areas of direct habitat loss within allocation boundaries

Habitat	Loss to residential development (ha)	Loss to employment development (ha)	Loss to transport infrastructure corridor	TOTAL (ha)
Arable and horticulture	333.6	60.0	24.05	417.65
Open mosaic habitat on previously-developed land	12.0	219.1	9.9	241.0
Built-up areas and gardens	6.0	208	4.9	218.9
Neutral grassland (including grazing marsh)	14.5	164.9	13	192.4
Improved grassland	104.4	29.4	11.35	145.15
Transport corridor without associated verges	4.1	7.0	19.8	30.9
Scrub/scrub woodland	2.0	14.6	0	16.6
Intensively managed orchards	4.6	12.1	0	16.7
Other artificial rock exposures and waste	0	14.1	0	14.1
Broadleaved woodland	6.1	5.3	0.69	12.09
Brackish standing water with no sea connection	0	10.6	0	10.6
Standing open water and canals	1.0	3.7	0.3	5.5
Arable headland or uncultivated strip	4.2	0	0.2	4.4
Estuarine water or sea	0	3.5	0	3.5
Non-cereal crops including woody crops	3.5	0	0	3.5

Reedbeds	0	2.5	0	2.5
Transport corridor associated verges only	0.1	0.5	1.0	1.6
Sparsely vegetated land - ruderal ephemeral	00	1.7	0	1.7
Intertidal shingle/cobbles	0	1.2	0	1.2
Spoil heaps	0	1.1	0	1.1
Intertidal underboulder communities	0	0.7	0	0.7
Rivers and streams	0.2	0.2	0	0.4
Boulders and rock above the high tide mark	0	0.6	0	0.6
Marginal vegetation	0	0.6	0	0.6
Line of trees	0.3	0	0	0.3
Bolboscheoenus maritimus dominant community	0	0.4	0	0.4
Other swamp vegetation	0	0	0	0
Other coniferous woodland	0.2	0.1	0	0.3
Fixed dunes with herbaceous vegetation ("grey dunes")	0	0.3	0	0.3
Wet woodland	0	0.1	0	0.1
TOTALS	**496.8**	**762.3**	**85.19**	**1,344.79**

4.1.1.1 Proposed residential allocations

As can be seen from the above table, the vast majority of potential residential led development is within intensively farmed land including arable, horticulture (including intensive orchard) and improved grassland (= 89%). Of the remaining 11% of potential residential land, the most significant potential losses of semi-natural habitats are neutral grassland (14.5ha), open mosaic habitat on previously-developed land (12ha), broadleaved woodland (6.1ha), arable margins (4.2ha), scrub woodland (2ha) and standing open water (1ha, which the Kent Habitat Survey (2012) suggests could be up to 14 ponds).

Closer spatial analysis of the data using GIS reveals that the great majority of the allocated residential land parcels do not contain these semi-natural habitats. Rather, they seem to be largely clustered in a few locations, in particular the former Deangate Ridge Golf Course and a smaller parcel of land to the immediate south of the golf course, bordering the A228. In these allocations, there are small areas of scrub, woodland and neutral grassland recorded by the Kent 2012 Habitat Survey within a broad background matrix of improved grassland. Of these, only the small areas of woodland and any species-rich neutral grassland are considered to be of local biodiversity importance. Only two small patches of the above-mentioned woodland, both located on the former golf course, are mapped as priority habitat on Natural England's Priority Habitat Inventory. Cumulative loss of these ponds, woodlands, species-rich hedgerows or species-rich neutral grasslands that exist within these residential allocations could be a significant adverse effect at the local level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

The Chattenden Barracks site contains approximately 12ha of open mosaic habitat on previously-developed land, which is another priority habitat that typically contains a diverse invertebrate assemblage (see **Section 3.2**). The loss of such open mosaic habitat and its invertebrate assemblage at Chattenden Barracks could be a significant adverse effect at the local level in the absence of any mitigation. The loss of open mosaic habitat could also, in the absence of mitigation, have a significant adverse effect at the local level on common reptile species, which are typically found in such habitat in south-east England. Therefore, as a requirement of planning, robust mitigation will be developed for these possible local impacts, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Almost every other proposed residential-led allocation is dominated by intensive agriculture or horticulture with only limited, small-scale habitat features such as hedgerows, ponds, arable headlands, tree-lines, small watercourses and small patches of scrub and woodland, according to the 2012 Habitat Survey. In this respect, these proposed allocations have for the most part avoided direct habitat loss impacts on the more valuable and sensitive habitats in favour of the more artificial, intensive land-uses. Habitat losses of any cumulative significance here are likely to be mainly to linear field-boundary features such as hedgerows, watercourses, headlands and tree-lines and also localised features such as ponds. The cumulative loss of watercourses, linear woodlands, ponds and native hedgerows within this farmland could be a significant adverse effect at the local level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Despite the generally lower biodiversity of the habitats themselves, taken together, the cumulative loss of open farmland and former golf course associated with the residential-led proposed allocations could, in the absence of mitigation, have a significant adverse effect at the local level on open farmland species such as brown hare and a number of farmland bird species. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

The cumulative loss of linear/boundary habitat features could also adversely impact bat species, leading to a significant adverse effect at the local level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.1.1.2 Proposed employment allocations

Whereas the proposed residential-led allocations are skewed largely towards existing arable and improved grassland, the proposed employment allocations are focussed mostly on built-up areas and neutral grassland that dominate existing and disused industrial sites. This ‘brownfield land’ is likely to contain significant areas of priority open mosaic habitat on previously developed land (approximately 219ha) and a typically diverse invertebrate assemblage (see **Section 3.2**). This is particularly the case at the two largest employment allocations, located at the Isle of Grain and Kingsnorth industrial sites. Given the recognised importance of the Grain site alone for invertebrates of open mosaic habitat, the cumulative loss of such habitat could be a significant adverse effect at the national level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

The loss of open mosaic habitat could, in the absence of mitigation, also have a significant adverse effect at the county level on common reptile species, which are typically found in very high numbers in such habitat in south-east England. Therefore, as a requirement of planning, robust mitigation will be

developed for this possible county impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Nearly all of the directly-affected areas of employment land listed within **Table 9** appears to be outside of designated sites, apart from very small overlap with part of the Medway Estuary and Marshes SPA/Ramsar/SSSI and the Medway Estuary MCZ at Kingsnorth. The loss or damage of even very small portions of this designated habitat could be a significant adverse effect at the international level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

There are a significant number of standing water bodies within the proposed employment allocations (69 waterbodies according to Kent Habitat Survey 2012), which comprise a total area of approximately 3.7ha. In addition, there are reedbeds of up to 2.5ha. The loss of such aquatic/wetland habitats and the fauna they support (notably amphibians, breeding birds and invertebrates) could be a significant adverse effect at the county level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible county impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

The other, smaller proposed employment allocations are located on intensive arable and horticultural land to the north and east of Hoo St Werburgh. Habitat losses of any cumulative significance here are likely to be mainly to linear field-boundary features such as hedgerows, headlands and tree-lines (in addition to small waterbodies discussed above). Loss of these linear woodlands and native hedgerows could be a significant adverse effect at the local level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

As mentioned above, the cumulative loss of these linear/boundary habitat features could particularly impact bat species, leading to a significant adverse effect at the local level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.1.1.3 Transport infrastructure allocations

The potential land allocations for new transport infrastructure fall into two categories: rail and highways. For simplicity, both of these types of linear development corridors are combined for calculations of potential habitat loss. The notable habitat types that are impacted to the greatest extent by transport infrastructure are 13ha neutral grassland (including grazing marsh) and 9.9ha open mosaic habitat on previously-developed land. All other notable habitats potentially impacted are individually no more than 3ha in extent.

A key issue for the transport infrastructure is its direct impact on designated sites. The potential rail development directly impacts the South Thames Estuary and Marshes SSSI and the Thames Estuary and Marshes Ramsar site near to Hoo Junction and Canal Road in the west of the peninsula. There is also a small incursion into the Thames Estuary and Marshes SPA further eastwards. Whilst these amount to no more than 1 ha of overlap, this potential direct impact on habitat within the designations' boundaries represents a potentially adverse effect on site integrity. This could be a significant adverse effect at the international level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

It is also apparent that the highways works at the Woodfield Way roundabout may directly impact a very small portion (up to 0.01ha) of the Chattenden Woods and Lodge Hill SSSI on the west side of the roundabout. Any loss of habitat within the SSSI boundary could represent a significant adverse effect at the national level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

The potential rail improvements also directly impact nearly 2 hectare of the Canal and Grazing Marsh, Higham LWS near to Hoo Junction and Canal Road. This represents a possible significant adverse effect at the county level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible county impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.1.1.4 Overall direct habitat impact

In summary, the potential cumulative direct loss or damage of locally-important habitats to construction of residential, employment and transport developments could comprise the following:

- Broadleaf woodland and wet woodland (combined) – up to 13.7ha
- Scrub – up to 16.9ha
- Open mosaic habitat on previously-developed land – up to 247.3 ha
- Neutral grassland (including grazing marsh) – 192.3
- Watercourses – up to 0.4 ha
- Ponds/standing waterbodies – up to 5.5 ha / estimated c.83 waterbodies
- Reedbeds and other swamp vegetation - up to 2.9 ha
- Intertidal habitats – 1.9ha

4.1.2 Habitat fragmentation

In addition to direct loss of habitats during the construction phase, retained habitats either side of such losses, including designated sites, can suffer from the adverse effects of fragmentation. Fragmentation leads to a loss of connectivity between areas of habitat for the species that use those areas. This fragmentation can result from the severance of narrow wildlife corridors, such as hedgerows and stream corridors. It can also result from larger-scale removal of broad areas of connecting habitat. The effects on species can include reduced access to food, shelter, mates and new territory. Over time, such fragmentation can lead to reduced genetic diversity within sub-populations. It can also make it more difficult for species to adapt to other environmental changes (such as climate-related changes or increased disturbance) through dispersal/migration.

Fragmentation also leads to reduced size of habitat patches with an associated greater edge-area ratio, thus increasing any edge effects (ingress of light, wind, noise, airborne pollutants, etc). that can reduce habitat quality. So, fragmentation can harm not only mobile species, but also the retained habitat itself.

The cumulative assessment of potential fragmentation presented here is based on identifying important habitats either side of the proposed development allocations and how they are currently connected through and around the allocations.

Generally, the potential allocations do not appear to fragment any broad areas of connected priority habitat or designated sites. The key swathes of priority and designated habitat that connect at the landscape scale are those along the coast and associated coastal marshes, plus a broad corridor to

the west of Hoo St. Werburgh. None of these will be severed by the potential development allocations.

However, at the smaller-scale, there is potential for fragmentation of linear habitat features such as hedgerows, shelterbelts, arable headlands/margins and small watercourses which are found within and adjacent to the allocations.

Fragmentation of aquatic and riparian habitat would occur if streams and ditches within the development allocations became infilled or culverted, leading to isolation of any linked watercourse sections upstream and downstream of the allocations. This could adversely affect notable fauna that rely on watercourse connectivity such as water voles, freshwater invertebrate species, notable amphibians and grass snakes. This could be a significant adverse effect at the local level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Fragmentation of the hedgerow and shelterbelt network in and around the allocations could affect species associated with woodland and scrub that normally avoid crossing open or more disturbed habitat. One of the mammal species normally considered in this regard is the dormouse *Muscardinus avellanarius*. However, there are no records of this species within the Hoo Peninsula, so it is unlikely to be significantly affected.

Many bat species will use hedgerows and shelterbelts to navigate their way through the countryside. Fragmentation of these features may reduce bats' ability to safely and efficiently reach roosting and foraging areas either side of the allocations. This fragmentation impact is of particular concern for the notable populations of bats present in the Chattenden Woods and Lodge Hill SSSI, if the potential developments along the southern and eastern borders of the SSSI do not include significant bat habitat corridors such as continuous dark tree-lines, shelterbelts and hedgerows that connect to similar habitats in the wider, undeveloped countryside. The magnitude of this unmitigated effect on bat populations is difficult to estimate but cumulatively it is likely to be a significant adverse effect at the county level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible county impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Another notable mammal that is believed to rely on hedgerows for nightly movements and dispersal is the hedgehog. They need to be able to move freely through a well-connected range of habitats to find food, mates and areas to nest. Radio-tracking studies show that hedgehogs can travel around 2km in a night in urban areas, and up to 3km a night in rural landscapes. They are suffering particular declines in rural areas, thought to be partly due to hedgerow loss and fragmentation exposing them to greater predation. Therefore, cumulative hedgerow fragmentation is likely to be a significant adverse effect at the local level for hedgehogs in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Linear boundary features such as hedgerows are important habitats for invertebrates in agricultural landscapes. Such features can provide shelter, larval food plants and nectar resources. UK butterflies are known to rely on such features. In general, the butterfly fauna of hedgerows consists mainly of common species although species richness is potentially high with 39 species (64% of the British list) being recorded from hedgerows (Lewington, 2003; Dover and Sparks, 2000). Although the notable butterfly species mentioned in **Section 3.3.2** are not particularly reliant on hedgerows, due to impacts on the wider butterfly assemblage, cumulative hedgerow fragmentation may lead to a significant adverse effect at the local level in the absence of any mitigation**.** Therefore, as a requirement of

planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.1.3 Hydrological effects

Aquatic and wetland habitats are vulnerable to changes in hydrology that affect both soil and surface water levels and the flow characteristics of rivers and streams. This in turn can affect the species that use those habitats. Construction activity can affect hydrology through site drainage, watercourse diversion, impoundment of watercourses, and the creation of rapid run-off surfaces through removal of intercepting vegetation and soils and replacement with hard, impermeable substrates. This can lead to water deficits at certain times and excessive peak flows in others. This can change the quality of the habitat and the species communities that use it.

For example, water voles require sufficient water levels near their burrows and feeding areas in order to provide escape from terrestrial predators but must avoid frequent flooding of their burrows. Birds that that rely on grazing marshes in winter require a high water table to provide ideal conditions for foraging. The maintenance of reedbeds for a range of species is highly water-level dependent. Freshwater invertebrate communities are adapted to certain flow regimes in watercourses.

Low flows can also exacerbate other impacts such as water pollution (through concentration of pollutants) and habitat fragmentation (through aquatic habitat severance during drought).

It is not possible to accurately estimate the hydrological effects of development in all of the potential development allocations, but those proposed allocations located over, near or upstream of water bodies and wetlands are likely to be have relatively greater potential effect than those that aren't. Between the A228 and the Kingsnorth industrial estate there is a watercourse running through several allocations to the south of the railway line. This watercourse appears to feed a large (undesignated) reedbed habitat downstream, near its confluence with Damhead Creek. A significant reduction in downstream flow due to construction activity could impact this reedbed leading to a significant adverse effect at the local level in the absence of any mitigation (or even an internationally significant effect if these reedbeds provide functionally-linked land for the adjacent SPA/Ramsar site). Therefore, as a requirement of planning, robust mitigation will be developed for this possible impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

A similar situation exists for a small watercourse running parallel and to the south of Main Road in Hoo St Werburgh. This watercourse runs adjacent to and through several proposed development allocations south and west of Hoo St Werburgh before it reaches some reedbed habitats near its confluence with the Medway Estuary. Some of these wetlands are within the overlapping designated sites of the Medway Estuary. A significant reduction in downstream flow due to construction activity could impact these designated wetlands leading to a significant adverse effect up to the international level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

4.1.4 Water Pollution

The hydrological linkage described above in **Section 4.1.3**, can be applied to the risk of construction-related water pollution and subsequent effects on aquatic habitats both within and downstream of allocated development land. Pollution can include toxic chemicals, high nutrient concentrations and mobilised silt.

The greatest risks are to designated sites that have aquatic and wetland features. Pollutants arising from construction sites and entering the watercourses that flow through or adjacent to development allocations and then onward to the SPA/Ramsar sites (see **Section 4.1.3**) could damage the habitat of their qualifying features. This has the potential to result in a significant adverse effect up to the international level in the absence of any mitigation. This also applies to direct runoff into SPA/Ramsar sites from immediately adjacent construction sites. Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

Pollution arising from construction runoff into adjacent SSSIs (e.g. Chattenden Woods and Lodge Hill SSSI) could result in a significant adverse effect up to the national level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.
Elsewhere, such waterbourne pollution is likely to have a significant adverse effect up to the local level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.1.5 Air pollution

Sources of air pollution associated with construction activity include on-site emissions from vehicles and plant, plus the generation of dust. It also includes off-site emissions from vehicles serving the construction sites by using local and regional roads. No traffic modelling or emissions dispersion modelling was available for this CEcIA. However, Natural England internal guidance (June 2018) suggests that greatest risks are to designated sites within 200m of traffic sources. This applies to sites that may be sensitive to such pollutants and which are at risk of exceeding their critical loads for each polluting substance.

The two large employment allocations at Grain and Kingsnorth are within 200m of the Medway Estuary and Marshes SPA/Ramsar site which already exceeds several of its qualifying features' critical loads for atmospheric nitrogen deposition according to the Site Improvement Plan for the Greater Thames Complex (Natural England 2014) and the UK Air Pollution information System (apis.ac.uk). Sections of existing roads leading to and from these potential development allocations also come within 200m of international designated sites (Medway and Thames Estuary sites). Therefore, vehicle and plant emissions arising from these development sites and vehicle access during construction may have potential for significant adverse effects at the international level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

Several of the other proposed allocations are within 200m of SSSIs such as Chattenden Woods and Lodge Hill SSSI and Tower Hill to Cockham Wood SSSI, both of which already exceed their critical loads for atmospheric nitrogen deposition. Air emissions arising from these development sites and the roads that connect to them during construction therefore have potential for significant adverse effects at the national level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.
Elsewhere, the cumulative effect of air pollution on non-designated priority habitats is likely to have a significant adverse effect up to the local level in the absence of any mitigation**.** Therefore, as a

requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.1.6 Invasive species

The few records of invasive non-native species in the Hoo Peninsula probably reflects low recording effort. Invasive plants and invertebrates can be spread into sensitive habitats both within and beyond construction sites. Reproductive parts of invasive plants and small invertebrates can adhere to contractors' clothing, vehicles and machinery, which can then be transported to more sensitive habitats. They can also be transferred between sites through site drainage and construction waste/spoil.

For aquatic invasive species, the hydrological linkage described above in **Section 4.1.3** and **4.1.4**, can be applied to the risk of species introductions and subsequent effects on aquatic habitats both within and downstream of allocated development land. The greatest risks are to designated sites that have aquatic and wetland features. Invasive species arriving at, or arising from, construction sites and then entering the watercourses that flow to the Medway Estuary and Marshes SPA/Ramsar site could damage the habitat of qualifying features.

Terrestrial invasive species could also be transferred to the peninsula's SPA/Ramsar sites and/or its SSSIs. This is more likely to happen where designated sites are adjacent to the development allocations or the access routes used by construction traffic.

Such accidental aquatic and terrestrial transfers to SPA/Ramsar sites have the potential to result in a significant adverse effect up to the international level in the absence of any mitigation. Such transfers into SSSIs have the potential to result in a significant adverse effect up to the national level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Elsewhere, invasive species introductions would be a significant adverse effect at the local level in the absence of any mitigation, except where they affect Local Wildlife Sites (e.g. Grain Pit LWS), in which case it could constitute a significant adverse effect up to the county level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.1.7 Lighting

The adverse effects arising from artificial lighting of construction sites apply mainly to nocturnal species. Bats are a species group believed to be particularly sensitive to lighting.

Illuminating a bat roost can cause disturbance (Downs et al 2003) and desertion and can also delay bats from emerging which shortens the amount of time available to them for foraging (Boldogh et al 2007). Nocturnal insect abundance occurs soon after dusk; a delay in emergence means this vital time for feeding is missed. This has been shown to have direct impacts on bats' reproductive ecology, such as slower growth rates and starvation of young (Duverge et al 2000). Lighting a key flightpath some distance from the roost could also cause roost desertion.

Artificial lighting can also affect the feeding behaviour of bats by the attraction of insects to sources of light; or the presence of lit conditions posing a barrier to movement. Studies have shown that noctule,

Leisler's bat, serotine and pipistrelle bats can congregate around white mercury streetlights (Rydell J et al 1993, Blake et al 1994) and white metal halide lamps (Stone et al 2015b) feeding on the insects attracted to the light, but this behaviour is not true for all bat species. The slower flying broad-winged species such as long-eared bats, Myotis species (which include Brandt's bat, whiskered, Daubenton's bat, Natterer's bat and Bechstein's bat), barbastelle, and greater and lesser horseshoe bats generally avoid all streetlights (Stone et al 2009, 2012, 2015a). Consequently, bat species less tolerant of light are put at a competitive disadvantage and are less able to forage successfully and efficiently. This can have a significant impact upon fitness and breeding success.

In addition, it is thought that insects are attracted to lit areas from beyond the immediately illuminated habitat. This is thought to result in adjacent habitats supporting reduced numbers of insects, a 'vacuum effect'; population declines have been shown further afield, suggesting both direct and indirect impacts at play (Langevelde et al 2018). This is a further impact on the ability of the light-avoiding bats to be able to feed. It is noticeable that most of Britain's rarest bats are among those species listed as avoiding artificial light, so artificial lighting has potentially devastating conservation consequences for these species (Rowse et al 2016).

The effects of artificial lighting on drinking resources for bats has been recorded to be stronger than on foraging. White light has been shown to stop slower-flying species drinking at cattle troughs, and even for faster-flying species drinking behaviour was reduced, however foraging behaviour increased as above (Russo et al 2017).

When considering how bats move through the landscape, artificial lighting has been shown to be particularly harmful if used along river corridors, near woodland edges and near hedgerows. Studies have shown that continuous lighting in the landscape, such as along roads or waterways, creates barriers which many bat species cannot cross, especially the slower-flying species (Fure, A. 2012), even at very low light levels. Common pipistrelles – the UK's most numerous species – have been recorded avoiding gaps that are well lit, thereby creating a barrier effect (Hale et al 2015).

Artificial lighting is also thought to increase the chances of predation by birds, and therefore bats may modify their behaviour to respond to this threat (Speakman et al 1991, Jones et al 1994).
In summary, these impacts both alone and in combination are likely to have significant impacts for slower-flying, rarer species, and even for fast-flying species, potentially affecting reproductive, foraging and roosting opportunities. On a population and ecosystem level, impacts may affect the overall genetic pool of bat species and their prey species.

There are numerous bat records throughout the Hoo Peninsula, with a significant cluster within the Chattenden Woods and Lodge Hill SSSI. Several species are recorded here, and many of the records are of roosts, including for maternity and hibernation. Therefore, this designated site is of particular known importance for bats. There are several proposed residential-led development allocations situated adjacent to this SSSI along its south and east boundary. This includes allocations at Chattenden Barracks, the former Deangate Ridge Golf Course and the Deangate Ridge Sports Ground, which together share nearly 2.5km of boundary with the Chattenden Woods and Lodge Hill SSSI. Light-spill into the SSSI from these potential developments carry significant risk to the known assemblage of bat species roosting, foraging and commuting within and from the SSSI, and this could constitute a significant adverse effect at the county level for bats in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible county impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Elsewhere, the allocations are mostly bounded by relatively artificial, low-diversity open habitats. Arable and improved grassland make up nearly 60% of land within 100m of all allocation boundaries.

Beyond the Chattenden Woods and Lodge Hill SSSI boundary already mentioned, woodland and scrub habitats represent a very small portion of land within 100m of the allocation boundaries. Often these are linear belts of woodland, tree-lines/shelterbelt and scrub that, together with hedgerows and stream-sides, may form useful bat commuting corridors, irrespective of their overall area. These smaller patches and linear corridors of arboreal and riparian habitat could be impacted by light-spill during construction which could adversely affect bat movements through the landscape. This could be a significant adverse effect at the local level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Birds can also be disturbed by artificial lighting during construction as it can disrupt their circadian rhythms and daily patterns of activity. Birds that migrate or hunt at night navigate by moonlight and starlight. Excessive artificial light at night (ALAN) can also disorient birds during migration. Bright lights at night on large buildings attract birds. Migratory birds depend on cues from properly timed seasonal schedules. Artificial lights can cause them to migrate too early or too late and miss ideal climate conditions for nesting, foraging and other behaviours. Exposure to artificial light at night has also been shown to affect the immune responses of some birds.

In the Hoo Peninsula, this is a particular risk to the avian qualifying features of designated sites. The larger potential employment allocations at Grain and Kingsnorth are surrounded on several sides by the Medway Estuary and Marshes SPA/Ramsar/SSSI. The internationally-important assemblages of bird species using these marshes and estuarine habitats are largely migratory. The openness of these landscapes also makes artificial lighting highly visible from significant distances. Any lighting impacts on bird populations or assemblages that are qualifying features of the SPA/Ramsar could be a significant adverse effect up to the international level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

The Chattenden Woods and Lodge Hill SSSI is designated partly for its important breeding population of nightingales. Proposed residential-led allocations share nearly 2.5km of boundary with this SSSI. Very recent work from Homes England has suggested that indirect effects of anthropogenic light could have a relatively strong impact (75% territorial loss) adjacent to development, reducing to 50% by 100m and tailing off to a very low (less than 5%) effect by 300m. If artificial lighting during construction of this proposed housing were to cause significant disturbance to this species it would constitute a significant adverse effect at the national level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Construction lighting is less of an issue for the other designations in the peninsula that have avian features of interest, as the development allocations are located some distance form these other sites and often with intervening settlement present already.

Outside of designated sites, construction lighting's effects would be limited to a range of more common bird species that use farmland and gardens, and therefore any impacts would most likely have a significant adverse effect at the local level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Certain invertebrates may be susceptible to artificial construction lighting. The Chattenden Woods and Lodge Hill SSSI is noted for the nationally scarce moths: white-barred knot-horn *Elegia similella*, carrot seed moth *Sitochroa palealis* and lichen crest *Dichomeris alacella*. Moths are attracted to

artificial lights where they are more susceptible to predation. Lighting can also alter moth behaviour (i.e. by inhibiting sex hormones, thereby reducing reproduction) and cause contact with hot parts of lights which can kill moths or damage their wings and antennae. These moth species are not reasons for notification of the SSSI. Therefore, lighting impacts to these notable moth populations could constitute a significant adverse effect at the local level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Non-designated habitat that is nationally important for invertebrates and lies adjacent to and within some of the allocations is open mosaic habitat on previously developed land. This includes proposed allocations at Chattenden Barracks, Grain and Kingsnorth. These habitats together contain a very diverse assemblage of invertebrate species. Lighting impacts to these important invertebrate populations and assemblages could constitute a significant adverse effect at the national level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.1.8 Noise

Noise emanating from active construction sites can disturb wildlife using retained habitats within or adjacent to such sites. As described for potential light-spill effects, important semi-natural habitats that lie adjacent to proposed residential-led allocations and are therefore exposed to construction noise are largely those within Chattenden Woods and Lodge Hill SSSI. This SSSI is designated partly for its important breeding population of nightingales. Proposed residential-led allocations share nearly 2.5km of boundary with this SSSI. Therefore, construction noise poses a significant risk to nightingales and the SSSI, particularly during the breeding season.

Nightingales can be impacted by noise in several ways. Firstly, it can cause them to move away from sources of noise thus increasing energy expenditure and limiting their willingness to forage and breed within otherwise suitable habitat. Furthermore, construction noise can interfere with their own vocalisations thus leading to reduced breeding success. There is also some evidence that bird song has a role to play in conspecific attraction whereby the presence of other nightingales already occupying the area acts as an indicator of suitable habitat (Holt, Hewson & Fuller 2012). It is thought that females search for males to pair with at night, and that the nocturnal advertising song of the males could serve as a settlement cue for other arriving males, whilst the song of multiple males could provide a stronger stimulus for females. This is perhaps less relevant for the construction phase as most construction work is likely to take place during the day.

Any reduction in nightingale population caused by noise would be a significant adverse effect at the national level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Important semi-natural habitats that are adjacent to employment allocations and therefore exposed to construction noise are largely within the Medway Estuary and Marshes SPA/Ramsar/SSSI. Here the impacts of construction noise on birds would be of greatest significance in the winter. This is because most of the avian qualifying features are overwintering or passage species, although breeding avocet and little tern are also qualifying features. Disturbance from noise will often cause birds to fly away from the source of noise. This causes them to expend valuable energy reserves and to abandon favoured feeding or resting places, both of which can be critical in cold winter months. For qualifying breeding species, noise disturbance can cause nest abandonment and reduced feeding of parents and chicks. If this has long-lasting population impacts, then it would be a significant adverse effect up to the international level in the absence of any mitigation**.** Therefore, as a requirement of planning,

robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

Outside of designated sites, construction noise effects would be limited to a range of more common bird species that use farmland and gardens, and therefore any impacts would most likely have a significant adverse effect at the local level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.1.9 Visual disturbance

Visual disturbance may be particularly significant in relation to birds using open, coastal habitats such as those within and next to the internationally-designated sites. Whilst visual disturbance effects on waterbirds have been more frequently studied, empirical information on threshold variability remains poor. However, by way of example, a flight response might be expected by many species if approached to within c.100-150m across a mudflat (Cutts, et al. 2013). High-level visual disturbance is typified by regular reactions to visual stimuli with birds moving away from the works to areas which are less disturbed. Most birds will show a degree of response to stimuli. Birds that remain in the affected area may not forage efficiently and if there are additional pressures on the birds (cold weather, extreme heat, etc.) then this may impact upon the survival of individual birds or their ability to breed. Visual stimuli reaches high levels of disturbance with workers operating outside of equipment, fast movement, large plant and close proximity to the birds (especially encroachment on mudflats) contributing to this level of disturbance. Most species studied show behavioural changes in response to such stimuli up to 250m from the source, with reduced feeding and often taking flight or walking away (Ibid).

Important semi-natural habitats that are adjacent to employment allocations and therefore exposed to construction-related visual stimuli are largely within the Medway Estuary and Marshes SPA/Ramsar/SSSI. Here the impacts would be of greatest significance in the winter. This is because most of the avian qualifying features are overwintering or passage species, although breeding avocet and little tern are also qualifying features. If this has long-lasting population impacts, then it would be a significant adverse effect up to the international level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

The effect of construction-related visual stimuli on nightingales of the Chattenden Woods and Lodge Hill SSSI is more difficult to quantify. The effects of human presence examined in a study currently being undertaken by Homes England was related to recreational disturbance and particularly dog-walkers. The presence of dogs presents a very different visually-perceived risk to nightingales than does nearby construction activity. However, in the absence of specific data for construction activity, the 100m impact distance for human walker/dog-walker presence provides a precautionary indication. On this basis, any reduction in nightingale population caused by construction-related visual stimuli within 100m of the SSSI would be a significant adverse effect at the national level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Outside of designated sites, construction-related visual effects would be limited to a range of more common bird species that use farmland and gardens, and therefore any impacts could have a significant adverse effect at the local level in the absence of any mitigation. Therefore, as a

requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.2 Effects during operation

4.2.1 Water Pollution

During the operational phase, the main risk of water pollution effects from development comes from the additional wastewater passing through sewage treatment works to be discharged into sensitive watercourses and associated wetlands. This can be treated water arising through normal treatment works' operation, or from untreated wastewater in combined storm overflows during occasional periods of significant precipitation and runoff.

All foul water from public sewers in and around Hoo St Werburgh currently discharges to a large sewage pumping station located to the south-east of the existing settlement. Foul sewage is then pumped in a westerly direction via a 250mm rising main (a pipe under pressure) to a 300mm diameter public sewer in Four Elms Hill, Chattenden. This network ultimately outfalls into the Whitewall Creek Wastewater Treatment Works.

This arrangement presents two distinct alternatives to enable the foul water flows from the proposed Hoo development to discharge to the existing Southern Water public sewerage and sewage treatment system:-

- Increase the capacity of Southern Water's terminal sewage pumping station at Hoo to accommodate the foul water flows from the proposed Hoo Developments together with local public sewer improvements if necessary. Capacity at the Whitewall Creek Wastewater Treatment Works would also need to be increased to treat the additional foul water flows; or
- Replace Southern Water's terminal sewage pumping station at Hoo with a new wastewater treatment works to accommodate both existing and proposed foul water flows and abandon the current pumping regime.

The greatest risks in failing to accommodate and fully treat the additional wastewater are to designated sites that have aquatic and wetland features. Pollutants from the new developments' wastewater entering the Medway Estuary and Marshes SPA/Ramsar site could damage the habitat of qualifying features. For example, Natural England have noted in their site monitoring that algal blooms were detected on Bartlett Spit and Bishops Ooze (SSSI Unit 100) in 2016 directly in front of the Motney Sewage treatment works outfall. Elevated nutrient inputs from wastewater over a sustained period can alter the community composition and therefore have the potential to result in a significant adverse effect up to the international level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

However, Southern Water has indicated a commitment to upgrade foul water infrastructure to accommodate the anticipated growth of Hoo St Werburgh. When clarity on the extent of new development is available, the options outlined above will be explored further by Southern Water, with infrastructure improvement planned and designed to support new development in a timely and coordinated fashion.

4.2.2 Air pollution

Sources of air pollution associated with the operation phase of residential development are mainly emissions from additional vehicles using local and regional roads, including the proposed new roads. Vehicles and their emissions are also a feature of the operation phase in proposed employment

allocations. For reasons given in **Section 4.1.5**, the greatest risks are to designated sites within 200m of these sources that may be sensitive to such pollutants and which are at risk of exceeding their critical loads for each polluting substance.

The two large employment allocations at Grain and Kingsnorth are within 200m of the Medway Estuary and Marshes SPA/Ramsar site which already exceeds several of its qualifying features' critical loads for atmospheric nitrogen deposition according to the Site Improvement Plan for the Greater Thames Complex (Natural England 2014) and the UK Air Pollution information System (apis.ac.uk). Sections of existing roads leading to and from these potential development allocations also come within 200m of international designated sites (Medway and Thames Estuary sites). Therefore, vehicle emissions arising from these development sites and associated linking roads during operation may have potential for significant adverse effects at the international level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

Several of the other allocations, including new or improved roads, are within 200m of SSSIs such as Chattenden Woods and Lodge Hill SSSI and Tower Hill to Cockham Wood SSSI, both of which already exceed their critical loads for atmospheric nitrogen deposition. Air emissions arising from these development sites and associated vehicle use during operation therefore have potential for significant adverse effects at the national level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

In addition, industrial activity within the employment allocations can generate significant air pollutant emissions including those that may travel significantly further than 200m. The Defra/Environment Agency's "*Air emissions risk assessment for your environmental permit*" (which applies to industrial emission sources) currently identifies distances of 2 km for local and nationally important designated sites and areas of ancient woodland, and 5, 10 or 15 km depending on the emission source for European Sites. Therefore, industrial emissions arising from these potential employment sites during operation may have potential for significant adverse effects at the international level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

Given the lower relative importance of habitats outside of the designated sites, the cumulative impact of operational air pollution on these is likely to be a significant adverse effect at the local level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.2.3 Hydrological effects

The operation phase of new development can affect hydrology through greater water resource demands. This can arise from increased local population and associated number of homes and neighbourhood services in residential allocations. It can also arise from within employment allocations, such as from industry or services. This can lead to a lowering of the water table and increased risk of drought during extended periods of low rainfall. This can change the quality of the habitat and the species communities that use it as described in **Section 4.1.3**.

The water supply companies have a duty to plan for future growth in demand including that from new development. This is done through the Water Resource Management Plan (WRMP) process, which must take full account of ecological impacts and the need for effective mitigation. There is a particular focus on statutory designated sites during this process. It is therefore assumed that significant impacts to nationally and internationally important sites will be avoided or fully mitigated by the water company through water supply and demand-management measures. The Hoo Consortium's Development Framework Document (2017) states that preliminary enquiries were made with the main utility companies in respect of the expansion, replacement or supplementing existing services, and those initial discussions indicated there are no insurmountable issues relating to water supply.

4.2.4 Predation

The operation phase of new housing developments brings with it a risk of increased predation on local wildlife from domestic cats.

There have been several studies over recent years on cat predation. The most recent comprehensive study of cat home ranges and ecological impact is that done by Kays et al in 2020 and published as "*The small home ranges and large local ecological impacts of pet cats*" (Animal Conservation, ZSL 2020). This studied 925 pet cats from six countries, finding remarkably small home ranges (3.6 ± 5.6 ha). Most (75%) cats used primarily (90%) disturbed habitats. Cats have similar or higher prey items per month than wild carnivores, but the effect is amplified by the high density of cats in neighbourhoods. As a result, pet cats around the world have an ecological impact greater than native predators. However, the study found that this impact was concentrated mostly within 100m of their homes.

An earlier but recent UK study by Hanmer et al (2017) of only 38 cats found that the median furthest distance they reached from home in a peri-urban setting was 148m. Despite differences in proximity to more natural habitat, cats showed a clear selection preference for garden habitat as opposed to natural habitats. This study concluded that a buffer zone of ~335 m between peri-urban housing and areas of conservation concern would be appropriate. This exclusion zone calculated for the peri-urban area is similar to that found by Thomas et al. (2014).

Earlier studies that provide evidenced advice on cat ranges and nature conservation buffers include Lilith et al (2008) who found that the longest linear distance moved by any cat in their study was 300m and suggested adding a 20% margin for safety (i.e. total buffer = 360m).

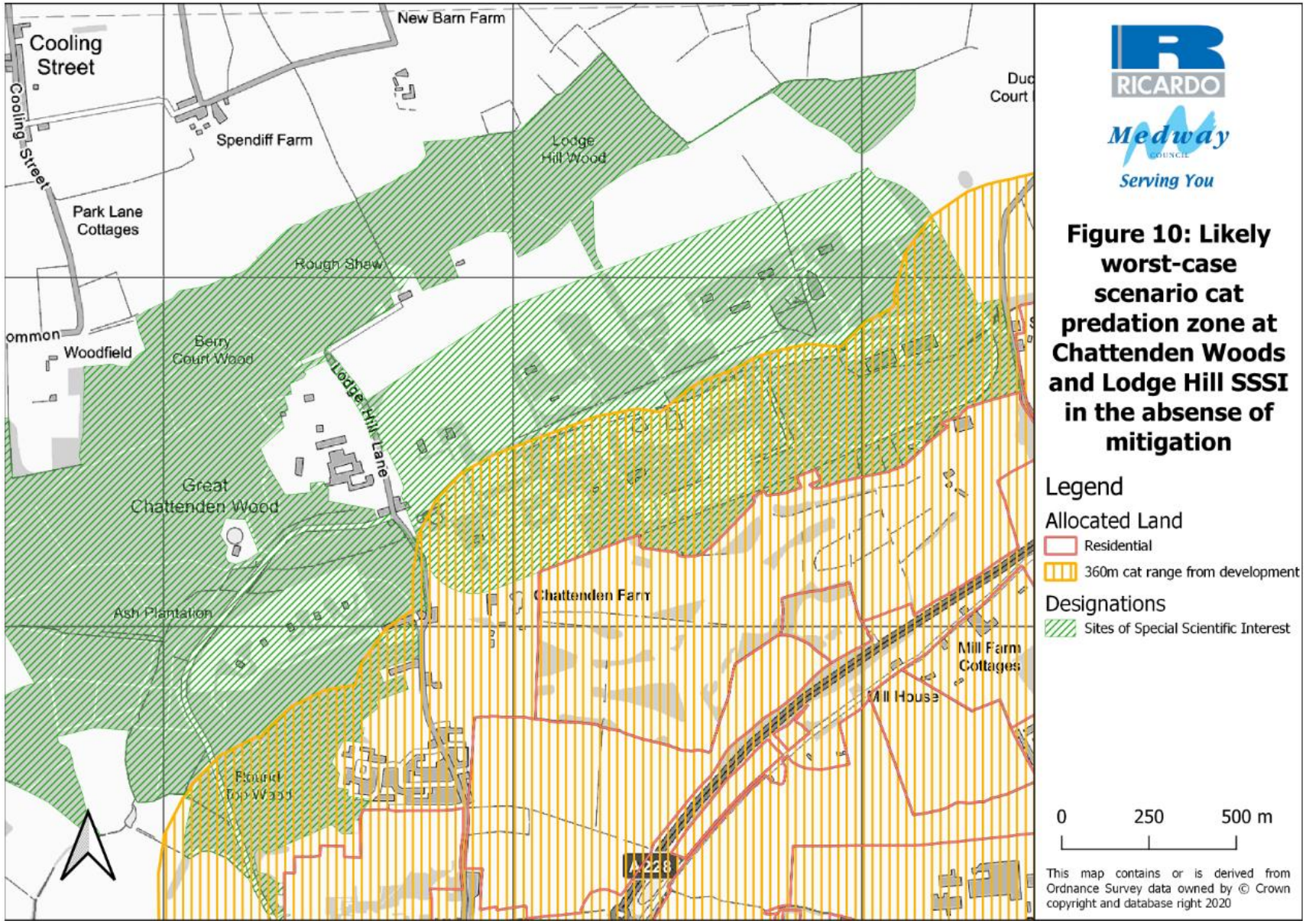
In light of these scientific studies, it is considered for this CEcIA that unmitigated domestic cat predation effects on sensitive features could be significant within approximately 360m of residential development.

During the development of this CEcIA, work commissioned by one of the Hoo Peninsula proposed developers, Homes England, is currently being undertaken on a more site-specific insight into the potential impact range of cats on the nightingale populations of the Chattenden Woods and Lodge Hill SSSI. The evidence currently suggests that with housing development beyond 360m the effect is negligible at the SSSI boundary. As residential development moves closer, in the absence of mitigation, they modelled increasing % territory losses in 50m bands. For example, in the absence of mitigation, approximately 10% nightingale territory loss might be expected within the outer 50m margin of the SSSI (on the development side) with development located 300m to 350m away.

Potential residential-led allocations share nearly 2.5km of boundary with Chattenden Woods and Lodge Hill SSSI with its important breeding population of nightingale. Based on the evidence referenced above, cats from residential areas could, in the absence of mitigation, significantly reduce the breeding population of nightingales within the SSSI if such development is situated within 360m of

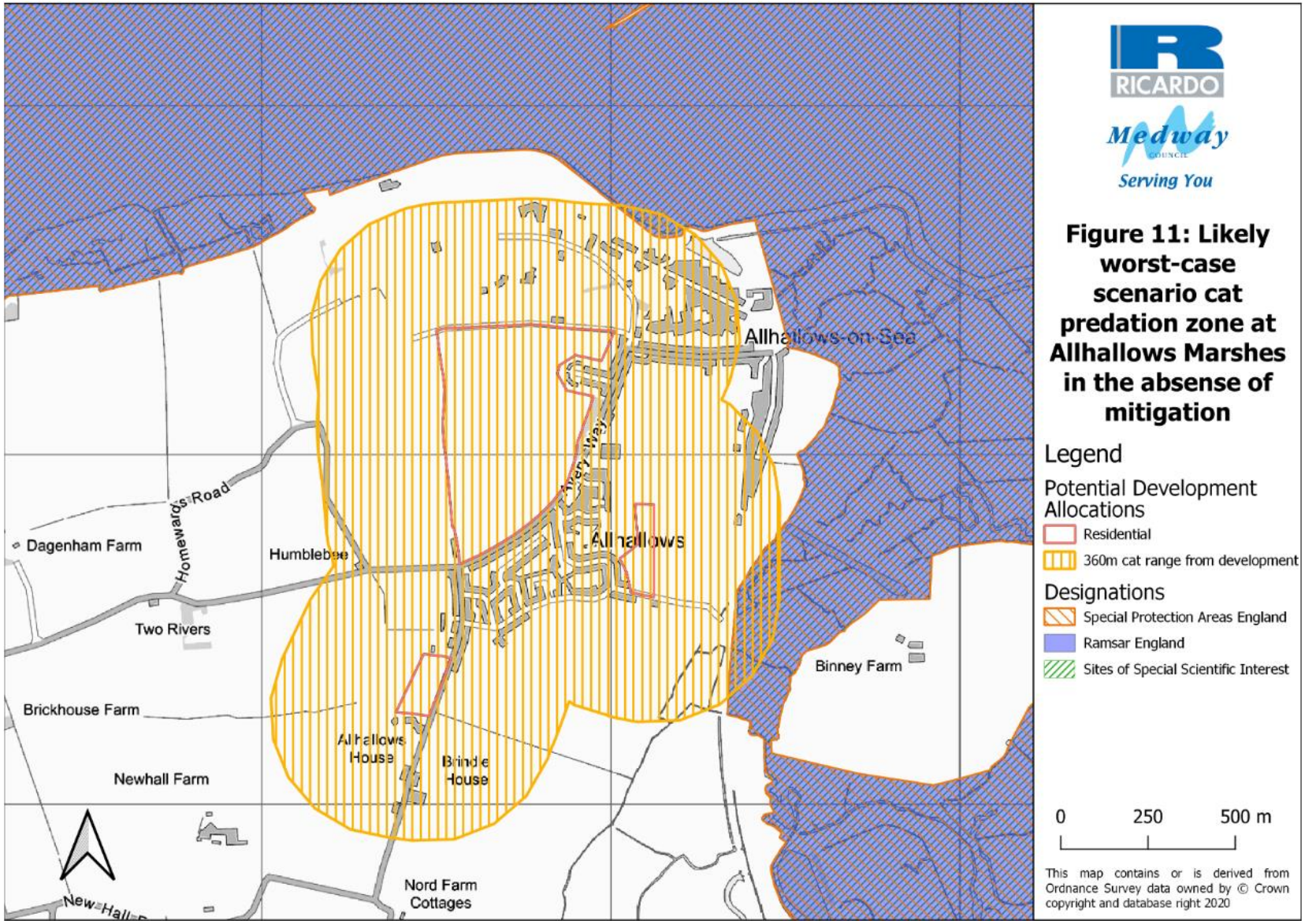
the SSSI. Given the proximity of the allocation boundaries to the SSSI, this predation pressure could extend over a very significant area within the SSSI boundary if residential development extends to these boundaries (see **Figure 10**). There is also good evidence that such losses could be exacerbated by reduced conspecific attraction whereby the presence of other nightingales already occupying the area acts as an indicator of suitable habitat (Holt, Hewson & Fuller 2012). Any significant reduction in the SSSI's nightingale population caused by unmitigated cat predation would be a significant adverse effect at the national level. Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Figure 10 Likely worst-case scenario cat predation zone at Chattenden Woods and Lodge Hill SSSI in the absence of mitigation



The risk of increased cat predation within internationally designated sites (SPA/Ramsar) located to the south of Hoo St Werburgh is avoided by the proposed residential-led allocations, as they are at least 360m away. Beyond Hoo, only two residential allocations come within 360m, at Allhallows Marshes (part of Thames Estuary and Marshes SPA/Ramsar site) (see **Figure 11**). This cat range only overlaps the designation here by a relatively small amount and SPA/Ramsar birds are likely to have a lower susceptibility to cat predation, compared to nightingales. However, on a precautionary basis, cats associated with residential development in the small, easternmost allocation here (north of Binney Road) could have a significant adverse effect at the international level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

Figure 11 Likely worst-case scenario cat predation zone at cat predation zone at Allhallows Marshes in the absence of mitigation



4.2.5 Lighting

The potential adverse effects of night-time artificial lighting on a range of notable species are described in **Section 4.1.7**. A discussion of these generic risks is therefore not repeated here. Equally, the sensitive areas within the Hoo Peninsula mentioned in **Section 4.1.7** apply to operational effects too.

In summary, Chattenden Woods and Lodge Hill SSSI is of particular known importance for bats, invertebrates (notably moths) and especially breeding birds (nightingale). The potential residential-led allocations at Chattenden Barracks, the former Deangate Ridge Golf Course and the Deangate Ridge Sports Ground together share nearly 2.5km of boundary with the Chattenden Woods and Lodge Hill SSSI. Unmitigated light-spill into the SSSI from these potential developments could constitute a significant potential adverse effect on bats at the county level, moths at the local level and on nightingale at the national level. Therefore, as a requirement of planning, robust mitigation will be developed for this possible impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Elsewhere, the residential allocations are mostly bounded by arable and improved grassland that together make up nearly 60% of land within 100m of all allocation boundaries. However, within such farmland, linear belts of woodland, tree-lines/shelterbelts, hedgerows and stream-sides could be impacted by light-spill during operation which could adversely affect bat movements through the landscape. This could be a significant adverse effect at the local level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Open mosaic habitats on previously developed land at Chattenden Barracks, Grain and Kingsnorth contain a diverse assemblage of invertebrate species including rare and scarce species, to which lighting impacts could potentially be a significant adverse effect at the national level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Unmitigated lighting impacts arising from the larger potential employment allocations at Grain and Kingsnorth could also significantly affect the internationally-important assemblages of bird species that are qualifying features of the Medway Estuary and Marshes SPA/Ramsar site**.** This could be a significant adverse effect up to the international level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

Operational lighting is less of an issue for the other designations in the peninsula that have avian features of interest, as the development allocations are located some distance from these other sites and often with intervening settlement present already.

4.2.6 Noise

Noise emanating from residential areas during their operational phase is likely to be of lower significance than the construction phase. This is because unlike construction activity in undeveloped land, residential-led uses tend to have a more constant and predictable background noise range to which birds can habituate over a longer time period. That is not to say that there would be no discernible effect, as noise from vehicles, people and machinery all contribute to greater overall noise

that is artificial and therefore may trigger greater alertness, nervousness and avoidance behaviours among sensitive species. However, it is also well recognised that some species discussed in relation to construction noise disturbance (**Section 4.1.8**) such as bats and birds can and do inhabit residential areas where there are sufficient habitat features, and these are apparently habituated to associated noise.

Residential allocations share nearly 2.5km of boundary with Chattenden Woods and Lodge Hill SSSI with its important breeding population of nightingale. Unmitigated noise from residential areas could potentially interfere with their own vocalisations thus leading to reduced breeding success. There is also some evidence that bird song has a role to play in conspecific attraction whereby the presence of other nightingales already occupying the area acts as an indicator of suitable habitat (Holt, Hewson & Fuller 2012). It is thought that females search for males to pair with at night, and that the nocturnal advertising song of the males could serve as a settlement cue for other arriving males, whilst the song of multiple males could provide a stronger stimulus for females. Any significant reduction in the SSSI's nightingale population caused by noise would be a significant adverse effect at the national level. Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Within the employment allocations, the operational phase noise may be more akin to those of the construction phase if such land is used for heavy industry. Infrequent, unpredictable but high magnitude noise events are less easy for birds to habituate to and are more likely to lead to discernible signs of disturbance behaviours in individuals (alarm, flight, avoidance, etc). The Medway Estuary and Marshes SPA/Ramsar/SSSI lies adjacent to several large potential employment allocations. Most of the avian qualifying features are overwintering or passage species, although breeding avocet and little tern are also qualifying features. Disturbance from noise could cause them to expend valuable energy reserves and to abandon favoured feeding or resting places, both of which can be critical in cold winter months. For qualifying breeding species, noise disturbance can cause nest abandonment and reduced feeding of parents and chicks. If this has long-lasting population impacts, then it would be a significant adverse effect up to the international level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

4.2.7 Recreational disturbance

Research carried out in north Kent (Footprint Ecology, 2011) has found that there have been marked declines in the numbers of (wintering) birds using the SPAs, and these have occurred at the locations with the highest levels of access. It identified that disturbance caused by the presence of people was a potential cause of the decline. A range of activities were found to create disturbance. Walking dogs off the lead had a noted impact, but also running and cycling.

The study also identified that 75% of visits to the coast originated from within 6km. Beyond the 6km threshold there is a measurable decline in visitors coming to the coast. It was estimated that there would be 15% additional coastal recreation resulting from new housing planned in the surrounding area. The research concluded that a likely significant effect cannot be ruled out from residential developments within six kilometres of the coastal designated sites and from larger residential developments further away.

Other studies and local planning policies within the UK indicate that increased use of designated sites for recreation can arise from developments up to 7km away (e.g. from Thames Basin Heaths).

All of the potential development allocations within the Hoo Peninsula fall within 2km of nationally or internationally important designated sites (see **Figure 2**). Within this distance, there is a very high likelihood that levels of recreation would significantly increase within and adjacent to these designated sites, due to the local population increase. In fact, three of the proposed residential-led allocations are within 500m of SPA/Ramsar sites designated for their internationally important bird populations and assemblages (see **Figure 2**). Two of these proposed allocations are large areas of land that have the potential to house a significant number of people (and dogs) within easy walking distance of the SPA/Ramsar sites.

An increase in coastal recreation (including grazing marshes) could impact bird species associated with the two coastal SPA/Ramsar sites. Due to the range of species associated with the SPA and Ramsar designations and utilisation of a range of habitats by bird species, recreational disturbance anytime of the year could cause adverse effects such as abandonment of the nest or unwillingness to forage and breed within otherwise suitable habitat. However, the biggest impacts, and the most studied, are those during winter when large numbers of qualifying birds are reliant on maintaining their energy reserves through frequent feeding and reduced energy expenditure.

Visual disturbance may be particularly significant in relation to birds using open, coastal habitats such as those within and next to the internationally-designated sites. As noted in **Section 4.1.9**, by way of example, a flight response might be expected by many species if approached to within c.100-150m across a mudflat (Cutts, et al. 2013). High-level visual disturbance is typified by regular reactions to visual stimuli with birds moving away to areas which are less disturbed. Most birds will show a degree of response to stimuli. Birds that remain in the affected area may not forage efficiently, and if there are additional pressures on the birds (cold weather, extreme heat, etc.) then this may impact upon the survival of individual birds or their ability to breed. Most species studied show behavioural changes in response to such stimuli up to 250m from the source, with reduced feeding and often taking flight or walking away (Ibid).

Any reduction in associated SPA/Ramsar bird populations caused by recreational disturbance would be a significant adverse effect at the international level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

Consultation with the RSPB has revealed that there is a particular concern with disturbance to breeding waders such as lapwing and redshank that use the grazing marsh / wet grassland habitats of the designated sites in spring-summer. Access to the peninsula's shoreline is limited in many areas, and a mitigation strategy to deal with disturbance impacts along the shoreline (e.g. to SPA/Ramsar wintering birds) is already in place (SAMMS). However, breeding waders nest in open landscapes of wet grassland, many of which are traversed by public footpaths. As they are ground-nesting birds they are particularly susceptible to disturbance. Sites where this might be a particular issue include Higham Marsh, Cliffe Pools, Rye Street Common, Northward Hill and Allhallows Marshes.

Such breeding waders (e.g. lapwing and redshank) are not qualifying features of the SPA, Ramsar site or SSSI, but consultation with the RSPB indicates that 75% of all breeding waders in the South East of England are found in North Kent with South Sheppey and the Hoo Peninsula Marshes being the two main centres of population. In particular, the North Kent Marshes are very important for breeding lapwing and redshank. Therefore, the likely impacts to breeding populations of notable but non-qualifying wader populations caused by recreational disturbance could lead to a significant adverse effect at the regional level. Therefore, as a requirement of planning, robust mitigation will be

developed for this possible regional impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

With Chattenden Woods and Lodge Hill SSSI sharing nearly 2.5km of boundary with proposed residential-led allocations, there is a significant risk due to proximity that there will be recreational pressure through activities such a dog walking negatively affecting the important population of breeding nightingales. This would be due to disturbance to territory establishment and reduced breeding success as a consequence of elevated predation risk coupled with reduced foraging efficiency. Any reduction in nightingale population caused by recreational disturbance would be a significant adverse effect at the national level. Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

The important feature of Northward Hill SSSI/High Halstow NNR is the heronry, which at over 200 pairs is the largest in Britain. There is a diverse breeding bird community and the insect fauna is also of interest particularly moths and butterflies. Similar to the effects on nightingales described above, physical disturbance during the nesting season, in the absence of any mitigation, could cause abandonment of the nest and limiting their willingness to forage and breed within otherwise suitable habitat. Any reduction in heron population caused by recreational disturbance would be a significant adverse effect at the national level. Therefore, as a requirement of planning, robust mitigation will be developed for this possible national impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Elsewhere, recreational disturbance will be limited to a range of more common and widespread species and habitats along public footpaths and non-designated areas of natural greenspace, some of which may be priority habitats or contain priority species. Therefore, any impacts would most likely have a significant adverse effect at the local level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.2.8 Recreational damage

The likelihood of increased visitor numbers to designated sites is established in **Section 4.2.7** above. In addition to the disturbance already described, recreational damage to habitats and species can arise from deliberate vandalism of sites by visitors or, more commonly, from unintentional impacts of increased trampling of vegetation and soils, over-fertilisation by dog waste, litter, accidental fires, and pollution e.g. (oil/fuel) or ground damage from vehicles (e.g. off-roading). Accidental damage could also arise from the introduction of invasive non-native species, for example attached to visitors' vehicle tyres or clothing.

Any significant damage of qualifying habitats or habitats that support populations of qualifying species of designated sites would be a significant adverse effect at the international level in the absence of any mitigation for SPA and Ramsar sites. Therefore, as a requirement of planning, robust mitigation will be developed for this possible international impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6 and/or measures developed through the HRA derogation process.

For SSSIs it could be a significant adverse effect at the national level in the absence of any mitigation. And for locally designated sites, such significant damage could be a significant adverse effect up to the county level in the absence of any mitigation**.** Therefore, as a requirement of planning, robust mitigation will be developed for this possible impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

Outside of designated sites, recreational damage will be limited to a range of more common and widespread species and habitats along public footpaths and areas of natural greenspace, and therefore any impacts would most likely have a significant adverse effect up to the local level in the absence of any mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible local impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

An exception to this would be damage to any non-designated ancient woodland, where such damage could be a significant adverse effect at the regional level in the absence of any mitigation**.** There are three such parcels of ancient woodland within close proximity to the potential residential allocations (see **Figure 6**). One is just off Sharnal Street near High Halstow, another to the north-east of the Fenn Street roundabout that follows a stream corridor, and the other is Haven Street Wood located south-west of Chattenden Woods and Lodge Hill SSSI. The former is immediately adjacent to the proposed High Halstow residential-led allocation, whereas the other two are near to allocations somewhat separated, but both have footpaths running through or adjacent to them. Therefore, as a requirement of planning, robust mitigation will be developed for this possible regional impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.3 Cumulative effects from combined impact types

4.3.1 Approach

Where more than one type of potential adverse effect has been identified, there is further potential for these effects to act in combination to cause a more significant effect than each one acting alone. The purpose of a cumulative (or in-combination) assessment is not to re-state the likely presence of two or more effects (which is already done in **Sections 4.1 and 4.2** above), but rather to identify those effects that could act together to lead to an overall combined effect greater than the sum of its constituent parts. In other words, to be considered under this heading, the effects need to have some realistic chance of working in *synergy* to cross a *threshold of significance* that the constituent effects acting alone wouldn't.

With this in mind, one needs to consider if the highest geographical level of effect-significance assigned to a feature in **Sections 4.1 and 4.2**, would be exceeded for any particular feature through an in-combination effect.

Given the scale used (based on CIEEM 2018), this would immediately rule-out any combination that includes an already-identified internationally-significant effect. 'International' is the maximum level of significance and could not, therefore, be exceeded by in-combination effects; so, an in-combination assessment in this case would be of no use to the decision-maker. The highest level of mitigation or compensation would be required anyway for that feature.

Having excluded those of international significance, for the remaining effects the logical approach will be to determine whether the highest level of significance suffered by any single feature is exceeded when cumulative, synergistic effects on that feature are considered. This is the approach taken in the rest of this section.

4.3.2 Cumulative effects on qualifying birds of designated sites

One of the more obvious potential cumulative effects would be from the various operational effects of what can be referred to as increased 'urbanisation' on birds. This focusses on the combination of

population disturbances from lighting, noise, and human visibility/recreation, plus cat and dog predation/presence. The individual effects for each of these have been discussed in **Section 4.2**.

Section 4.2 has already found that recreational disturbance to the SPA/Ramsar birds could be of international significance, so cumulative effects will not lead to a higher level of significance (as one doesn't exist: **see Section 4.3.1**). No amount of combining with lighting or noise, which also each had internationally-significant effects alone, will change this level of effect-significance.

Sections 4.1 and 4.2 found that effects on the breeding nightingale population that uses Chattenden Woods and Lodge Hill SSSI could be of national significance. Given the way in which levels of importance are assigned to features (see **Section 2.2.2**), this population and its associated SSSI cannot be affected to a greater than national level of significance, no matter how may effects combine. In other words, again, the highest possible level of effect-significance has already been recognised in earlier sections of this report. The same is true for the qualifying herons of Northward Hill SSSI/High Halstow NNR.

To conclude, there are no cumulative/in-combination effects that result in a higher level of significance than has been already stated for qualifying birds of designated sites.

4.3.3 Cumulative effects on farmland breeding birds

Effects on the assemblage of notable farmland and garden birds around the Hoo Peninsula were discussed in **Sections 4.1 and 4.2**. The individual disturbance effects were deemed to be of no more than local significance.

The predicted cumulative effect of lighting, noise and recreation combined is unlikely to create synergistic effects that raise the significance to a higher level (i.e. 'county'). Peak times in noise and lighting are unlikely to coincide, due to the former being during the day and the latter at night. Therefore, there is unlikely to be a significant synergistic effect from concurrent light and noise. Of more significant concern would be the cumulative effect of lighting causing disruption to birds' diurnal 'rhythms' which reduces individual's fitness, which is then exacerbated during the day by noise impacts plus human and cat disturbance causing reduced feeding, resting and breeding activity. Reduced conspecific attraction could also exacerbate this pressure.

This combined disturbance could be become a cumulative effect only if it pushed the populations beyond a threshold where their conservation status at the county level was threatened (i.e. the level higher than 'local'). However, given the extent of these disturbance impacts, the relatively common habitats affected, and the statuses of the species concerned (see **Section 3.3.3**), it is considered that these farmland/garden bird populations' deteriorations due solely to disturbance effects would not be significant at the county scale.

However, when one considers the scale of farmland and open mosaic habitat loss that could occur during the construction phase in the absence of mitigation/compensation (see **Section 4.1.1**), the reduced habitat available to the farmland bird populations will accentuate the disturbance effects during the operation phase. Smaller areas of habitat will lead to fewer resources, less safe refuge and greater 'edge-effects' in the remaining habitat, which then could allow disturbance to penetrate more and have a greater effect than it otherwise would.

The overall effect on notable farmland birds of combining several types of disturbance with the loss and damage of habitat across all of the allocations is considered to be one of up to county significance in the absence of mitigation. Therefore, as a requirement of planning, robust mitigation will be developed for this possible county impact, and any residual adverse effects will be compensated according to the framework outlined in Chapter 6.

4.3.4 Cumulative effects on invertebrates

The loss of large areas of open mosaic habitat described in **Section 4.1.1** has already identified a potential effect of national significance on the assumed terrestrial invertebrate assemblage associated with those habitats. For there to be any materially additional effect arising from combining impact types, it would need to exceed national significance (i.e. it would need to be an effect of international significance). This is considered to be unlikely due to the scale of overall impact on notable invertebrate habitat, the types of habitat affected and the relatively limited evidence of assemblages or populations of international importance inhabiting these (see **Section 3.3.2**).

Likewise, there was an effect of county significance identified for the loss of standing waterbodies and the fauna they support, including aquatic invertebrates, which is unlikely to be exceeded due to cumulative impact types.

4.3.5 Cumulative effects on bats

In **Sections 4.1 and 4.2,** the highest level of effect-significance for bats was found to be of county level, relating to the effects of lighting from development on Chattenden Woods and Lodge Hill SSSI. This SSSI provides particularly good bat habitat as evidenced through survey records (see **Section 3.3.6**). For there to be any materially additional effect arising from combining impact types, it would need to exceed county significance (i.e. it would need to be an effect of at least regional significance). This is considered to be unlikely due to the scale of overall impact on notable bat habitat, the types of habitat affected, and the relatively limited evidence of populations of regional importance inhabiting the Hoo Peninsula (the best recorded population being that at Chattenden Woods and Lodge Hill SSSI, deemed to be of county importance).

4.3.6 Cumulative effects on other notable mammals

For other notable mammal species likely to inhabit the Hoo peninsula, each impact type described in **Sections 4.1 and 4.2** was found to be of no more than local significance in its effect on their populations. For there to be any materially additional effect arising from combining impact types, it would need to exceed local significance (i.e. it would need to be an effect of at least county significance).

For water voles, the most likely combinations of impact types that represent a threat would be those affecting watercourses and other waterbodies such as habitat loss and fragmentation combined with hydrological effects (i.e. water level changes) and or water pollution. Additionally, cat predation could also combine with reduced water levels and isolation of sub-populations to impact the wider population. However, there is are relatively limited numbers and lengths of watercourses directly impacted (area = 0.4 ha) and these all flow south, so are not connected to the core water vole populations recorded in the north of the peninsula. Therefore, it is considered that, even with a combining of impact types, the significance of effect would remain as local.

For the notable terrestrial mammals such as hare, hedgehog and harvest mouse, habitat loss is likely to be the single greatest threat, and this was considered to be of local significance in **Section 4.1**. It is considered unlikely that any combination of other impact types with such habitat loss would increase the significance beyond local.

4.3.7 Cumulative effects on amphibians

For amphibians, habitat loss is likely to be the single greatest threat. **Section 4.1** indicates that up to 3.6 ha of standing water habitat (estimated 83 waterbodies) could cumulatively be lost to the

developments, plus a substantial amount of terrestrial habitat surrounding these. This is already recognised to be of county-level significance (see **Section 4.1**). Of those waterbodies that remain after construction, the greatest risks to notable amphibians from other impact-types would be pollution, water level changes and increased traffic (mortality). However, this is unlikely to increase the overall cumulative significance to above the county level, as there is no indication from existing data that the amphibian populations or associated habitat within and immediately adjacent to the potential allocations are of regional significance.

4.3.8 Cumulative effects on reptiles

The most significant effects on reptile species are those relating to habitat loss as described in **Section 4.1**, in particular the loss of open mosaic habitat on previously-developed land but also scrub and field-margins. This was considered to have an overall effect of local significance. Other forms of impact are unlikely to combine with such habitat loss to increase the significance level, as the species likely to be affected are widespread and there is no indication the affected populations are of county importance or greater.

5 Review of existing frameworks for mitigation, compensation and enhancement

5.1 General approach

This review of existing local frameworks and initiatives to mitigate and compensate for development is informed by a well-recognised hierarchy of measures:

- **Avoid** adverse impacts where possible
- **Mitigate** those impacts that cannot be avoided
- **Compensate** for what cannot be mitigated
- **Enhance** to achieve a net gain in biodiversity

The cumulative assessment of potential impacts reported in **Section 4** was based on a single, peninsula-wide development scenario (the mapped potential allocations) provided by Medway Council that had, prior to this assessment, already sought to avoid the most significant impacts (see **Section 2.3**). This 'incorporated avoidance' includes keeping nearly all of the potential allocations outside of any sites designated for nature conservation (see **Section 3.1**). Furthermore, the majority of the allocated land falls within either intensive arable/horticultural land uses, or previously developed land (see **Section 3.2** and **Section 4.1.1**). The potential allocations therefore mostly avoid direct impacts to priority habitats, but there are some exceptions, notably large areas of open mosaic habitat on previously-developed land, plus smaller-scale farmland (and former golf course) features such as hedgerows, tree-lines, ponds, and arable headlands/margins.

Apart from limiting the loss of open mosaic habitat, further avoidance of impacts will need to focus primarily on addressing indirect disturbance and damage of important features outside of the allocations.

For farmland habitats and much of the open mosaic habitat within the proposed allocations, a significant extent of unavoidable direct impact is assumed, and so mitigation will be required in such cases. Likewise, any indirect impacts on features beyond the proposed allocation boundaries that cannot be avoided with a reasonable degree of certainty, will require mitigation.

Where all reasonable efforts to avoid and mitigate are insufficient to remove significant adverse effects, compensation for residual adverse effects must be provided. Compensation will normally take the form of habitat creation and/or enhancement outside of the allocations, on the basis that any such measures inside of the allocation boundaries constitute mitigation as described above.

In developing a spatial framework for compensation, a minimum allowance for biodiversity net gain of 10% should be included.

It should be reiterated here that failure to fully mitigate any identified adverse effects on internationally-designated sites (SPA and Ramsar) would require a plan or project to be taken through HRA Stage 3 (assessment of alternatives) and Stage 4 (proving Imperative Reasons of Overriding Public Importance (IROPI)) before compensation could be considered. Therefore, ***the habitat compensation reviewed and suggested in this report does not necessarily include all that may be required for Habitats Regulations derogation purposes under a successful IROPI case.***

5.2 Existing spatial biodiversity strategies

5.2.1 Biodiversity Opportunity Areas

For over a decade there have been considerable efforts to develop a network of Biodiversity Opportunity Areas (BOA) throughout Kent which is based on sound biogeographical principles and environmental data available at the landscape scale. The original BOA mapping was based on geographic information systems such as the Kent Landscape Information System (KLIS) (Kent County Council) and the Living Landscapes project (Kent Wildlife Trust and KCC). These are described below. The data that go into these opportunity mapping systems are based on sound scientific understanding of the physical landscape in Kent. However, whether a particular area of land is included in any habitat network is partly based on certain species dispersal thresholds and environmental limits set by ecologists, using a degree of professional judgement. Thus, like any prioritisation process, these methods contain an element of subjectivity.

KLIS is a geographic information database that allows the user to map various layers of landscape and habitat data for Kent in various combinations. These include Habitat Opportunity mapping, which identifies the potential of land throughout Kent for creating or restoring priority habitats based on physical parameters such as soil type, geology, topography and proximity to similar habitat.

The Living Landscapes project was an initiative led by Kent Wildlife Trust to identify opportunities for county-wide strategic habitat networks in response to past degradation and future threats such as climate change and development. The project makes use of KLIS's habitat opportunity data and the location of existing habitat from the county-wide Habitat Survey. In summary, the approach looks at parcels of land that have opportunity for creation of a particular habitat type in relation to their proximity to significant existing areas of that same habitat. These areas of higher opportunity are then filtered by setting a threshold distance from patches of existing similar habitat. Those parcels that are within the set distance (based on assumed dispersal distances for less mobile species typical of that habitat type) of the existing habitat are included in the network, and those that are more isolated are filtered-out. This process is repeated for each priority habitat type and then the resulting maps are combined to form a theoretical network of all priority habitats across Kent. In this way, the decision as to whether a particular field is in or out of the derived network is not made subjectively at the individual site level. However, there was a degree of subjective professional judgement required in setting dispersal distance thresholds and the level of physical 'opportunity' that qualifies.

It is important to note that by using this model, not all areas of existing BAP habitat or even designated sites will necessarily fall within the resulting strategic network. This is not because the quality or importance of that site is lower, but simply that it is too isolated from other areas of habitat or high habitat opportunity to qualify under the parameters set.

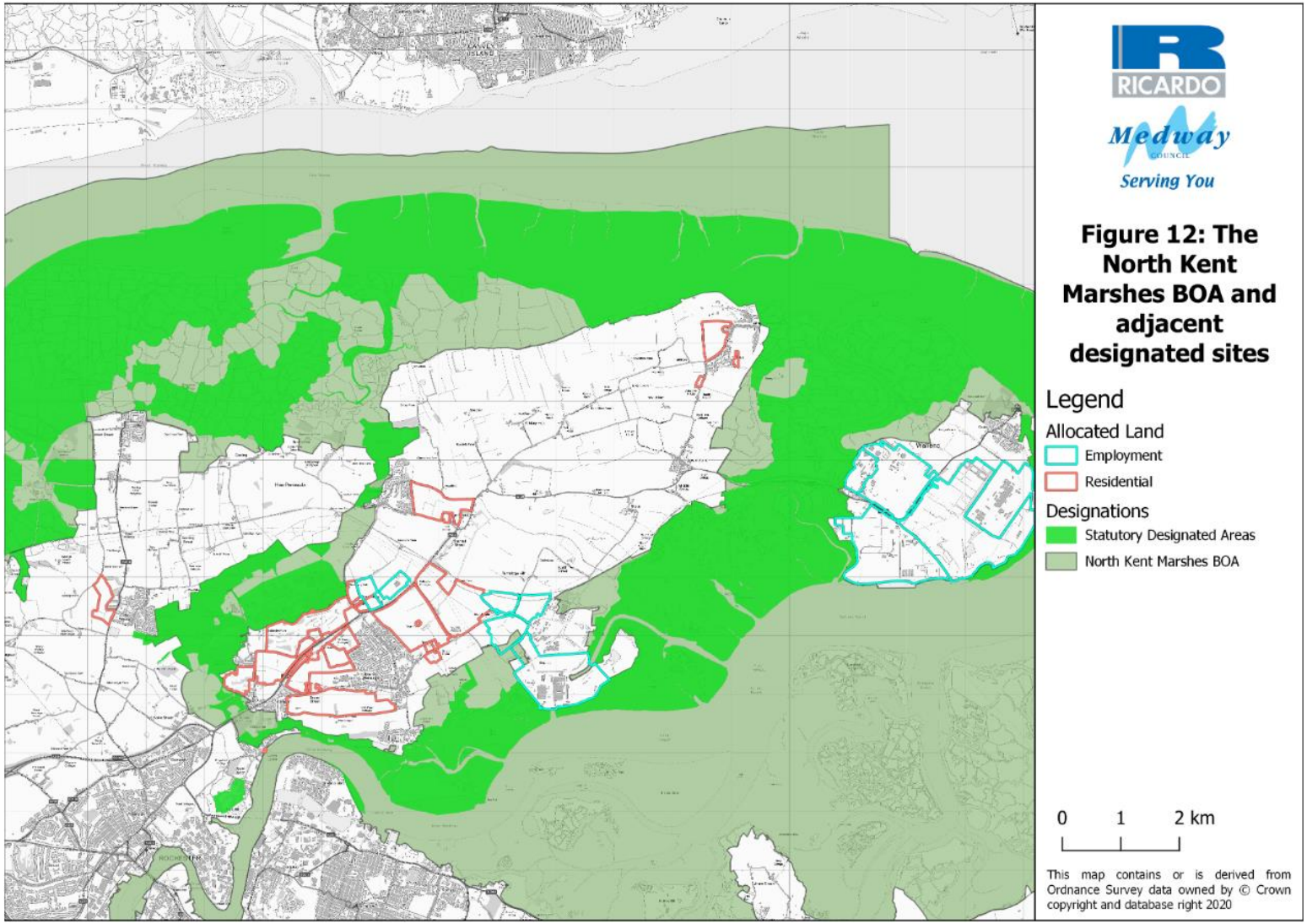
The Living Landscapes network was developed for Kent as a whole and has been used as the key spatial model for Kent to inform the Biodiversity Opportunity Areas. In more recent years, BOAs have been further developed for different parts of the county based on broad landscapes, including the one that covers the Hoo Peninsula: the North Kent Marshes BOA.

Given that local planning authorities in Kent, including Medway Council Unitary Authority, recognise these BOAs for land use decision-making, it is highly appropriate for BOAs to form the fundamental structure around which habitat creation measures are developed in this CEcIA (see **Section 6**).

The North Kent Marshes BOA extends, buffers and connects designated sites throughout the peninsula, as shown in **Figure 12**. In particular, it demonstrates that successful realisation of the biodiversity opportunity here would create an important continuous corridor of valuable habitat running

north to south through the middle of the peninsula, connecting the majority of the statutory designated sites via intermediate new habitat. The BOA also has the potential in several locations to offer alternative natural greenspace between the potential allocations and the designated sites.

Figure 12 The North Kent Marshes BOA and adjacent designated sites

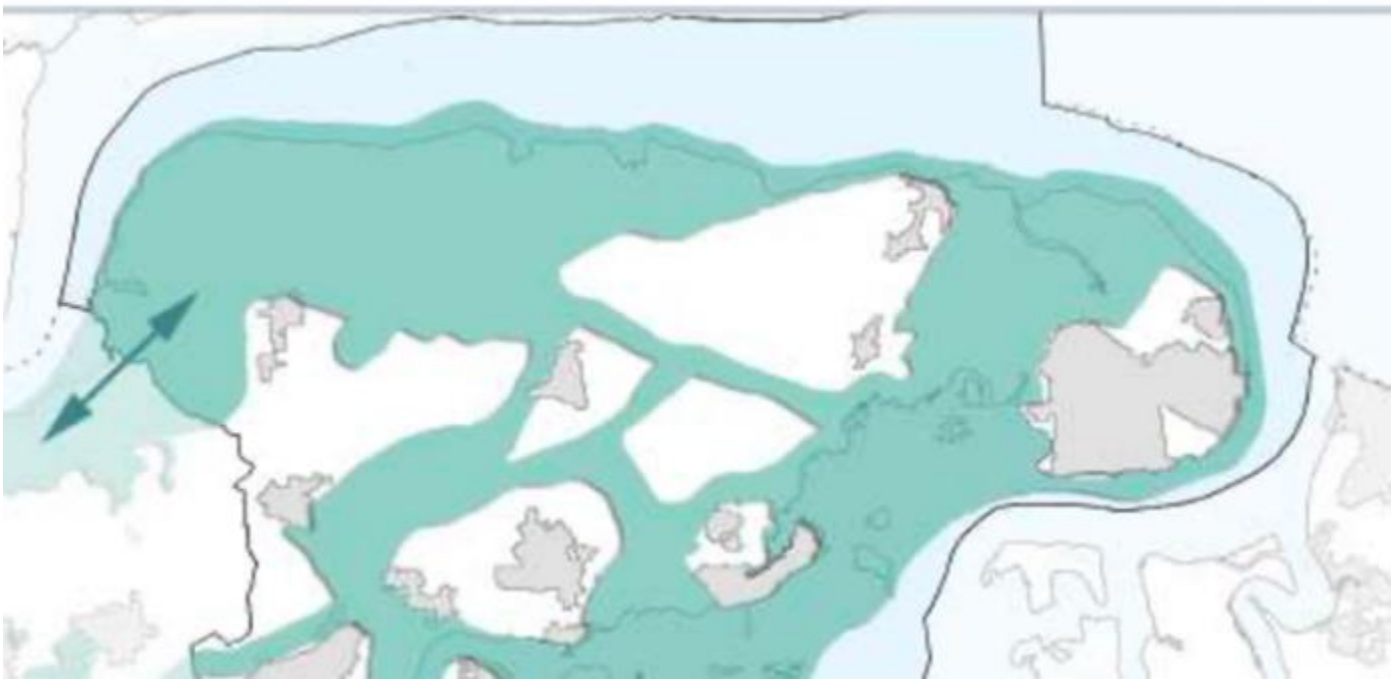


It is also notable that the potential allocations largely avoid development within the BOA, thus avoiding the loss of such opportunity for biodiversity network improvement.

5.2.2 Medway Green and Blue Infrastructure Vision

It is apparent from consultation with the Vision's author (Sharon Bayne, pers. comm. 2020), that Medway Council's Green and Blue Infrastructure Vision (2019) for Hoo Peninsula sees the development of a network of habitat corridors being based largely around the BOA (see **Section 5.2.1**), with some additional, subjectively derived, linking corridors through the middle of the peninsula, as shown in **Figure 13**. It is also clear from consultation that this was a very 'high-level' exercise to deliver a broad concept rather than identifying specific parcels of land for habitat creation based on detailed environmental data. Therefore, where it overlaps the BOA it has a stronger, more objective evidence-base, but where it doesn't overlap the BOA, it is more subjective.

Figure 13 **Medway Green and Blue Infrastructure Vision** (image: Medway Council 2019)

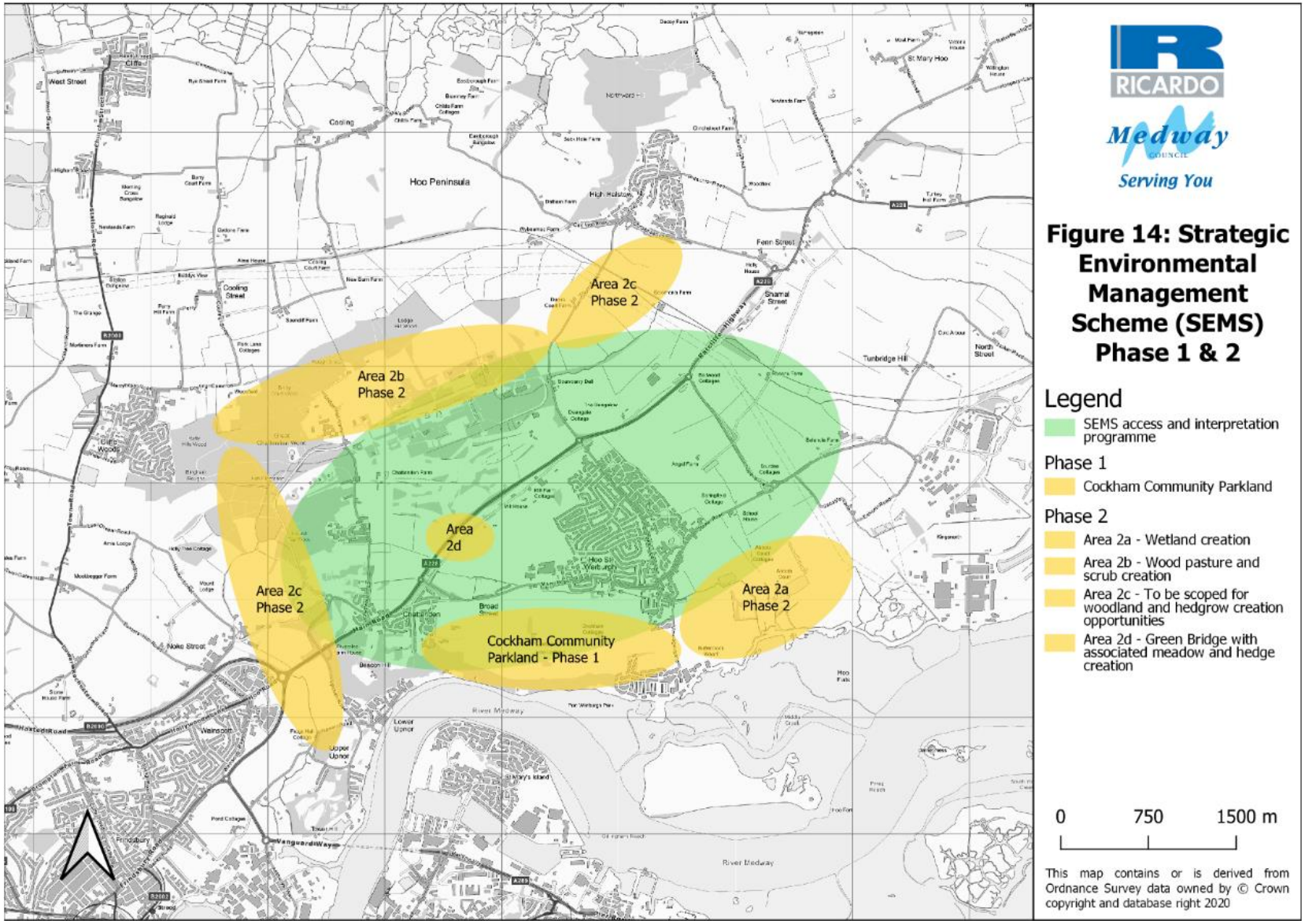


5.2.3 Developing Strategic Environmental Management Scheme (SEMS) initiatives

Part of the funding provided through the HIF is to be targeted at strategic environmental management measures in order to mitigate adverse environmental impacts of development and provide a net gain for biodiversity. This SEMS will be informed by the outcomes of this CEcIA, but in the meantime there has been some initial spatial planning for SEMS and development of some specific SEMS initiatives.

Medway Council's initial ideas for the spatial arrangement of SEMS focusses on areas of rural land that encircle Hoo St Werburgh, where most of the proposed development is to take place, thus providing publicly accessible greenspace and biodiversity near to the growing population and between that population and many nearby designated sites. This initial conceptual layout is shown in **Figure 14** below.

Figure 14 Indicative locations for SEMS greenspace provision



There is some overlap of the current SEMS areas with the North Kent BOA at Lodge Hill and near to Kingsnorth power station site, but much of the current SEMS sits outside of the North Kent BOA. This is true, for example, for the potential Community Parkland being considered under SEMS, which is ideally located to mitigate increased recreational pressures on the SPA and Ramsar site.

Under SEMS, Medway Council is in the process of developing proposals for a new Community Parkland area to the south of Hoo St. Werburgh. The area of land identified for this parkland is situated in the south of the Peninsula between the potential residential-led allocation south of Main Road Hoo and the statutory designated sites: Tower Hill to Cockham Wood SSSI and the Medway Estuary and Marshes SPA/Ramsar/SSSI. The intention is to provide a recreational impacts buffer to the designated sites through a large area of sustainable alternative greenspace to intercept and divert visitors away from the designations. Being outside of the BOA but potentially connecting to it, this initiative provides an additional opportunity for connected biodiversity compensation and net gain through habitat creation, in addition to serving the recreational needs of local residents. This is currently reflected in plans for increased woodland, scrub, hedges, wet grassland and meadows. In other words, whist principally a mechanism intended to deal with indirect impacts (e.g. recreational disturbance to designated sites and their qualifying bird species), there is no reason why the potential Community Parkland, and other alternative recreational greenspaces still to be defined, can't also help to deal with direct impacts (e.g. habitat loss within the allocations); the two purposes are complimentary rather than mutually exclusive.

The role of such SEMS land in providing Sustainable Alternative Natural Greenspace (SANG) has been considered in consultation with Natural England. The potential for SEMS land, such as any potential Community Parkland located inland, to divert a significant number of visitors away from coastal designated sites is limited in Natural England's view. They cite evidence from Footprint Ecology reports that the majority of visitors who travel some distance to coastal sites, when presented with alternative greenspace further inland, will still want the 'coastal experience' and may therefore continue to use the designated sites. However, they accept that the SEMS land could be effective at encouraging use of alternative greenspace at the more local/neighbourhood level, especially people regularly walking or dog-walking from their homes to nearby rural sites. So, even with SEMS land provision, there is likely to be a significant residual effect from population growth on coastal designated sites that needs addressing through visitor access management such as an expansion of Birdwise (see **Section 5.2.4**) locally including additional ranger and educational measures.

5.2.4 Strategic Access Management and Monitoring Scheme (SAMMS) and Bird Wise North Kent

Bird Wise is the brand name of the North Kent Strategic Access Management and Monitoring Scheme (SAMMS), a partnership of local authorities, developers and environmental organisations. SAMMS deals with the disturbance impact on birds caused by additional recreational visitors to the coast arising from the building of new homes within 6km of the three Special Protection Areas (SPAs) of the Thames Estuary, the Medway Estuary and the Swale. SAMMS is referenced in Policy NE 1 in the Development Strategy consultation document leading into the preparation of Medway's Local Plan.

Under SAMMS, developers can provide mitigation by making a developer contribution (£250 per net additional dwelling) to Bird Wise. Bird Wise provides a way for new housing schemes to mitigate the impact of additional recreation on the north Kent SPA and Ramsar sites should the developer commit to paying the tariff set out by the Strategy. As one of the key mitigation elements, Bird Wise currently employs one permanent and two seasonal wardens to undertake awareness-raising work with local estuary users (particularly dog walkers). This makes it possible to conclude that a significant effect on the SPA or Ramsar site as a result of the development is unlikely and enables development to go ahead in compliance with the Habitats Regulations and enables developers to deal with the issue quickly and simply. This recognises that in most cases, it will not be viable for a development to provide its own bespoke mitigation package for cumulative or in-combination effects and therefore a strategic approach is necessary.

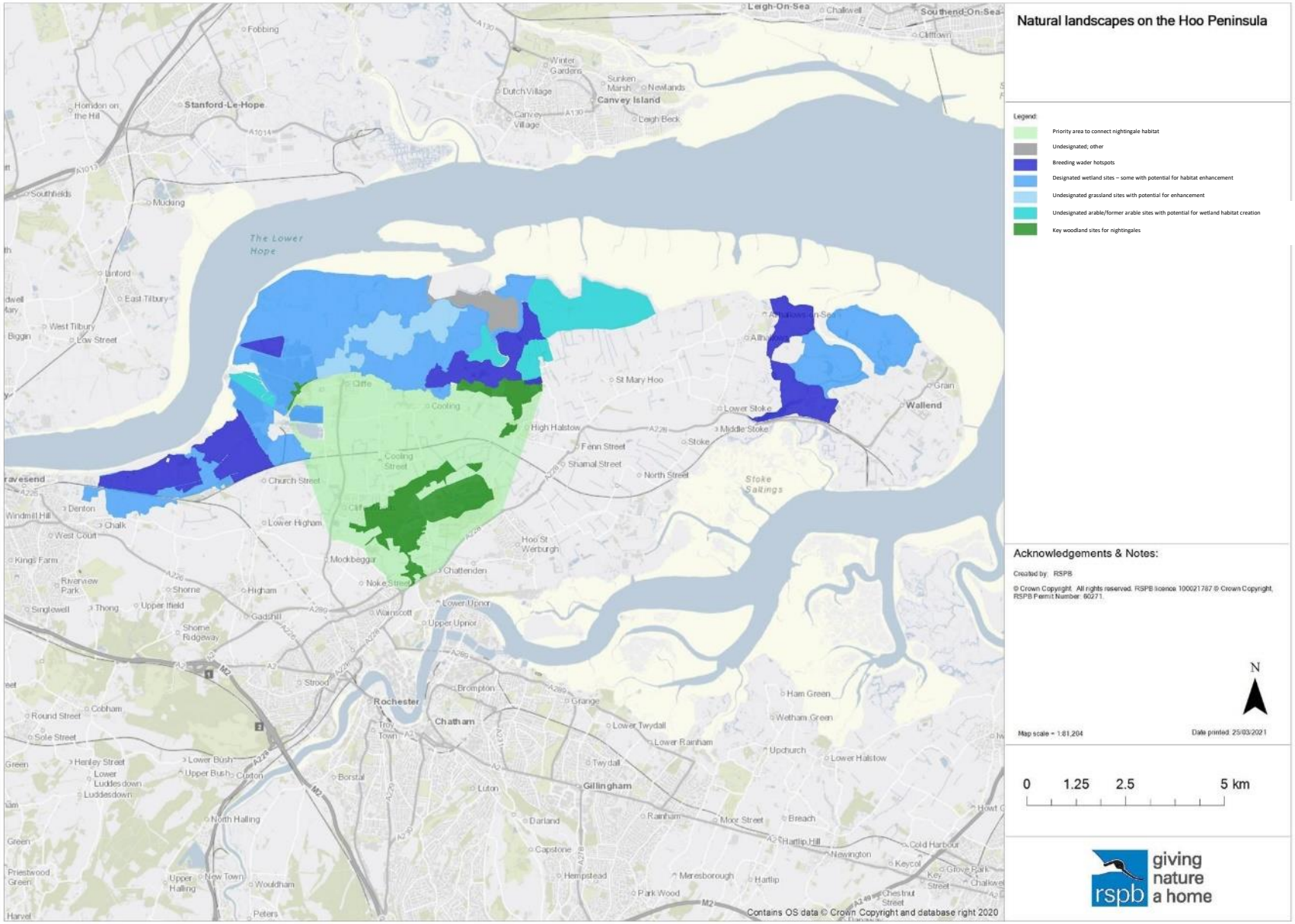
Some schemes, particularly those of considerable scale or located close to the boundaries of the SPAs or Ramsar sites, may need to provide other mitigation measures in addition to making that financial contribution in order to ensure effective avoidance/mitigation of impacts on the sites. It is understood that Natural England may recommend an enhanced SAMMS (e.g. 'SAMMS+') to address the scale of housing development located so close to the designated sites within the Hoo peninsula. This may include the funding of an additional long-term, dedicated warden scheme and management and maintenance programme for the above-mentioned SEMS land but embedded in tried and tested Bird Wise structures, in addition to enhanced measures within the European sites.

5.2.5 RSPB Nature Recovery Network for Hoo Peninsula

During consultation for this assessment, the RSPB provided their current voluntary vision for a Nature Recovery Network (NRN) of habitats, largely targeted at key bird species associated with existing designated sites and nature reserves. This responds to the large number of proposed houses in close proximity to especially sensitive wildlife habitats. In addition to ensuring the developments comply with planning policy and legal obligation, this means that the remaining habitat fragments on the Hoo Peninsula should be of better quality, bigger and better connected (i.e. the Lawton principles[1]). **Figure 15** indicates where some of these improvements could be directed and is focussed on woodland (including scrub) and wetland habitat creation, restoration and enhancement mainly for breeding nightingales and breeding waders.

[1] J.H., Lawton & Brotherton, Peter & V.K., Brown & C., Elphic & A.H., Fitter & J, Forshaw & R.W., Haddow & S., Hilbourne & R.N., Leafe & M.P., Southgate & Sutherland, William & T.E., Tew & J., Varley & G.R., Wynne. (2010). Making Space for Nature: A Review of England's Wildlife Sites and Ecological Network.

Figure 15 – RSPB's Proposed Nature Recovery Network for Hoo Peninsula



It is useful to note that much of the non-designated wetland habitat opportunity identified by the RSPB NRN is within the BOA (see **Section 5.2.1**). The significant areas of non-designated NRN land that fall outside of the BOA comprise the majority of the 'woodland connectivity zone' situated around and south of Cliffe and Cooling. This zone also falls largely outside of the draft Medway Green and Blue Infrastructure areas (see **Section 5.2.2**). The exception to this is the eastern part of the 'woodland connectivity zone' between Northward Hill and Lodge Hill which is recognised by these other habitat creation frameworks.

It is also noteworthy that this RSPB's NRN vision contrasts somewhat with the current Medway SEMS approach. Whereas SEMS focusses its habitat measures around Hoo St Werburgh in the south of the peninsula, the RSPB's vision is focussed on areas further north between and adjoining the statutory designated sites and their own reserves. In relative terms, the current SEMS appears to be driven by proximity to proposed development to address increased recreation demands and related recreational pressure on designated sites, plus mitigating for effects on people and wildlife near to development such as noise, lighting, air quality, etc.. This may be because SEMS is required to deliver multi-purpose greenspace for both people (recreation, amenity, mental and physical health) and for nature, rather than a more specific focus on nature recovery, and key species alone. Whereas, the RSPB NRN appears to be focussed more on extending existing high-quality habitats associated with designations for key species to compensate and enhance for habitat loss and damage (direct and indirect) elsewhere in the peninsula and to strengthen the resilience of the designated sites and reserves.

6 A composite framework for mitigation, compensation and net gain

6.1 Key themes

From the above impact assessment (**Section 4**) and review of existing initiatives to address biodiversity risks (**Section 5**), several key themes for mitigation, compensation and enhancement emerge. These themes reflect different approaches to identified sources and types of impacts. These are:

- Avoidance of indirect impacts through buffering of designated sites
- Avoidance of indirect impacts to designated sites through providing alternative greenspace for recreation
- Managing the residual indirect impacts to designated sites, on site, through visitor and domesticated predator management
- Compensating for direct and residual indirect impacts to biodiversity through habitat creation to achieve an overall net gain.

It is important to note that these approaches are not mutually exclusive, as they can be combined to good effect. For example, alternative greenspace for recreation can also provide spaces for habitat creation and can act as a buffer for designated sites. Regardless of whether they are combined within the same location or situated separately, the measure of success will be how well they deal with the risks to biodiversity. This also means that where an area of natural open space is proposed by this CEcIA, landscape and additional recreational benefits (i.e. those going beyond diverting visitors away from designations) will be viewed favourably but are of secondary importance to the primary aim of this CEcIA which is to address biodiversity impacts of development and build future resilience through net gain.

6.2 Measures to address direct habitat loss

6.2.1 Quantification

For a study of this strategic, broad-scale nature, it is assumed, as a worst-case scenario, that all of the habitats within the proposed allocations could potentially be lost to development or significantly damaged. This assumed 'worst-case' is the basis for the potential habitat losses described in **Section 4.1** and is used to determine the maximum amount of compensation required to achieve no net loss of biodiversity and, subsequently, the minimum required net gain under such a worst-case. This worst-case scenario does not represent an actual target. Again, as stated in **Section 4.1**, it is recognised that in reality there will almost certainly be some retention of existing habitat and the creation of new habitat within the allocation boundaries. Therefore, there is ample scope for developers to modify or reduce the requirement for off-site compensation and enhancement, by incorporating more within their sites, in consultation with statutory and other local stakeholders.

The currently-accepted tool for quantifying the biodiversity value of habitats to be lost and therefore what quantity needs to be replaced (and surpassed for net gain) is DEFRA's Biodiversity Metric as described in **Section 2**. Whilst this tool is useful for dealing with direct habitat loss and damage, it is less obviously applicable to indirect impacts, particularly to species, such as noise, artificial light, predation, downstream pollution and recreational disturbance. Whilst the habitat 'condition' multiplier within the Metric might be used for this purpose, this requires a much greater degree of assumptions to be made using subjective professional judgement. Any resulting quantities must therefore be used

with great caution and would relate more to habitat than to species populations. Therefore, this CEcIA only applies the DEFRA metric to (worst-case) direct habitat loss. Therefore, the DEFRA metric results do not represent a target for HIF or SEMS to meet. The actual requirements will be calculated using the DEFRA metric during site master-planning consideration and the setting of the individual sites' Land Use Budget. As the local planning authority, Medway will determine compensation and net gain requirements on a site by site basis but this CEcIA provides a framework ensuring informed consideration of these potential requirements.

Applying the DEFRA Biodiversity Metric to the habitat areas in **Table 9** results in the following biodiversity units that could be lost to development in the absence of any mitigation (**Table 10**):

Table 10 Indicative biodiversity units potentially lost to development (without mitigation)

Habitat	Residential	Employment	Transport	TOTAL Biodiversity Units Lost
Arable and horticulture	733.92	132.00	52.91	918.83
Neutral grassland	127.60	1451.12	88.0	1,666.72
Grassland - Modified grassland	459.36	129.36	47.05	635.77
Cropland - Intensive orchards	10.12	26.62		36.74
Mixed scrub	17.60	128.48		146.08
Ornamental/introduced shrub		2.64		2.64
Reedbeds		36.30		36.30
Marginal/other swamp vegetation		4.36		4.36
Broadleaved woodland	53.68	46.64	9.68	110.00
Cropland - Arable field margins cultivated annually	18.30		0.88	19.18
Brackish standing water with no sea connection		93.28		93.28
Standing open Water	14.52	53.72	4.36	72.60
Cropland - Non-cereal crops	7.70			7.70
Spoil heaps		4.84		4.84
Built up areas and gardens	13.20	915.20	21.56	949.96
Intertidal underboulder communities		10.16		10.16
Intertidal shingle/cobbles		17.42		17.42
Woodland and forest - Wet woodland		1.45		1.45
Transport corridor associated verges (Urban - Introduced shrub)	0.44	2.20	4.4	7.04
Boulders and rock above high tide		8.71		8.71
Rivers and streams	2.90			2.90
Line of trees	1.32			1.32
coniferous woodland	0.88	0.44		1.32
Sparsely vegetated land – ruderal/ephemeral		7.48		7.48
Estuarine water or sea		50.82		50.82

Urban - Open Mosaic Habitats on Previously Developed Land	174.24	3,181.33	143.75	3,499.32
TOTAL	**1,635.79**	**6,304.57**	**372.59**	**8,312.94**

It is notable that by far the greatest contributor to potential biodiversity unit loss is the Employment category of allocation. This is nearly four times the unit loss of the next highest category: residential. The habitat types within the employment allocations that are contributing most to this unit-loss are open mosaic habitats and neutral grassland (including grazing marsh). Most of the potential loss of these two habitats is at the Grain allocation. Therefore, the potential development at Grain has a very significant influence on the total cumulative biodiversity unit loss predicted from a worst-case scenario without any mitigation.

6.2.2 Avoidance of habitat loss

As already mentioned, the first master-planning consideration should be the avoidance of as much habitat loss within the allocations as possible. It is far better to preserve an existing biodiversity resource of a given value than to replace it elsewhere or at a later date, as long as the surrounding influences that maintain its interest also remain intact (for example, surrounding terrestrial habitat that supports the function of a great crested newt breeding pond). This would require a process of using detailed surveys to identify the most important habitats within each allocation and then seeking to preserve and protect these throughout the construction and operation phases.

Such development-specific survey and resulting design recommendations are beyond the scope of this CEcIA; however, the basic principle established here should be applied in a rigorous way by developers and their consultants so that the best features for wildlife are preserved in situ. This may include avoidance of stream culverting, retention of ponds and surrounding terrestrial habitat (e.g. as new village ponds within a village green), retention of mature orchards repurposed as ‘community orchards’. It may also include preservation of certain boundary features as part of the street-scene such as existing tree-lines that connect wider landscape features for bats.

6.2.3 Mitigation of habitat loss

In practice, it is often difficult to preserve some of the existing ecological features in situ within a development allocation boundary. Therefore, in such cases, the next approach to addressing habitat loss should be to mitigate through reducing the impact (e.g. magnitude, extent, duration, etc) as far as possible and/or repairing/replacing the feature in situ (e.g. after construction).

It may prove impossible to greatly reduce habitat loss or replace it in situ. However, by extending the definition of ‘mitigation’ here to include replacing the function and value of the impacted habitats elsewhere within the same development allocation, greater scope for effective, localised mitigation arises. In reality, this approach sits within the blurred boundary between mitigation and compensation: categories that are somewhat scale-dependent.

Such measures could include landscaping of new road verges to replace the linear grassland interest of impacted arable headlands and margins. Tree and shrub elements of the new landscaping could be arranged to emulate the structure and function of the impacted hedgerow and shelterbelt network. Sustainable drainage schemes (SuDS) could be designed to help replace any riparian corridors and ponds lost to construction. Living/green roofs and walls could be specified for new buildings to help replace lost grassland and open mosaic habitats.

Within the master-planning of all such features, priority should be given to creating effective links through and around the built development to maintain connectivity within the wider landscape. Therefore, the creation of integral habitat corridors and ‘stepping-stones’ is a core design principle that should be considered for all of the allocations.

6.2.4 Compensation for habitat loss and net gain

It is recognised that within the proposed allocations, priority will be given to the provision of housing or commercial development, and therefore retention or replacement of much of the existing habitats may not be possible within the allocation boundaries. For this reason, broad areas and/or quantities of land outside of the allocations that may be suitable for habitat compensation are identified here.

Using the DEFRA Biodiversity Metric with the data on potential combined residential, employment and transport habitat losses provided in **Table 9**, it has been calculated that there could be a worst-case loss of over eight thousand Biodiversity Units that would require compensation (see **Table 10**), which includes over six thousand Biodiversity Units solely for worst-case loss within employment allocations. The presumption is that, in a worst-case scenario of total loss of biodiversity units within the allocations, such loss must be matched through off-site compensation plus a minimum 10% extra for the required net gain. This would equate to a minimum required area of compensation land of *at least* 1,500 hectares but could be significantly more. The actual value is dependent on the types of habitat created in each compensation area and the value of the habitats that exist there already which would be replaced or enhanced.

As described in **Section 6.2.1**, in the absence of design detail, this is based on a precautionary worst-case scenario in terms of quantity required: i.e. assuming loss of all habitat within the allocations. In reality, as master-planning and design of each development evolves to incorporate avoidance and mitigation, the compensation areas (or biodiversity units) required elsewhere will reduce. However, a key purpose of this CEcIA is to examine whether sufficient overall capacity for compensation can be identified early in the planning process, hence the need to start with a worst-case assumption.

To compensate for this worst-case habitat loss from residential and transport infrastructure, areas of strategic habitat creation opportunity have been identified from selective use of existing strategies and frameworks (see **Section 5**) in combination with professional judgement and use of GIS resources. In doing this, this CEcIA seeks to target biodiversity compensation and net gain to:

1. Areas that would create habitat links (e.g. corridors and 'stepping-stones') between designated sites and non-designated priority habitats.
2. Areas that would buffer and/or extend designated sites and non-designated priority habitats (e.g. cat predation buffers, alternative greenspace for nature recreation and restoration of wetlands adjacent to designations).

It is important to recognise that an area of compensation opportunity may serve both purposes at the same time. In choosing such areas, the principle is to build upon an already extensive biodiversity resource, rather than seeking to create new habitat in isolation.

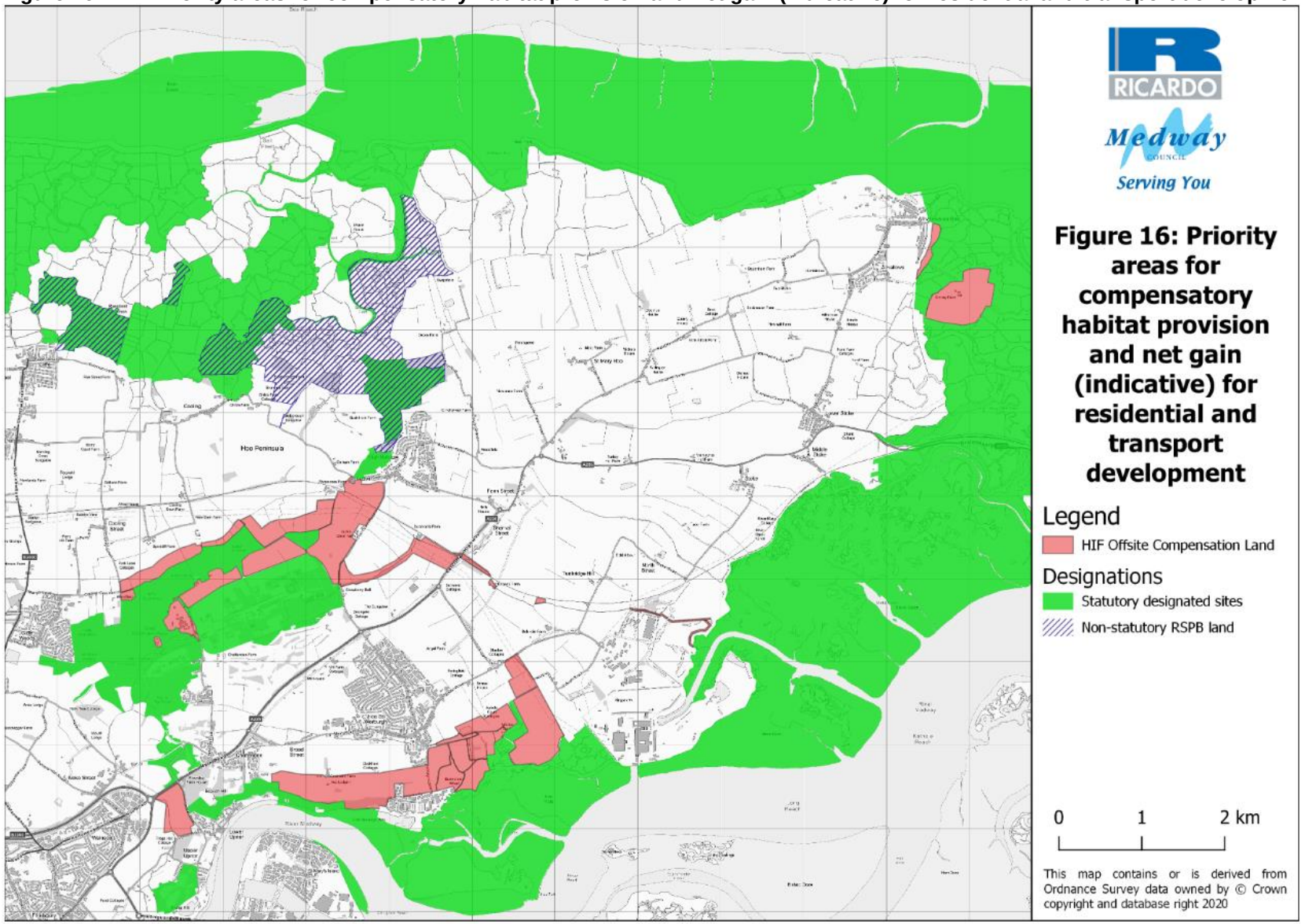
This mapping of compensation and net gain opportunity does not currently include sufficient compensation for employment allocations under a worst-case scenario. This is for two reasons. Firstly, Medway Council are keen to understand and prioritise the requirements for HIF-related development (housing and linked access infrastructure) as a priority, in order to inform their SEMS initiatives and any additional housing-related requirements. Secondly, as noted above in Section 6.2.1, the worst-case scenario for habitat loss within the potential employment allocations, in particular at Grain, is leading to a disproportionate potential requirement for off-site compensation land, based on current data. It is likely that this will need to be dealt with through further strategic avoidance and mitigation within the employment allocation boundaries before any meaningful mapping of required compensation land can be done (based on revised biodiversity unit calculations).

Indicative locations of strategic compensation opportunity for housing and transport impacts are provided in **Figure 16**, shown alongside statutory designated sites and RSPB reserves for context. These prioritise the principal existing spatial strategy for habitat creation, namely the North Kent Marshes BOA described in **Section 5.2.1** and shown in **Figure 12**. This addresses the opportunity for expanding and buffering internationally-important wetland habitat and also the opportunity for linking the terrestrial SSSIs in the centre of the peninsula, thereby creating a key north-south habitat corridor. Thus, it respects and goes some way to implementing the RSPB's NRN vision, too. At the

same time, it includes the majority of non-designated SEMS land currently proposed by Medway Council to help deal with indirect effects as well as habitat loss.

The potential areas for compensation shown in **Figure 16** are likely to be sufficient to attain the required Biodiversity Units to achieve no net loss plus a 10% net gain in units, even under a worst-case scenario. However, this sufficiency cannot be confirmed until more detailed survey and design work has been done for both the land within the allocations and the compensation land. Therefore, this map should be considered to be indicative in terms of the scale and location of potential compensation land.

Figure 16 Priority areas for compensatory habitat provision and net gain (indicative) for residential and transport development



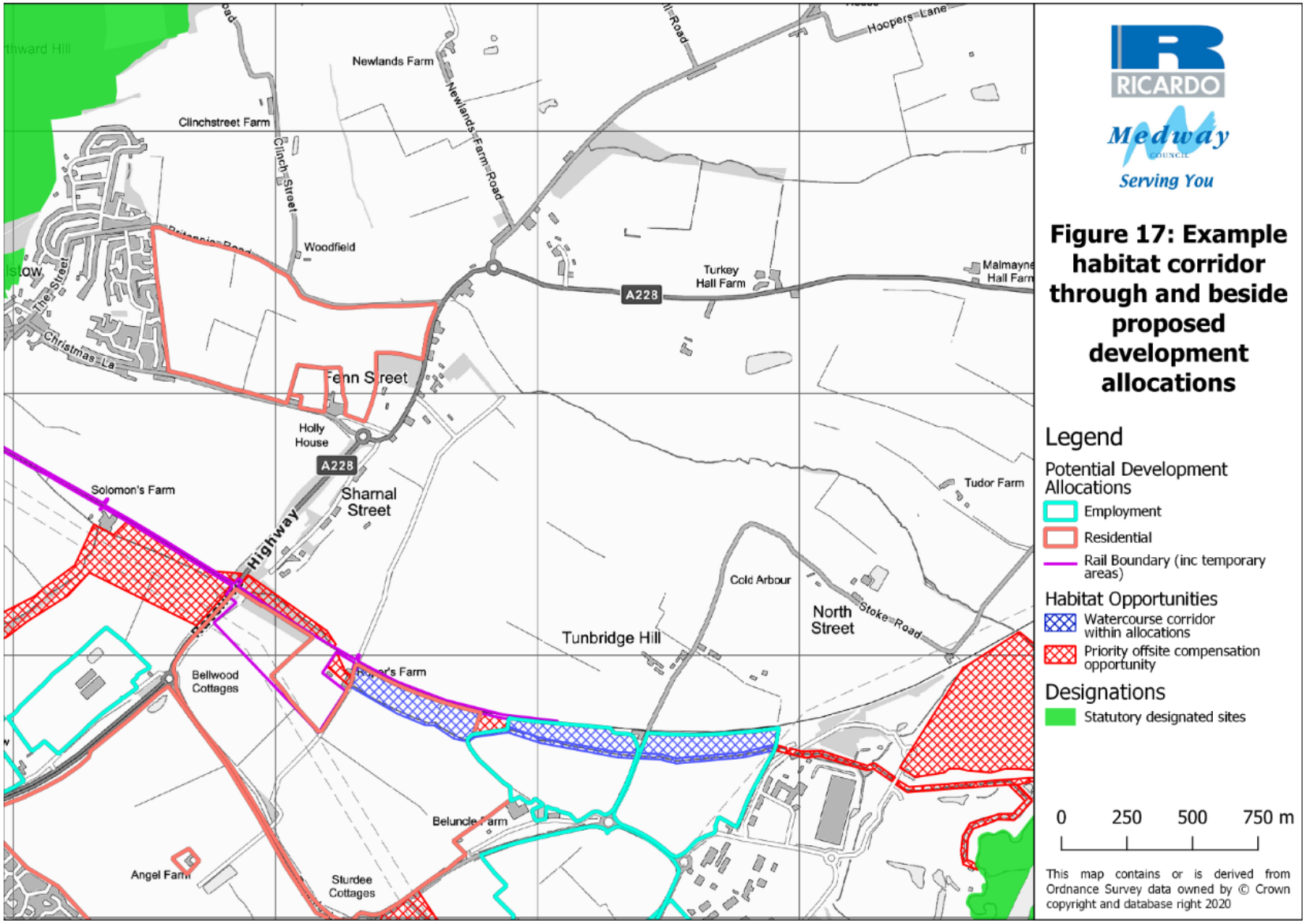
6.3 Measures to address habitat fragmentation

Many of the measures described above in **Section 6.2** that address habitat loss will also, if designed properly, reduce fragmentation. This design principle in **Sections 6.2.2** and **6.2.3** is about ensuring that habitat avoidance and creation within the development allocation boundaries forms habitat corridors that connect important habitats either side of the allocations that may currently be connected by features mentioned in **Section 4.1.2** such as hedgerows, stream corridors, tree-lines and field-margins. These would need to be wide enough and continuous enough to provide safe and attractive routes for wildlife through the new residential and commercial areas. The achievement of this width and continuity may be facilitated by combining these with landscaping for recreation and visual appeal to create multi-purpose greenspace within the developments.

An example of this approach is provided in **Figure 17** below. Here, the allocation of habitat to form a 'green and blue corridor' through and around development allocations takes advantage of the corridor of land around an existing stream and between the stream and the railway line. This example mitigation preserves and enhances the existing biodiversity interest of the stream and its immediate riparian corridor which could be at risk of fragmentation from development. It does this by using land that would presumably be more challenging to develop due to these existing linear features and the narrow fields they enclose. At the wider landscape scale, this potential habitat corridor also serves to provide a valuable east-west connection between the BOA and associated designated sites.

Similar retained and enhanced habitat corridors could be implemented along existing key hedgerows and other watercourses within the potential development allocations.

Figure 17 Example habitat corridor through and beside proposed development allocations



For any residual habitat fragmentation effects, by focussing compensatory habitat creation on the BOAs (see **Section 6.2.4**), strategic network opportunity will be realised at the larger scale, thus compensating for any localised fragmentation around the developments.

6.4 Measures to address hydrological effects

The potential hydrological impacts identified in Section 4.1 were deemed to arise during construction from site drainage, watercourse diversion, impoundment of watercourses, and the creation of rapid run-off surfaces through removal of intercepting vegetation and soils and replacement with hard, impermeable substrates.

In the first instance, mitigation should take the form of localised avoidance of development adjacent to watercourses and other wetland features. It is recommended that wherever possible, culverting of watercourses is avoided and that a minimum 10m riparian habitat buffer from the watercourse is maintained throughout construction and operation of the developments. Where possible, this buffer should be widened to provide opportunity for greater habitat retention and enhancement along riparian corridors. These measures can be incorporated with the measures to address habitat loss and fragmentation described in **Section 6.2 and 6.3** above, and indicative locations for these buffers is shown on **Figures 15 and 16**. Such natural river corridors will help to attenuate flood flows by intercepting and storing precipitation and runoff within natural soils and vegetation. Such storage then provides a reservoir of water to help maintain base-flows for aquatic flora and fauna downstream during dry periods.

Within a relatively intensive agricultural landscape, targeting habitat retention and creation at riparian corridors makes sound ecological sense, as these watercourses already provide some linear connectivity for wildlife through and beyond proposed development boundaries. They also provide unique opportunity to include aquatic and wetland interest within natural greenspace provision for people and wildlife.

Beyond the riparian corridors, construction site drainage and ground surfaces should be carefully managed to reduce the flashiness of flows into the rivers and downstream through various surface-permeability and attenuation measures. Measures should be detailed in a Construction Environmental Management Plans (CEMP) for each development. For the operation phase, the latest good-practice in Sustainable Drainage System (SuDS) and water use efficiency design should be employed, and SuDS should incorporate semi-natural wetland habitats wherever possible.

6.5 Measures to address water quality effects

During the construction phase, there will be a requirement for contractors to follow all relevant and current good-practice guidance on pollution prevention. This includes managing risks to both ground and surface waters through the best available techniques. Particular attention should be given to guidance in CIRIA C532: *Control of water pollution from construction sites* (2001). More recent useful guidance is provided in "*Guidance for Pollution Prevention - Works and maintenance in or near water*": GPP 5 Version 1.2 (2018). This guidance has been produced by Natural Resources Wales (NRW), the Northern Ireland Environment Agency (NIEA) and the Scottish Environment Protection Agency (SEPA), so any regulation to which it refers would need to be checked for its applicability to England. The Environment Agency does not currently endorse any similar guidance for England, but previously did through its own Pollution Prevention Guidelines. All such measures should be detailed in a Construction Environmental Management Plans (CEMP) for each development.

The measures of watercourse avoidance and buffering described above (Section 6.4) for hydrological effects are also highly beneficial for water quality, as are the SuDS and water efficiency measures during the operation phase.

Although this CEcIA has assumed that Southern Water will provide sufficient capacity for treatment of waste-water arising from the new developments, so as to maintain the same within-licence outputs to the aquatic environment, it is essential to ensure that such treatment capacity is fully operational before the additional waste-water demands are placed on it. Any time-lag between occupation of the new developments and the water company's increase in treatment capacity could lead to temporary impacts on ecological features of up to international importance, which could have long-term adverse effects.

For European sites that are already suffering adverse effects from excess nutrients at the time of planning application, any further nutrient input from development cannot be consented under the requirements of the Habitats Regulations, as confirmed by the recent 'Dutch Nitrogen Cases' ruling in the European Court of Justice. In such a situation, the developments may need to prove 'nutrient neutrality' for their wastewater at the receiving European site.

6.6 Measures to address air quality effects

Air quality effects of increased vehicle traffic and industrial emissions that adversely affect European sites cannot be permitted under the Habitats Regulations (except through derogation where an IROPI case is made). A separate HRA process for the Medway Local Plan is underway which, unlike this CEcIA, will be informed by traffic modelling and more detailed airborne pollutant dispersion modelling. Therefore any mitigation measures for European sites will need to develop out of that HRA process and will be required to remove all reasonable uncertainty over effect. This CEcIA therefore assumes no residual significant effect on European sites will arise from (mitigated) policies and allocations within the Local Plan as this would contravene the Habitat Regulations.

Potential air quality effects on Chattenden Woods and Lodge Hill SSSI arising from within the potential residential and employment allocations may be largely avoided if new roads and associated vehicle traffic can avoid being within 200m of the SSSI boundary. Currently this is not the case, as the proposed new distributor road through the Chattenden Barracks would run within 200m of the SSSI., Also, the proposed highways improvements along the existing Woodfield Way are within 200m of the SSSI. So, if these proximal road developments cannot be avoided, compensation measures are likely to be necessary.

6.7 Measures to address invasive species

During construction, biosecurity measures to avoid the spread of invasive non-native species should form part of the CEMP. The Environment Agency's 'Check, Clean, Dry' advice should be followed wherever possible by contractors. The occurrence of invasive species on a construction site should be carefully monitored, and if such species are identified, appropriate containment and effective treatment should be immediately implemented under professional specialist advice.

Operational effects are best avoided through a targeted programme of public awareness-raising on the risks from invasive species, particularly those plant species that residents and commercial site occupiers may choose to plant within their gardens and ponds, or which can be inadvertently spread through site maintenance and associated waste. There may be a role for Medway Council to lead on this information initiative in collaboration with the Environment Agency.

6.8 Measures to address lighting effects

Measures to mitigate for artificial lighting effects on wildlife during construction and operation should start with avoidance. At the master-planning scale this is likely to involve the design of unlit 'dark corridors' adjacent to especially sensitive habitats, such as designated sites. In the case of the Chattenden Woods and Lodge Hill SSSI a development buffer of up to 300m may be necessary. It should be noted that nightingales have particular sensitivity to night-time lighting, so this SSSI will need careful consideration and robust mitigation to avoid nationally-significant effects.

The effect of lighting should be capable of being reduced in distance from source through various lighting design measures. These is very good guidance on this for bats in Guidance Note 08/18 '*Bats and artificial lighting'* by the Bat Conservation Trust and the Institution of Lighting Professionals (2018). These measures aim to reduce or remove levels of illuminance (measured in lux) within sensitive habitats by, for instance, making such lighting directional and limiting to that which is absolutely necessary. For the protection of bat habitats, the following measures are recommended:

- All luminaires should lack UV elements when manufactured. Metal halide, fluorescent sources should not be used.
- LED luminaires should be used where possible due to their sharp cut-off, lower intensity, good colour rendition and dimming capability.
- A warm white spectrum (ideally (ideally <2700Kelvin) should be adopted to reduce blue light component.
- Luminaires should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
- Internal luminaires can be recessed where installed in proximity to windows to reduce glare and light spill.
- The use of specialist bollard or low-level downward directional luminaires to retain darkness above can be considered. However, this often comes at a cost of unacceptable glare, poor illumination efficiency, a high upward light component and poor facial recognition, and their use should only be as directed by the lighting professional.
- Column heights should be carefully considered to minimise light spill.
- Only luminaires with an upward light ratio of 0% and with good optical control should be used.
- Luminaires should always be mounted on the horizontal, i.e. no upward tilt.
- Any external security lighting should be set on motion-sensors and short (1min) timers.
- As a last resort, accessories such as baffles, hoods or louvres can be used to reduce light spill and direct it only to where it is needed.

Many of these measures will be of benefit in reducing impacts to birds as well.

Ultimately, mitigation through design should aim for no light-spill (i.e. zero lux increase) into sensitive designated sites such as the SSSIs and European sites. Wherever possible, this principle should also be applied to other, non-designated key habitats for bats (e.g. woodland, hedgerows, tree-lines, river corridors and known roosts) as informed through detailed bat roost and bat activity surveys at the project stage.

6.9 Measures to address noise disturbance

The best form of mitigation for noise effects is to maintain a suitable development free area between the source of noise (construction and operation) and the sensitive feature (habitats used by sensitive

species). There are several locations where potential development allocations are adjacent or very close to designated sites. These include those on the southern and eastern sides of Chattenden Woods and Lodge Hill SSSI, and those adjacent to the coastal SPA/Ramsar sites.

Where developments must proceed within c.300m proximity of a site designated for birds (or associated functionally-linked land), noise from construction sites should be mitigated through construction-industry good practice (e.g. BS 5228-1:2009+A1:2014: "*Code of practice for noise and vibration control on construction and open sites*. *Noise*"). Although construction sites are inherently noisy, there are many ways in which they can be made quieter. Sometimes a quieter process can be used. For example, pile driving is very loud. Boring is a much quieter method that may serve the same purpose. New equipment is generally much quieter than old equipment and should be carefully selected based on noise levels. Old or noisier equipment can be made quieter by simple modifications, such as adding new mufflers or sound absorbing materials. Equipment is also much quieter when it is well maintained. Noise levels drop quickly with distance from the source, so noisy equipment should be used as far away as possible from sensitive habitats. Temporary barriers/enclosures (e.g. acoustic fencing) can be built around noisy equipment or sites. These barriers can significantly reduce noise levels. Particularly noisy activities can also be timed to avoid more sensitive periods of the day or year for sensitive wildlife.

6.10 Measures to address cat predation

Based on the research into domestic cats' ranging behaviours, as described in **Section 5.2.4**, the approach to addressing cat predation on bird interest features of Chattenden Woods and Lodge Hill SSSI is likely to entail a combination of:

- effective and regularly inspected cat-proof fencing; plus
- a zone absent of any development that could house cats around the affected perimeter of the SSSI (see **Figure 18** for indicative location), and
- compensation for residual effects in the form of new and/or enhanced habitat for nightingales.

Work is currently underway for Homes England to determine the effects of cat predation on nightingales within the SSSI with and without cat-proof fencing, and what mitigatory effects different development-free buffers around the SSSI perimeter might have. Considering cat predation effects alone the initial evidence suggests that, with effective and well-maintained cat fencing and a 150m wide buffer, cats residing in the potential new homes would have a very limited effect on nightingales. The cat-proof fencing would need to have guaranteed regular inspections and maintenance over the long term. Such fencing could be supplemented with semi-natural barriers such as dense thorn-scrub, wet ditches, etc.

An audit of the condition of the existing fencing within the SSSI and surrounding environmental conditions would inform a detailed scope of requirements. It is anticipated that the existing fence would need to be enhanced to incorporate design specifications as detailed below.

Research has been undertaken in Australia as detailed in Long & Robley (2004) and Moseby & Read (2006) (as cited in White & Hirons (2019) – RSPB's Predator Exclusion Fence Manual) to test the effectiveness of fence designs as barriers to feral cats and other predators. Based on a series of pen and field trials, the most effective design specification for Chattenden Woods and Lodge Hill SSSI would be likely to comprise the following design specifications:

- >2m height (the current fences around Lodge Hill are at least 3m)
- Fence corners with internal angles greater than 120 degrees (Day and MacGibbon, 2002).

- Use of metal posts or clad wooden posts with corrugated roofing iron nailed to them
- No larger than 50 mm mesh aperture size (Day and MacGibbon, 2002).
- Loosely tensioned, floppy netted overhang (Coman and McCutchan, 1994). Loosely tensioned netting can deter climbing animals such as cats and foxes by denying them stable climbing footholds (Coman and McCutchan, 1994). According to Moseby & Read (2006), to be effective such fences should have a floppy top at least 600 mm wide enabling it to form a full semi-circle. A floppy topped fence without electric wires has successfully excluded foxes and cats from a 6000 ha reserve in Australia.
- Outward facing horizontal apron (usually wire mesh and often buried) to prevent animals burrowing under the fence.

It is worth noting that such experimental trial conditions where these specifications were tested tend to represent the worst-case scenario, i.e. animals are provided with extreme motivation to breach a fence, or are presented to the fence in unnaturally high densities, and therefore the effectiveness of these fences is more likely to apply to a range of situations.

It is well recognised that fences will only continue to be effective if they are regularly monitored and well maintained (McKnight 1969, Sexton 1984, Coman and McCutchan 1994, Hallett 2002). White & Hirons (2019) also consider that fences work if they are well-sited, well-designed and well-maintained. On this basis, a warden should carry out weekly full perimeter fencing checks during the six month period nightingales are likely to be present (April to September inclusive), and to a lesser extent outside this period, to ensure effective upkeep of the exclusion fencing.

Even with the cat-proof fencing described above housing development within 150m of the SSSI boundary would still carry a significant risk of cat predation that would require compensation in order to avoid a nationally-significant adverse effect. If, along with fencing, residential development within 150m of the SSSI cannot be avoided, then there are non-designated areas of land adjacent to and surrounded by the SSSI which offer potential opportunity for habitat creation and enhancement which, if sufficiently large, well connected, well designed and well managed, could maintain the overall carrying capacity for nightingales. However, the required amount and locations of such compensatory habitat will need to be determined through detailed work at the project level, which is beyond the scope of this CEcIA. Such work is currently being undertaken by Homes England's consultants for the proposed development at Chattenden Barracks. Other proposed developments near the SSSI boundary will need to do similar studies in order to determine the appropriate combination of fencing, other barriers, avoidance buffers and, as a last resort, compensatory habitat for residual effects.

The need to mitigate for increased cat predation also applies to the proposed residential allocation north of Binney Road at Allhallows. The effect on wetland birds has not been specifically modelled in the way it has for nightingales. However, the available research suggests that maintaining a 360m buffer between any new housing and the designated site boundary is advisable in the absence of any effective cat barrier. This would mean that the proposed allocation north of Binney Road might need to be allocated for other uses, rather than residential, unless some form of effective cat barrier (see **Figure 18** for indicative locations) could be installed as discussed above for Chattenden Woods and Lodge Hill SSSIs. However, tall fencing may not be in keeping with local landscape character or the objectives of the designated sites at this location, so a lower, more natural barrier may be necessary, such as a waterbody.

6.11 Measures to address recreational disturbance and damage

Recreational disturbance arising from an increased local population of residents and workers is most effectively avoided through the provision of alternative greenspace that is suitable for informal recreation and nature enjoyment. This is a well-recognised and used method of diverting people (and their dogs) away from designated sites to other areas of open greenspace that are less ecologically sensitive. Urban parks, village greens playing fields and community parkland are prime examples of this, but linear green access corridors can also contribute. Anywhere where habitat creation can be combined with recreational access should be considered; however, such alternative greenspace should be strategically located to intercept or divert visitors that would otherwise go to the designated sites.

The significant potential requirement for cumulative habitat compensation discussed in **Section 5.2** provides an opportunity to combine the provision of such habitat and alternative greenspace within the same areas of land, which would require careful landscaping and ongoing management. In particular, the creation of new community parkland would mean that some types of habitat creation that require regular management to realise their full potential (e.g. species-rich meadow grasslands, open mosaic habitat, ponds and wetlands) could be maintained and monitored as part of the normal annual park maintenance programme.

There is a large area of land already identified for community parkland by Medway Council to the south of Hoo St Werburgh, which is under early design ('Cookham Community Parkland'). This site could provide nearly 50 hectares of alternative greenspace to deal with indirect recreation impacts to designated sites, within which a significant portion of the new habitat could contribute to the mitigation and compensation required for cumulative, direct losses.

Much of this area sits outside of the BOA-influenced priority habitat compensation areas described in Section 6.2, so would be in addition to habitat creation based on BOA principles.

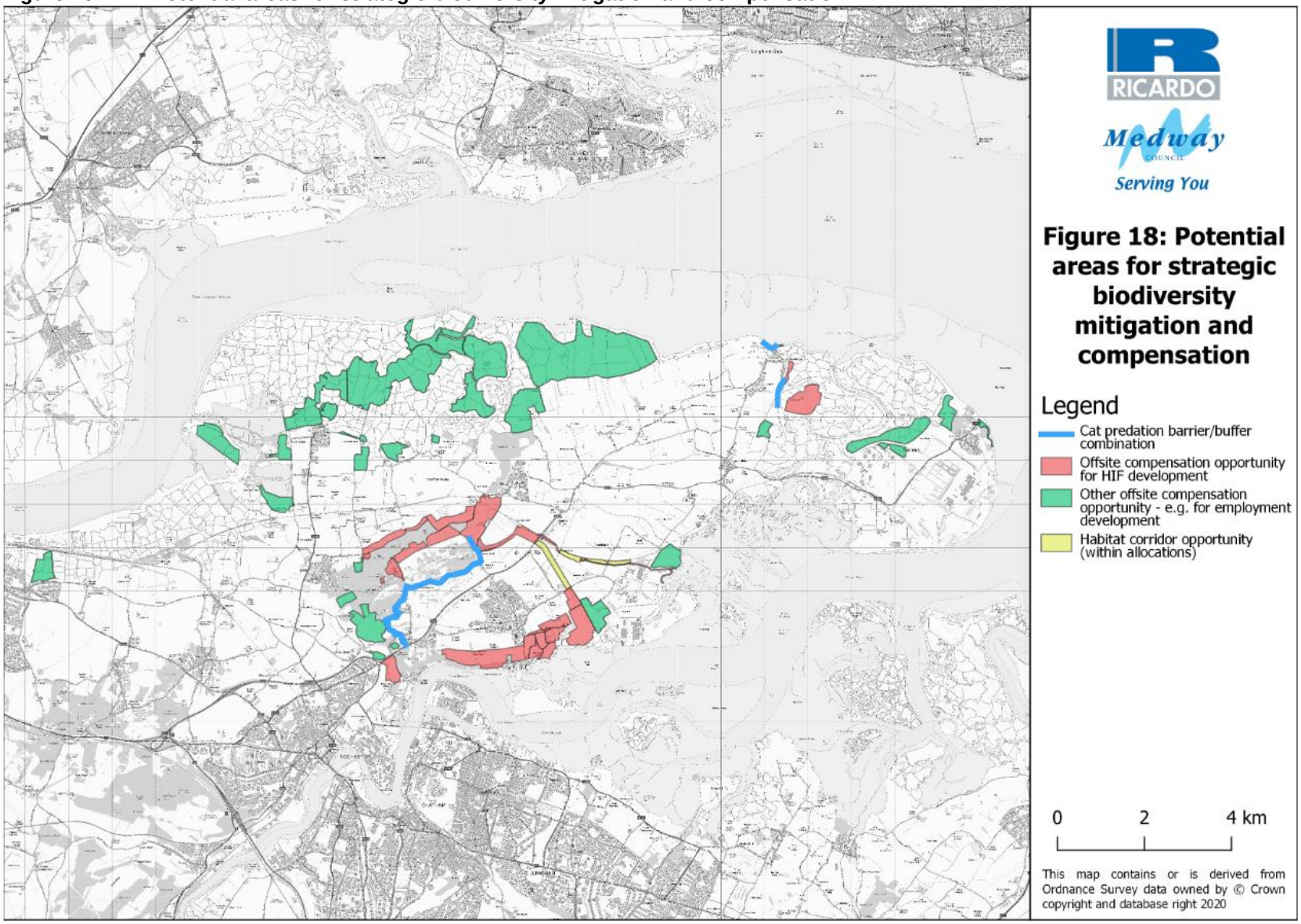
It is recognised that these additional greenspaces are unlikely to fully mitigate for recreational disturbance and damage to the designated sites. Although such measures can reduce the daily and annual numbers of visitors to designates sites, there will still be a portion of visitors that will want to visit these natural sites for the unique landscape and habitat qualities they possess (e.g. the 'coastal experience'). For the residual impacts this brings, further mitigation measures are required. These are likely to include increased on-site ranger/warden resources to monitor, manage and educate visitors, and to undertake maintenance and repair activities critical to wildlife protection in a timely manner (see also **Section 5.2.4**). Related measures will also include the provision of targeted facilities for visitors to avoid litter, waste and uncontrolled fires. Such facilities should be strategically located away from the more sensitive locations for qualifying features. It would also include habitat-protective infrastructure such as signage and fencing. Fencing may be particularly relevant to protecting the interests of the Chattenden Woods and Lodge Hill SSSI, whereas elsewhere, signage may be more suitable.

Funding of such additional measures to deal with increased recreation impacts and associated management could be through existing mechanisms such as Birdwise/SAMMS, but the per-dwelling contribution is likely to need to be increased given the scale and proximity of the proposed new developments within the Hoo Peninsula. A detailed, costed set of measures should be prepared for the number of additional visitors predicted through further study. This study may form part of the SEMS-funded set of measures or could be funded jointly by the developers as part of their obligation to provide HRA and ecological impact assessment for their proposals.

6.12 Combined mitigation/compensation land

Combining all of the potential mitigation/compensation land described in **Sections 5.2 to 5.11**, a comprehensive map of potential strategic biodiversity mitigation and compensation land can be produced (**Figure 18**).

Figure 18 Potential areas for strategic biodiversity mitigation and compensation



These mapped areas for biodiversity would serve to:

- Provide habitat compensation required to achieve no net loss of biodiversity (i.e. no reduction in Biodiversity Units)
- Provide a net gain in Biodiversity Units
- Provide strategic mitigation and compensation for potential impacts to designated sites, particularly relating to cat predation, noise and lighting.
- Provide a strengthened habitat network with improved connectivity for species resilience.
- Help to realise the opportunity identified within the North Kent Marshes BOA
- Provide alternative greenspace (where appropriate) to prevent significant recreational disturbance of designated sites.
- Help address air quality impact through the filtering and absorption effects of natural vegetation.
- Reduce rapid runoff of precipitation, thus reducing flood risk, maintaining wetlands and protecting watercourses from pollution.
- Reduce the number and significance of identified adverse effects arising from development.

6.13 Potential funding mechanisms

Prior to the completion of the CEcIA, the SEMS was intended by Medway Council primarily for providing mitigation and compensation in the vicinity of Hoo St Werburgh to address the impact of proposed development north of the Peninsula Way (funded by HIF to address recreational and cat predation impacts of the Chattenden, Gladman, and Deangate proposed allocations primarily on SSSI habitat and birds) and also the impact on the estuary SPA/Ramsar sites from development both north and south of the Peninsula Way. This is now likely to involve the creation of biodiverse greenspaces that buffer the designated sites and offer the growing population alternative greenspaces for recreation both close to and across the Hoo Peninsula.

Specific SEMS measures to address the indirect impact of Road and Rail infrastructure will, where possible, be delivered by SEMS, but failing that, the HIF interventions will have to fund their ecological compensation and net gain requirements.

SAMMS is already in place to address the indirect impact on designated sites across north Kent of development-related growth in recreational use, driven by growth in population and access within 6km. However, due to the Hoo peninsula developments' locations being so close to the SPA/Ramsar etc, an enhanced SAMMS ('SAMMS+') is likely to be needed to address the locally-concentrated risks of recreational impacts. This may include the funding of a long-term dedicated wardening scheme and a management and maintenance programme for the above-mentioned SEMS land.

A wider habitat compensation scheme and also a net gain package with a specific biodiversity focus would likely need to be funded directly by the developers to complement SEMS and SAMMS+. This should focus initially on the opportunity areas identified by this CEcIA (Figure 17) and in consultation with Medway Council, Natural England, the Kent Nature Partnership and the RSPB.

Table 5 Summary of cumulative ecological effects

Feature	Biodiversity importance	Type of impact	Nature of Effect	Significance of unmitigated effect	Mitigation	Biodiversity Gain	Significance of residual effect
Habitats	Local	Direct loss through allocation developments	Permanent	Significant	Master planning individual allocation planning applications to reduce habitat loss and to promote habitat creation. Following the strategic compensation opportunities identified within Figure 16	A 10% biodiveristy net gain can achieved	Not significant
Habitats	Local	Fragmentation	Permanent	Significant	Master planning individual allocation planning applications to reduce habitat loss and to promote habitat creation. Following the strategic compensation opportunities identified within Figure 16 and Figure 17.	A 10% biodiveristy net gain can achieved	Not significant
Hydrological effects	Local	Changes in soil and surface water levels of rivers and streams	Permanent	Significant	Avoidance of development adjacent to watercourses and other wetland features. culverting of watercourses is avoided and that a minimum 10m riparian	N/A	Not significant

					habitat buffer from the watercourse is maintained throughout construction and operation of the developments. Measures should be detailed in a Construction Environmental Management Plans (CEMP) for each development.		
Water quality	Local	Pollution	Permanent	Significant	Follow guidance is provided in “Guidance for Pollution Prevention - Works and maintenance in or near water”: GPP 5 Version 1.2 (2018). Follow mitigation for hydrological effects.	N/A	Not significant
Air quality	Local	Pollution	Permanent	Significant	HRA undertaken informed by traffic modelling and more detailed airborne pollutant dispersion modelling for impacts on European sites. Proximately of roads avoided within 200m of SSSI boundaries.	N/A	Not significant
Invasive species	Local	Spread of invasive species	Permanent	Significant	Biosecurity measures to avoid the spread of invasive non-native	N/A	Not significant

					species should form part of the CEMP. The Environment Agency's 'Check, Clean, Dry' advice should be followed wherever possible by contractors.		
Lighting	Local	Disturbance to light sensitive species	Permanent	Significant	Master-planning design of unlit 'dark corridors' adjacent to especially sensitive habitats, such as designated sites. Following guidance Note 08/18 'Bats and artificial lighting' by the Bat Conservation Trust and the Institution of Lighting Professionals (2018).	N/A	Not significant
Noise	Local	Disturbance to light sensitive species	Permanent	Significant	Where developments must proceed within c.300m proximity of a site designated for birds (or associated functionally-linked land), noise from construction sites should be mitigated through construction-industry good practice (e.g. BS 5228-1:2009+A1:2014: "Code of practice for noise and vibration control on	N/A	Not significant

					construction and open sites. Noise"). New equipment is generally much quieter than old equipment and should be carefully selected based on noise levels. Particularly noisy activities can also be timed to avoid more sensitive periods of the day or year for sensitive wildlife.		
Cat predation	National	Cat predation on bird interest features of Chattenden Woods and Lodge Hill SSSI	Permanent	Significant	Effective and regularly inspected cat-proof fencing. A zone absent of any development that could house cats around the affected perimeter. Compensation for residual effects in the form of new and/or enhanced habitat for nightingales.	N/A	Not significant
Recreational disturbance	Local	Damage to habitats and disturbance to designated species within European sites and SSSI's.	Permanent	Significant	Provision of alternative greenspace that is suitable for informal recreation and nature enjoyment. Increased on-site ranger/warden resources to monitor, manage and educate visitors, and to	N/A	Not significant

					undertake maintenance and repair activities critical to wildlife protection in a timely manner		

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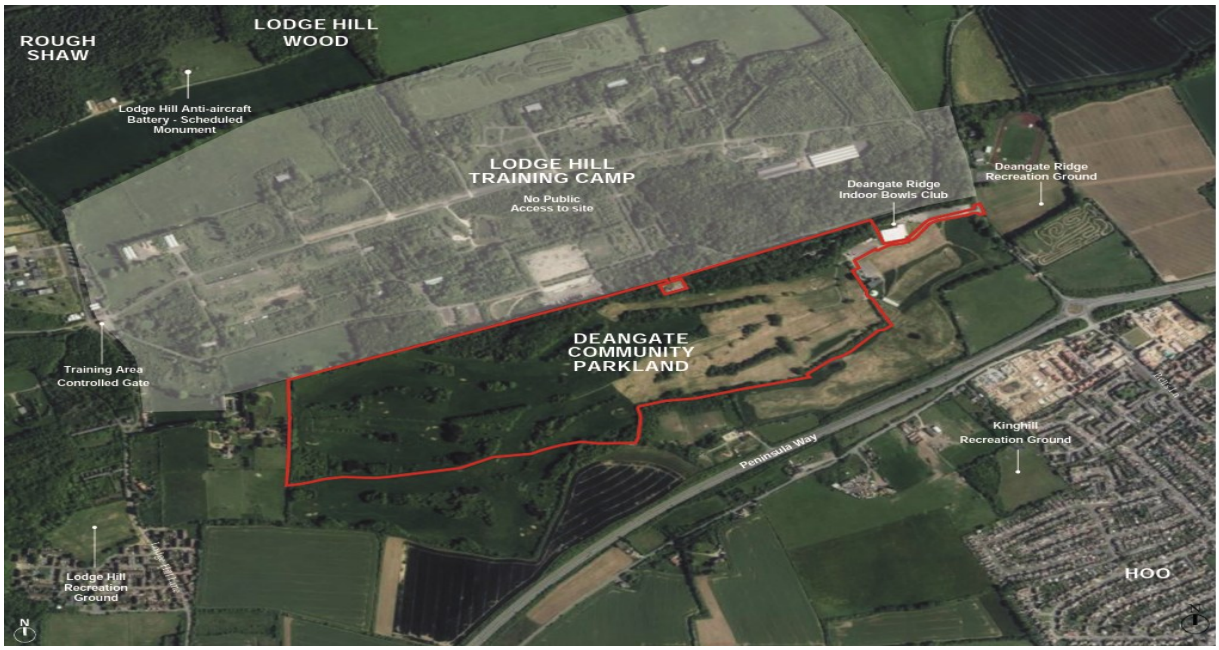
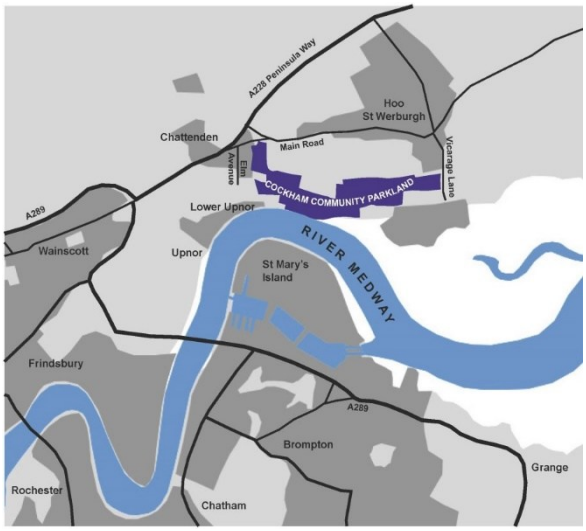
Housing Infrastructure Fund – Strategic Environmental Management Scheme Overview





1 Background

1.1 In November 2019 Medway Council obtained £170m worth of funding from HE (Homes England) through the HIF (Housing Infrastructure Fund) to provide infrastructure to support the delivery of 10,600 new homes on the Hoo Peninsula. The total funding was for road, rail infrastructure and environmental mitigation.

1.2 The SEMS (Strategic Environmental Management Scheme) was intended to provide substantial environmental mitigation to offset future development on the Hoo Peninsula and over £14 Million was initially allocated to SEMS when funding was awarded in November 2019. The funding offer was withdrawn in 2023.

1.3 As a result of the withdrawal of this funding Medway Council had to stop work on the original proposed investment in public access to open spaces which formed the basis of SEMS. However the requirement for investment in environmental measures still exists to mitigate housing growth on the Hoo Peninsula. The Council continues to explore means to deliver aspects of the original SEMS programme.

2 SEMS Phase 1 Cockham Community Parkland

2.1 In November 2019, Medway Council secured £170m of government funding through the Housing Infrastructure Fund (HIF) to invest in road, rail and environmental infrastructure. Over £14 million of which was allocated towards SEMS and its objectives. Initially £4.5 million of this funding was put towards Phase 1 which was known as Cockham Community Parkland.

2.2 The proposed site for Cockham Community Parkland forms part of Cockham Farm. A series of fields currently in use for crop growing will be re-purposed to create the parkland. The fields lie to the south of Hoo St Werburgh and the east of Chattenden. The eastern edge of the park will meet Vicarage Lane. Saxon Shore Way (Upper) runs along part of the northern site boundary.

2.3 The Cockham Community Parkland (Planning ref MC/20/3264) was consented in July 2021.

Site Boundary:

Some of the key objectives for Cockham Community Parkland were to:

(i) Create a substantial public open space of at least 50 hectares.
(ii) Showcase the Peninsula's landscapes.
(iii) Celebrate nature through nurturing existing habitats and creating new ones.
(iv) Provide users with an opportunity to further enjoy views across the River Medway.
(v) Educate visitors about the importance of the estuary and need to protect it.

(vi) Provide appropriate visitor facilities including extensive space for passive recreation including space for picnics, play and woodland trails.

(vii) Create a network of safe and attractive routes for dog walkers, walkers and cyclists.

(viii) Design in flexibility for additional visitor facilities to be added in the future such as a visitor centre.

3 SEMS Phase 2a Hoo Wetlands Reserve

3.1 As part of SEMS Phase 2a, the Hoo Wetland Reserve planning application (planning ref MC/22/2479) was given approval in November 2022 subject to conditions including that the development shall be begun before the expiration of three years from the date of the permission.

3.2 The site was being brought forward as part of the Future Hoo Strategic Environmental Management Scheme (SEMS), with just under £2.5 million of which would fund the creation of Hoo Wetland Reserve.

3.3 The site comprises agricultural land with some wooded tree belt boundaries, with areas of grazing marshland. The site (Planning Application Boundary) is just under 16 hectares. It is located on the north shore of the River Medway between Hoo St Werburgh found to the west and Kingsnorth Power Station to the east. The site sits within Medway Council's administrative boundary.

3.4 Site Boundary:

3.5 The key design objectives of the site are:

(i) Deliver SEMS objectives through management measures, improve the condition of The Medway Estuary and Marshes SSSI, and Medway Estuary and Marshes Ramsar Site.
(ii) Protect and appropriately manage existing habits to support notable species identified through the SSSI and Ramsar site designations.
(iii) Expand current habitats and create new habitats suitable for promoting the existing and future wildlife populations.
(iv) Convert existing arable land uses to support appropriate wetland habitat systems. To align with existing site designations and longer-term aspirations for the Hoo Peninsula and Hoo Estuary.
(v) Provide enhancements to the Hoo hydrological infrastructure systems through the introduction of naturalised drainage and a series of wetland habitat typologies.
(vi) Enhance connectivity and rework existing path networks to provide sensitive routes. Visitors to only have controlled access to the site, ensuring existing and new wildlife habitats are protected;
(vii) Educate and celebrate, through site interpretation, the rich heritage, wildlife, and hydrological systems found on site and the wider Hoo Peninsula;
(viii) Ensure the long-term management of the wetland, including on-site ranger facilities. This will enable habitats and key species to thrive and will allow for the maintenance of visitor facilities.

4. SEMS Phase 2b Lodge Hill Countryside site

4.1 Lodge Hill Countryside site was intended to become Phase 2B of SEMS. £5 million of which would fund its eventual creation.

4.2 The Site is located on the Chattenden Ridge on the Hoo Peninsula, approximately 1.5km north of Chattenden and 1km north west of Hoo. It lies immediately north of the Lodge Hill Training Area and is 91.6 hectares in size.

4.3 Site Boundary:

a. 

4.4 The site is owned by Homes England and the ambition of the site was to provide substantial mitigation to the Housing Development aspirations of Homes England in the Lodge Hill area.

4.5 The site contains areas of the Chattenden and Lodge Hill Site of Special Scientific Interest (SSSI) (which also covers the former training ground immediately south of the site boundary) and supports nationally important numbers of breeding nightingales.

4.6 The key design objectives of the Lodge Hill Countryside site are:

(i) Encourage a wider use by an important population of Nightingales through creation of new habitat and sensitive access management.
(ii) Implement restoration proposals and maintain and enhance SSSI condition.
(iii) Respond positively to the site context, and landscape character of Chattenden Ridge.
(iv) Provide non-intrusive opportunities for visitors to learn about the historic context and previous military use of the site.
(v) Celebrate the Scheduled Monument whilst protecting it from direct public access.
(vi) Seek opportunities to provide seasonal permissive access along the existing track, linking to existing PRoWs network at the site boundaries, restricting direct access to the SSSI.
(vii) Implement an active management plan to compliment the focussed SSSI Restoration, Management and Access Strategy.
(viii) Explore opportunities for existing farm structures on site to support conservation grazing.

5. SEMS Phase 2c Deangate Community Parkland

5.1 SEMS Phase 2c known as Deangate Community Parkland was allocated £1.5 million from the £14 million budget for SEMS.

5.2 As of 2023 the former Deangate Golf course (closed in 2018) has been renewed as a designated asset of community value with permitted use granted to the public from Medway Council, the current landowner.

5.3 The Deangate Community Parkland Site is located on Deangate Ridge, North of the urban areas of Chattenden and Hoo St Werburgh, and to the South-West of High Halstow. The Site was originally used as a golf course and more recently public recreation space to the South of the Lodge Hill Training Area.

Site Boundary:

5.4 The key design objectives of the Lodge Hill Countryside site were:

(i) Create a substantial public open space of at least 43.3hectares which delivers SEMS objectives.

(ii) Respond positively to the site context, and landscape character of Chattenden Ridge.

(iii) Celebrate nature through nurturing existing habitats and creating new ones.

(iv) Increase public knowledge of the importance of the Nightingale population and the habitats they populate.

(v) Provide key visitor facilities including extensive space for passive recreation.

(vi) Create a network of safe and attractive routes for dog walkers, walkers and cyclists.

5.5 This Council is now taking forward this project.

6. SEMS Phase 2d - PROW - Public Rights of Way

6.1 This stream involved improvements to local public rights of way and routes were identified based on consultation feedback and engagement with the local parish council.

6.2 Selected PROW:

PROW 76

PROW 109

PROW 106 and 127

Assessment of impact on Nightingales of developing in vicinity of Chattenden Woods and Lodge Hill SSSI

February 2024

KWT Consultancy Services

Report Verification

Client	Medway Council (SEMS)
Site / job	Chattenden Woods and Lodge Hill SSSI
Central Grid Reference	TQ764737
Report Title	Assessment of impact on Nightingales of developing adjacent to Chattenden Woods and Lodge Hill SSSI
Report Reference	ECOSERV145

Quality Assurance

Report Version	Date	Prepared By	Reviewed By	Approved By
Draft	15/02/2023	Chas Holt, Head of Ecology, KWT Consultancy Services	Chas Holt, Head of Ecology, KWT Consultancy Services	Vincent Ganley, Managing Director, KWT Consultancy Services
Version 2	20/08/2023	Chas Holt, Head of Ecology, KWT Consultancy Services	Chas Holt, Head of Ecology, KWT Consultancy Services	Vincent Ganley, Managing Director, KWT Consultancy Services
Final	29/02/2024	Chas Holt, Head of Ecology, KWT Consultancy Services	Chas Holt, Head of Ecology, KWT Consultancy Services	Vincent Ganley, Managing Director, KWT Consultancy Services

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Any information provided by third parties and referred to within this report has not been checked or verified by KWT Consultancy Services (Adonis Blue) unless otherwise expressly stated within this document.

Contents

EXECUTIVE SUMMARY

This report was commissioned by Medway Council to provide ecological advice to inform the preparation of the new Medway Local Plan policies and assessment work for potential site allocations.

This report estimates the likely impacts on the breeding Nightingale population of Chattenden Woods and Lodge Hill SSSI, Kent, from potential residential development in the vicinity of the SSSI.

The literature review and impact assessment, in combination, are intended to inform an evidence-based approach to the hierarchical process of avoidance, mitigation or compensation (CIEEM 2018); with respect to evaluating potential impacts on the SSSI-feature breeding population of Nightingales at Chattenden Woods and Lodge Hill SSSI.

Using a conceptual model, which integrates a range of evidence-based indirect impact pathways affecting breeding Nightingales, estimated effects in terms of Nightingale territory loss that could result from development at different distances from the SSSI boundary are provided. Empirical data of Nightingale territory distribution on the SSSI in recent years have been used to model implications of a range of development scenarios with and without SSSI perimeter fencing. Key assumptions related to the perimeter fencing include core objectives to exclude cats and prevent human public access.

Results from this modelling exercise could be used to assist appropriate distance buffering from the SSSI boundary. Under all the distance buffer scenarios tested, the estimated impact of suburban residential development (with associated services and infrastructures) on land south the SSSI, east of Lodge Hill Lane, and north of the Peninsula Way, would be at least doubled in the absence of effective protective fencing and access restrictions. The secure fence and no-fence scenarios provide a binary test of the model and hence a range of estimated impact. The current fence (and associated condition/efficacy) will lie within that range.

The model has also been applied to the area west of Lodge Hill Lane, with reference to residential development on the former Chattenden Barracks. Estimated impacts have been differentiated to exemplify potential application of the model where distinct sources of land use change across a wider area may act either combination or in isolation.

An evaluation of the main elements of a proposed mitigation strategy is also introduced. This strategy would have an objective of, at least in part, addressing the territory losses estimated to result from development in the vicinity of the SSSI. The discussion summarises requirements for focus on future management of the SSSI, potential local habitat related opportunities, and other initiatives relevant to habitat suitability for breeding Nightingales.

1.0 INTRODUCTION

1.1 Background

Kent Wildlife Trust Consultancy Services (KWT CS) was commissioned by Medway Council to provide an impact assessment of likely effects on breeding Nightingales *Luscinia megarhynchos* of progressing development proposals in the vicinity of Chattenden Woods and Lodge Hill Site of Special Scientific Interest (SSSI) [1]. Potential development sites have been identified in this area, through work on the emerging Medway Local Plan. The Council prepared a brief for this commission, with the support of Natural England, to provide a better understanding of the potential impacts, and should mitigations be needed, advice on effective measures to address impacts.

Since the commissioning of the report, there have been some significant contextual changes. These include the withdrawal of the Housing Infrastructure Fund programme funding, which sought to deliver specific transport and environmental schemes in the proximity of the study area. There are some references in the document to the position earlier in the project development. The Council has not yet published its draft Local Plan confirming details of site allocations, and this report will inform the evidence base for the plan.

This impact assessment follows a literature review of key evidence, undertaken to assist in evaluation of likely impacts on breeding Nightingales *Luscinia megarhynchos* of progressing development proposals in the vicinity of a protected site. The literature review and impact assessment, in combination, are intended to inform an evidence-based approach to the hierarchical process of avoidance, mitigation or compensation (CIEEM 2018); with respect to evaluating potential impacts on the SSSI-feature breeding population of Nightingales at Chattenden Woods and Lodge Hill SSSI.

1.2 Structure of report

This impact assessment report – examining implications for Nightingales of new development in the vicinity of Chattenden Woods and Lodge Hill SSSI – is presented in key sections which present the methodological approach, results, discussion, and evaluation of findings.

In doing so, this impact assessment report provides the following:

(i) a **methodology** to model estimated impacts of development on breeding Nightingales.

(ii) a modeled **estimation of impact** on the Chattenden Woods and Lodge Hill SSSI breeding population of Nightingale under different scenarios of buffer distance and fencing strategy, using empirical territory data for the site.

(iii) an **evaluation of the main elements of a potential mitigation strategy** to address Nightingale territory losses at SSSI, informed by interpretation of the territory information available for the site.

The key scientific literature and other information used as an evidence base to inform the methodological approach are summarised in detail within an accompanying literature review.

As per the literature review, the focus species throughout this impact assessment is solely Nightingale, as the designated feature of interest at Chattenden Woods and Lodge Hill SSSI.

[1] Please refer to Chattenden Woods and Lodge Hill Site of Special Scientific Interest citation on Natural England website

2.0 METHODOLOGY

This section outlines the methodological approach to address the following specific objectives:

(i) analysis of annual Nightingale abundance and distribution across Chattenden Woods and Lodge Hill SSSI

(ii) generation of a model to estimate impacts of development on Nightingales.

2.1 Analysis of Nightingale data for SSSI

This impact assessment uses annual data on numbers and distribution of singing Nightingales at Chattenden Woods and Lodge Hill SSSI and immediate vicinity. These data were collected by British Trust for Ornithology, under contract to Homes England, during the period 2012 to 2022 (excluding 2014). The survey methodology, using a standardised intensive territory mapping approach, is described in the respective annual reports produced by BTO for Homes England.

The BTO/Homes England survey data have been used in the assessment for two main purposes. Firstly, the data facilitate a robust understanding of territory numbers at the site for the period since the SSSI was extended in response to Nightingale abundance in 2012, enabling comparison with baseline population size at designation. Secondly, the location of Nightingale territories across the site can be examined to inform patterns of distribution change that may have occurred over the survey period since designation.

The following parameters of the SSSI breeding population are examined, both in terms of pooled data across all years, and by dividing the surveys into two temporal periods (2012-2017 and 2018-2022):

2.1.1 Number of Nightingale territories

The number of singing male Nightingales at Chattenden Woods and Lodge Hill SSSI during the period 2012-22 is examined. This provides an indication of the trajectory of the territory-based population since the extension of the SSSI and inclusion of breeding Nightingales as a designated feature, as well as the degree of annual variation in numbers.

2.1.2 Distribution of Nightingale territories

Mapped data can provide insights into how distribution may have changed in response to either habitat-related or other environmental change across the site. This can highlight particular areas that have assumed greater importance in recent years in terms of concentrations of territories, and provides a framework to evaluate areas that may, all else being equal, assume greater importance in the future.

In order to examine spatial change in distribution, locations of Nightingale territories on the SSSI have been assessed by deriving kernel-based distributions of territories in each survey year and across the whole survey period. This is achieved by smoothing spatial data in GIS to generate kernel-based contoured “heat maps” based on territory density. Hereafter, core areas of Nightingale distribution on the site are referred to as “hotspots”.

2.2 Developing a model to estimate impact on breeding Nightingales

In order to quantify the estimates of potential impacts of development in the vicinity of a breeding population of Nightingales, a proposed model includes a range of impact pathways through which a breeding population of Nightingales is likely to be affected.

Empirical territory-based data can then be used to estimate impacts (quantified in terms of territory loss) of new development in the vicinity of a site.

Defining Nightingale territories

Individual territories are defined by aggregations of registrations generated by the mapping methodology. Spatial clusters of registrations generated over the course of several survey visits enables differentiation of territory spaces. Each territory space tends to be defined by the minimum convex polygon (MCP) generated by the cluster of registrations.

For the purposes of this assessment, the available territory data have been modelled in two different ways; based on use of 'territory centres' and 'territory polygons', respectively.

- 'Territory centres' use the central point of each territory MCP (as provided by BTO/Homes England). Territory centres were available for all surveyed years, hence this approach ensured use of a data from all years.
- 'Territory polygons' use the closest point of each MCP to a source of potential disturbance. MCP were available for all surveyed years excluding 2014.

The final estimates presented are an average of the two approaches.

Timescales of impacts

The timescale over which impacts would be expected to materialise is not included in the model per se. Responses to development scenarios by breeding Nightingales would be expected to begin in the short term and varyingly manifest themselves in terms of impacts on the number of individuals within a breeding population.

Full cumulative impacts on a breeding population of Nightingales would only become evident over a period of several years, because of indirect effects on habitat quality interacting with the species' ecology and breeding behaviour.

2.2.1 Impact pathways and response curves

The modelling approach applied in this assessment in relation to a breeding Nightingale population uses available evidence of likely effects derived by different impact pathways (stressors). The impact pathways (stressors) and sourced scientific literature have been summarised in an accompanying literature review.

Response curves are a means of showing quantified impact of the individual pathways (stressors) over a given distance. Bespoke response curves to show a response by breeding Nightingales to each impact pathway (stressor) are based on sourced evidence, supplemented where appropriate by expert opinion and knowledge relating to Nightingale ecology.

Final models combine the unsmoothed response curves to differentiate the key impact pathways. Impact (i.e. likelihood of territory loss, expressed as percentage) of the different pathways declines with increasing distance from development (Fig. 1).

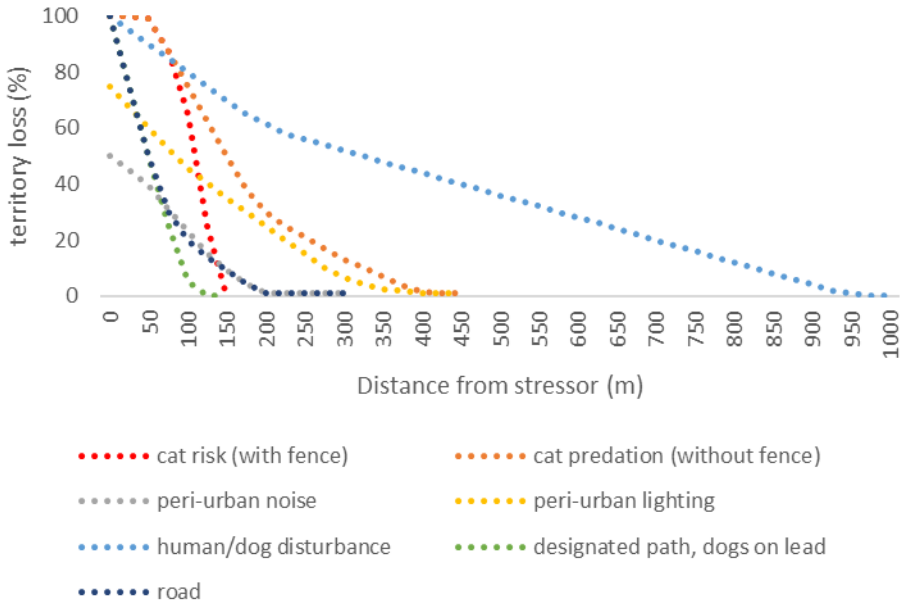


Fig. 1. Differentiation of impact pathways (stressors) to show estimated magnitude and persistence of effects.

The following is a summary of the patterns of response to the differentiated factors, and any associated assumptions, which have been used in the modelling of impact. Where applicable, the gradients, trajectories and key thresholds of the differentiated response curves (Fig. 1) are described. Fuller detail can be sourced from the accompanying literature review.

Cats

Differential responses to cats are applied according to the presence of an exclusion fence around the ex-training area. It is assumed that the retained fence, providing it is adequately maintained in the future, will be effective at preventing access by most cats. This may therefore require some work to the existing fence to ensure that current gaps are filled, or possibly installation of new fencing along the southern boundary of the SSSI. See fence condition assessment and monitoring protocol.

Importantly, in terms of response curves, even where there is a fence between the SSSI and development, there is a “predation risk” that also needs to be accounted for. The latter is relevant within immediate proximity of new houses and has been considered to reduce over a relatively short distance such that there will no effect by 150 m. This distance effect also allows for the possibility that a minority of persistent cats will find ways of accessing through the fence.

In a ‘no fence’ scenario, the direct impacts of predation by cats (as well as additive indirect effects through “predation risk”) have been accounted for up to 360 m from residential development. Although in some circumstances, such as the presence of an intervening road, the distance over which associated impacts is likely to considerably vary, it would be appropriate to have a consistent approach. For example, adjacent to an intervening road, it would be envisaged that cat activity might

be reduced, however access by cats at night would probably be largely unaffected by the presence of a road associated with or linking residential development.

Key rationale for inclusion of cats as a pathway of impact: predation risk (actual and perceived) of adult nightingales and fledged juveniles.

Noise

Given the importance of audio connectivity within Nightingale breeding aggregations, it is important to account for this pathway in modelling effects on this species. The same response curves have been applied irrespective of the presence or absence of fencing. Indirect effects of anthropogenic noise in suburban settings have been deemed to have a moderate impact immediately adjacent to development, but this reduces over 200 m distance to a point of no effect by 300 m. This is considered suitably precautionary and will account for spatial variation in noise levels that may generated as a result of different land use types, e.g. elements of business and industrial.

Key rationale for inclusion of anthropogenic noise as a pathway of impact: reduction in habitat quality, interruption of audio connectivity between adjacent territories affecting conspecific attraction and the possibility that some kinds of noise may be used as cues for predation risk.

Light

Based on published evidence, indirect effects of anthropogenic light in suburban settings have been deemed to have a relatively strong impact (75%) adjacent to residential development, reducing to 50% by 100 m and tailing off to a negligible effect by 300 m.

Given the relevance of nocturnal behaviour and associated interactions between birds within Nightingale breeding aggregations, it is very important to account for this pathway in estimating impacts. Associated changes in habitat characteristics may also influence invertebrate food supplies. Response curves are the same regardless of the presence or absence of fence.

Key rationale for inclusion of anthropogenic light as a pathway of impact: reduction in habitat quality, possible effects on invertebrate food supplies such as moth larvae.

Disturbance associated with human access

In the presence of a fence, there is an assumption that there will be no indirect disturbance to Nightingales inside the fence-line. A straight-line relationship has been assumed up to one km from new development in the absence of a fence. Potentially there could be opportunities for additional mitigation through vegetation management (e.g. barriers around sensitive areas) and dedicated ranger activities but these are difficult to incorporate into models in the absence of specific knowledge about how they might be applied or, indeed, whether they are affordable at sufficient scale. All else equal, it assumed that a more defined access management strategy will be developed in order to minimise access to sensitive areas and promote targeted routes away from Nightingale habitat.

Key rationale for inclusion of human disturbance as a pathway of impact: reduction in habitat quality through disturbance to territory establishment and reduced breeding success as a consequence of elevated predation and predation risk coupled with reduced foraging efficiency. These impacts expected to derive from a combination of human access and the activities of dogs off leads.

Designated footpaths

Where new footpaths become a feature, for example across the northern escarpment, as per above, a full and robust access management strategy will be needed. In terms of pattern of response, it is suitably precautionary to assume a straight-line relationship with respect to territory loss up to 100 m, but full persistence of existing territories beyond that distance. Displacement of territories would be assumed immediately adjacent to a footpath. The use of designated footpaths will become particularly relevant in situations and locations where access may otherwise be restricted and where dogs are to be kept on leads. To acknowledge effects of increased access to the wider countryside, a trace effect of 5% has been included up to 5 km.

Key rationale for inclusion of designated footpaths as a pathway of impact: adjacent to designated footpaths, it is reasonable to assume a reduction in habitat quality; disturbance to territory establishment, plus impacts on nesting and foraging. These effects will be generated by humans and particularly dogs as described above.

Roads

Based on original plans for a new distributor road, in that event it was considered suitably precautionary to assume a relationship of territory loss due to such a road up to 200 m with full persistence of existing territories beyond that distance. In such a scenario, based on the sourced evidence, full displacement of territories would have been assumed immediately adjacent to a road.

Key rationale for inclusion of roads as a pathway of impact: reduction in habitat quality; disturbance to territory establishment, interruption of audio connectivity and conspecific attraction.

Note: The final iteration of the local proposal dictated that a distributor road was no longer relevant in this impact assessment.

2.2.2 Composite response curve

A smoothing index is used to generate a single response curve to address the combined influence of more than one impact pathway. In doing so, combined impacts of different pathways are indexed which generate response values to model reduced indirect impact with distance from proposed development.

This composite curve could be adapted as required, e.g.:

(i) refine core assumptions (see 2.2.2.1 Impacts in close proximity to development; below),
(ii) account for site-specific scenarios or particular mitigation where appropriate,
(iii) differentiate impact between distinct development scenarios that may act cumulatively.

For the purpose of this impact assessment, composite curves have been generated for fenced and unfenced SSSI scenarios (Fig. 2).

Note: Based on the fencing condition assessment, the existing ex-training area fence can reasonably be inferred to represent an intermediate scenario between the fenced and unfenced scenarios. An associated estimate of impact could therefore be assumed to be intermediate with respect to the respective estimated impacts on Nightingale territories. Although the efficacy of the existing fence would be closer to the fenced scenario used in the model, this would decline over time.

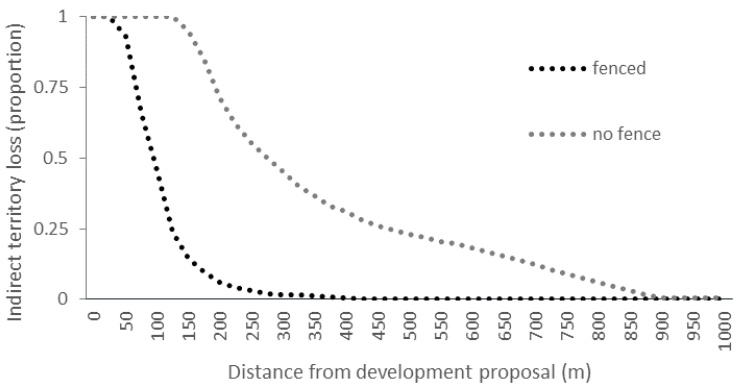


Fig. 2. Smoothed composite response curves for fenced and unfenced SSSI scenarios

2.2.3 Assumptions with use of model at Chattenden Woods and Lodge Hill SSSI

Empirical data relating to nightingale territory locations at Chattenden Woods and Lodge Hill SSSI for the period 2012 to 2022 have been modelled to estimate impacts of land use change in the vicinity. The model integrates some key assumptions:

Impacts in close proximity to development

A core assumption – based on an agreed approach that combines previous studies with expert opinion specific to the situation at Lodge Hill – is that proposed development adjacent to the SSSI should be assumed to, via combination of all the associated impact pathways, result in complete territory loss up to a distance of:

(i) 150 m in the absence of a protective fence;
(ii) 50 m where there is a protective fence in situ.

Any such territory losses can reasonably be assumed to take place in the immediate to short term.

Habitat management on SSSI

This impact assessment report does not attempt to quantify any potential loss or accrual of Nightingale territories associated with the following management works at Chattenden Woods and Lodge Hill SSSI or in the surrounding area:

(i) any UXO clearance that may be required for ex-MOD land;

(ii) prescriptive habitat management undertaken in the future with respect to part of the site's SSSI designation for MG5 grassland; or that might be implemented to extend, maintain or alter the location of Nightingale-favoured habitat on the SSSI;

(iii) habitat creation and management measures that might be implemented to extend, maintain or alter the location or availability of Nightingale-favoured habitat on land adjacent to the SSSI.

Approaches to mitigation

This impact assessment is also based on the assumptions that:

(i) Retention and future maintenance of existing protective military fencing around the ex-training area will have a core objective of preventing entry by cats.

A fencing condition assessment (with recommendations) accompanies this report as supporting material. As important context within which to interpret the results of the model estimates presented in this report (comparing binary fenced and unfenced scenarios), the key results from the condition assessment are summarised as follows:
- Of 187 fence sections, 74 were deemed to be cat proof, 39 were deemed not cat proof, and 74 were not sufficiently accessible to determine cat proofness.
- Of the assessed fence, 97 sections were deemed to have a renewal time of more than ten years, and 32 were deemed to have a renewal time of less than ten years.

(ii) Any restriction of public access to the ex-training area of the SSSI would, as a minimum, cover the period of April to July when breeding Nightingales would be susceptible to disturbance.

2.3 Applications of Nightingale impact assessment model

This assessment is to be considered a demonstration of the model approach in the vicinity of Chattenden Woods and Lodge Hill SSSI. There is scope for refinement and integration of updated land use proposals and greater certainty about timing of different elements.

For the purposes of this impact assessment, the model is exemplified as below:

2.3.1 Model application A: informing buffer zones

The model has been used to estimate indirect territory losses under scenarios of different buffer distances between the southern boundary of the SSSI. This application of the model applies to the area east of Lodge Hill Lane and north of the existing Peninsula Way, addressing the comparison of different buffer scenarios involving either (i) fully robust perimeter fencing around the ex-training area at Lodge Hill Camp or (ii) no fencing.

Conceptual buffer distances from the SSSI boundary that have been modelled are: 100 m, 200 m, 300 m, 400 m, 500 m. A distance of 360m has also been modelled, specifically because this pertains to a cat buffering distance suggested in scientific literature.

2.3.2 Model application B: Chattenden Barracks zone of influence

The model has been used to estimate indirect territory losses under the scenario of residential housing on the area of ex Chattenden Barracks.

The application of the model in the Chattenden Barracks area originally incorporated a proposal for a distributor road nearby, and intended to exemplify how to differentiate impact in situations where possible to allocate proportional impact based on geographic location, number of dwellings, or a specific change of land use, etc. *The proposal no longer features a distributor road.*

3.0 RESULTS

3.1 Nightingales at Chattenden Woods and Lodge Hill SSSI

3.1.1 Number of territories

The following totals of singing male Nightingales were recorded in the annual surveys, 2012 to 2022:

2012 (85), 2013 (65), 2015 (61), 2016 (67), 2017 (70), 2018 (63), 2019 (82), 2020 (103), 2021 (120) and 2022 (140). No surveys were carried out in 2014.

After a period of relative stability, or even suggestion of a slight decline since the change to SSSI designation in 2012, the four consecutive years of 2019 to 2022 have shown an increase in Nightingale territories – reaching a peak of 140 singing males in 2022 (Fig. 3).

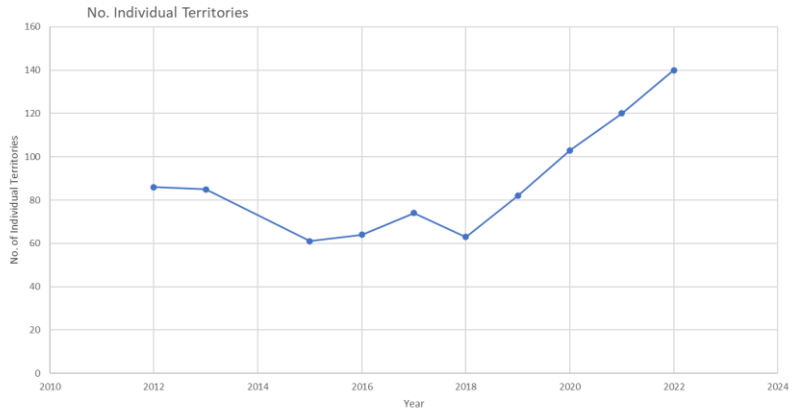


Fig. 3. Annual totals of singing male Nightingale at Chattenden Woods and Lodge Hill SSSI

3.1.2 Distribution of territories

Distribution of mapped territories at Chattenden Woods and Lodge Hill SSSI, pooled across all years, is shown in Fig. 4. Each year mapped separately is included as Appendix 1.

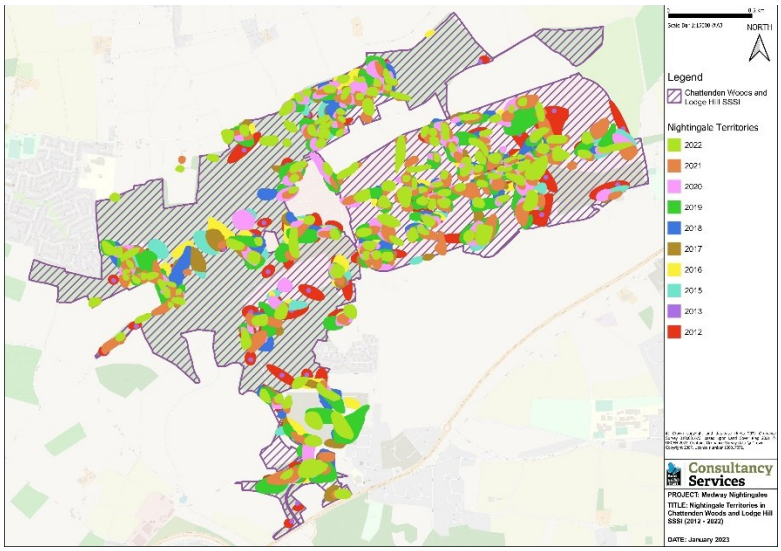


Fig. 4. Overview map showing distribution of Nightingale territories during 2012-2022.

These data are analysed to inform understanding of distribution of territories over the survey period.

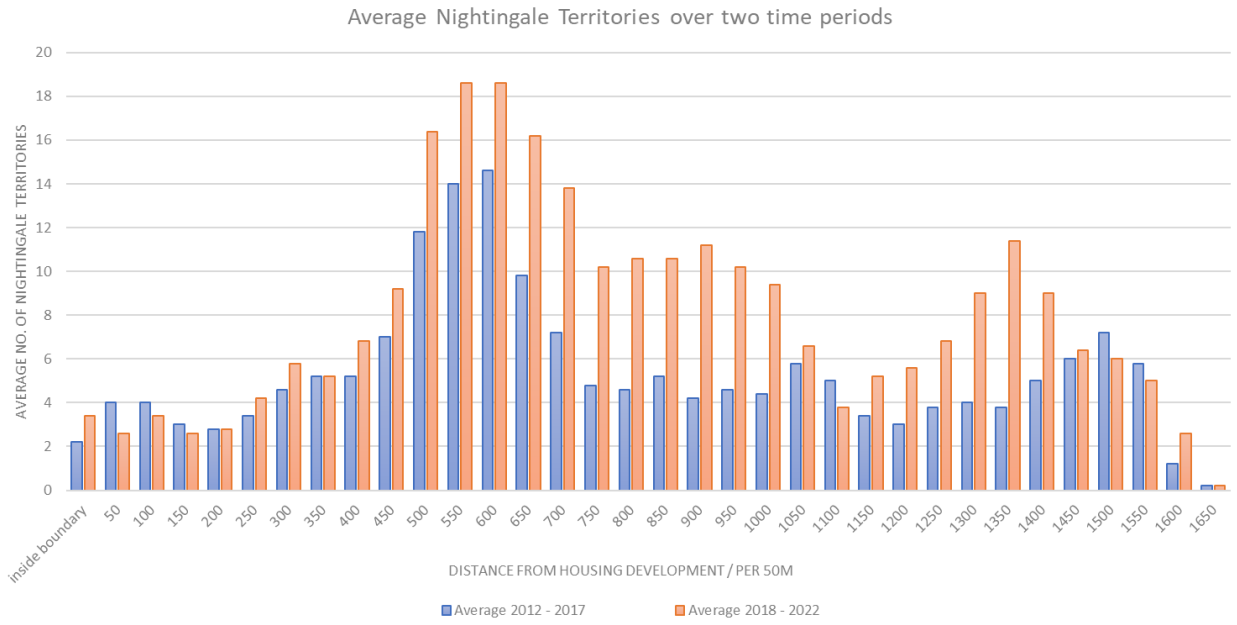


Fig. 5. Index of distribution by distance from southern perimeter of the SSSI boundary. The data are further categorised according to the early years (2012-2017; blue bars) or later years (2018-2022; red bars) within the period that surveys have been undertaken. No surveys were carried out in 2014.

Smoothed territory distribution data are shown below as hotspot maps for both periods, 2012-2017 (Fig. 6) and 2018-22 (Fig. 7). These illustrate the relative importance of different areas in the SSSI and provide visual representation of change between periods.

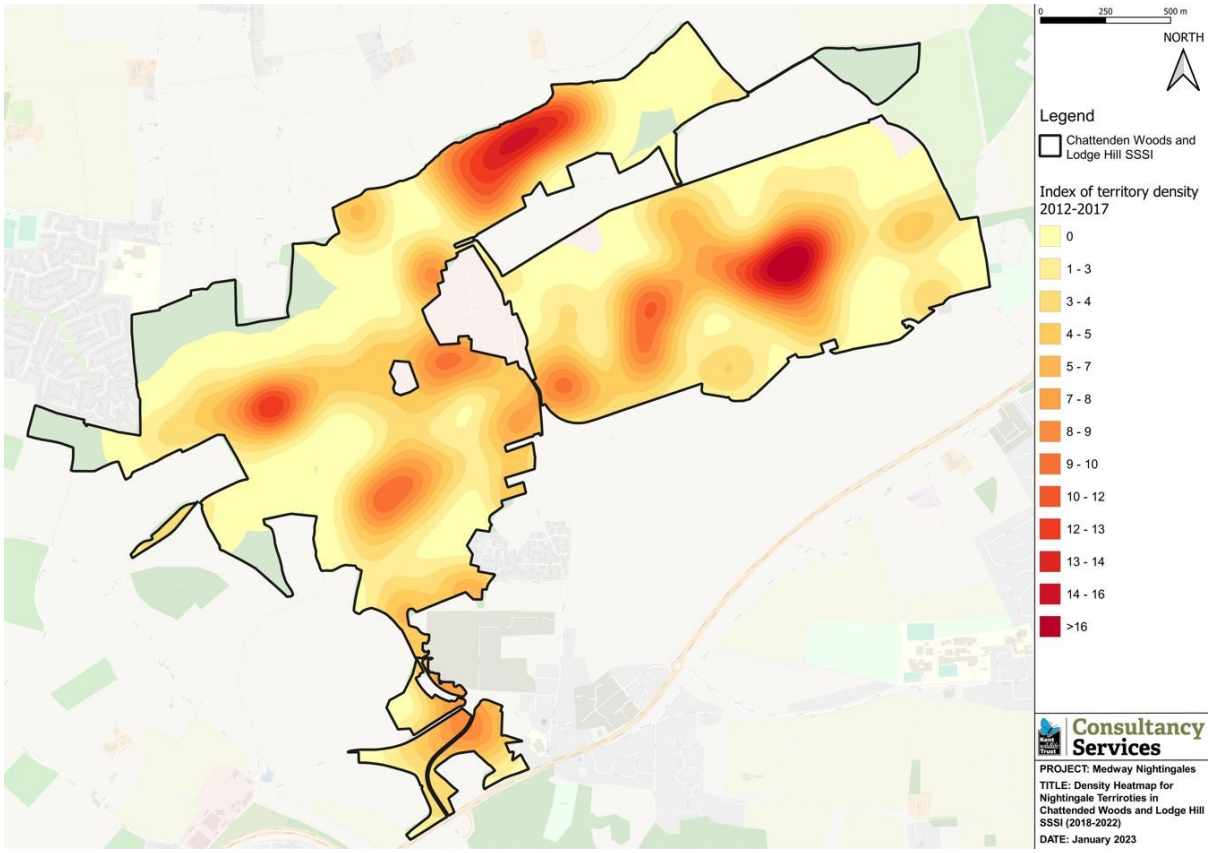


Fig. 6. Hotspot map for period 2012-2017

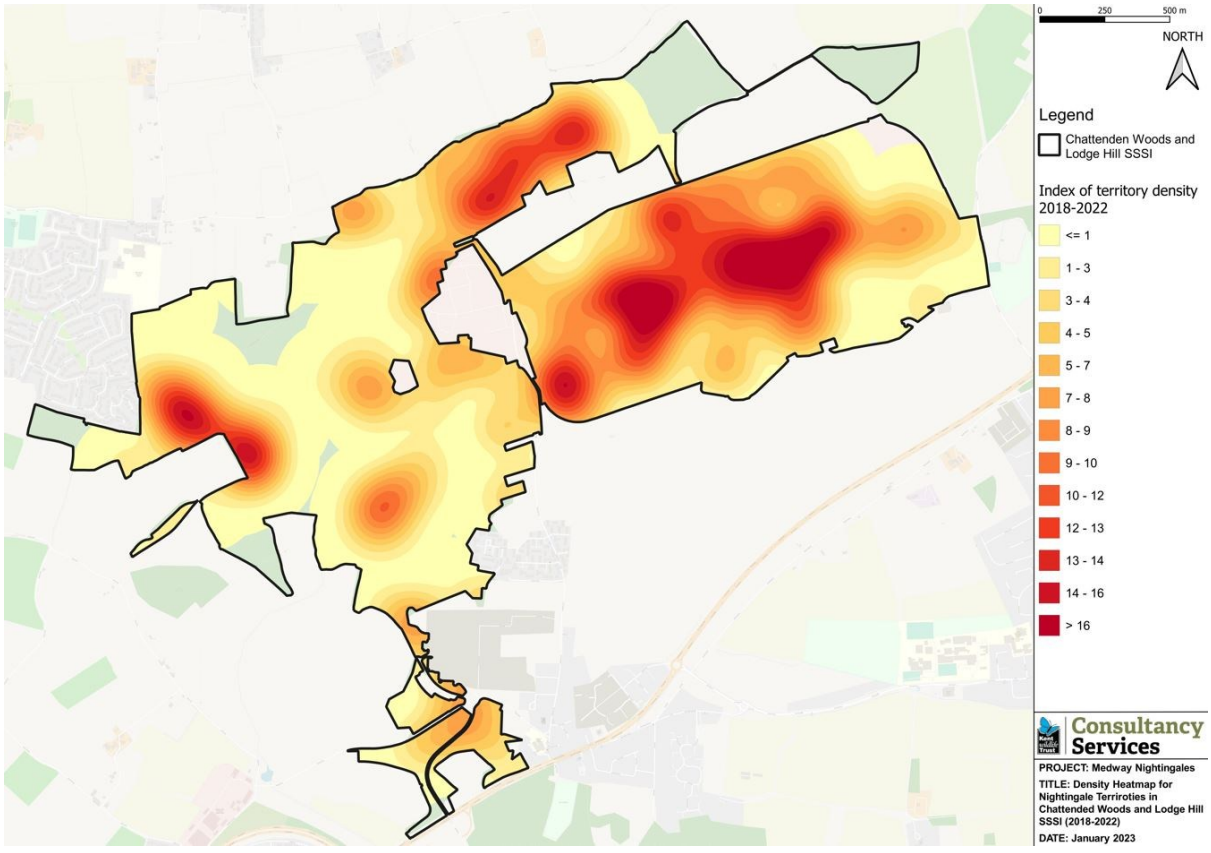


Fig. 7. Hotspot map for period 2018-2022

3.2 Applications of model in relation to Chattenden Woods and Lodge Hill SSSI

3.2.1 Buffer distance scenarios

Estimates of indirect loss of Nightingale territories under different buffer distance scenarios are presented (Table 1 and Fig. 10). The results are averaged across the two modelling approaches; based on use of territory centres and territory polygons, respectively.

Scenarios with and without use of cat proof perimeter fencing for the ex-training area are shown.

Table 1 shows the average and the range estimates; the annual data and associated model variation are included as Appendix 2.

Table 1. Modelled estimates of territory loss (proportion of SSSI population) under buffer distance and fencing scenarios

	Territory loss % (proportion of SSSI)					
	Fenced scenario			Unfenced scenario		
Buffer distance (m)	Av.	*Min*	*Max*	Av.	*Min*	*Max*
200	**21**	*17*	*30*	**45**	*41*	*58*
300	**16**	*12*	*24*	**33**	*28*	*46*
400	**11**	*6*	*17*	**22**	*18*	*32*
500	**7**	*5*	*10*	**14**	*7*	*22*

The averaged estimates of territory loss for the bespoke 360 m buffer scenario are 13% (fenced) and 25% (unfenced).

The pie charts (Fig. 8) illustrate the estimated reduction in Nightingale territories, in terms of proportion of the total SSSI population, that might be expected under different buffer scenarios. Each year of survey data is used as a replicate in the model. The red segments of each chart indicate the estimated reduction in territories in each scenario. The top row of charts relates to scenarios with no protective fencing around ex training areas of the SSSI, and the bottom row relates to scenarios with retention and maintenance of secure fencing to ensure no access by either cats or people.

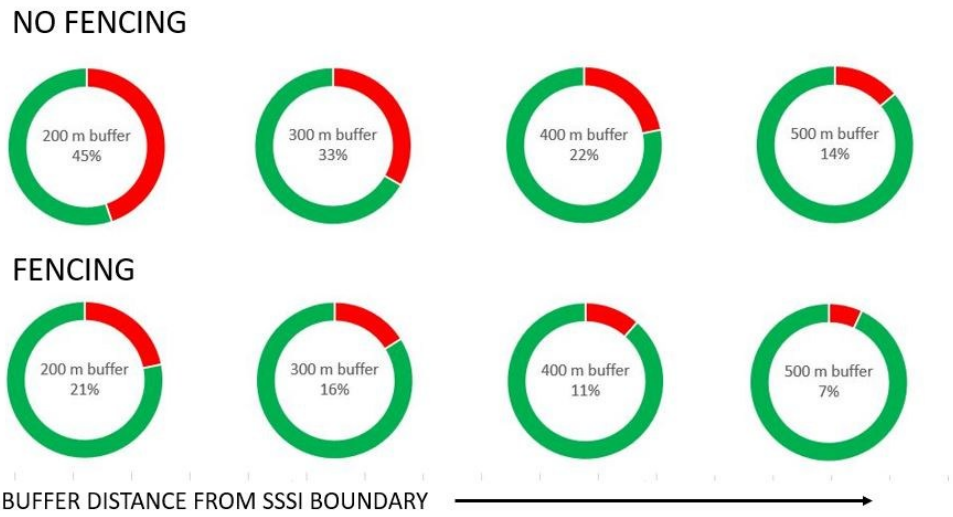


Fig. 8. Modelled estimates Nightingale territory loss in each scenario shown as proportion of SSSI population.

3.2.2 Chattenden Barracks ~~and distributor road~~

As described in methods, this application of the model relates to residential development at Chattenden Barracks (Table 2).

Table 2. Estimates of territory loss (average and range estimates) associated with proposal for residential housing on ex Chattenden Barracks.

	Territory loss % (proportion of SSSI)					
	Fenced scenario			Unfenced scenario		
Proposal	Av.	*Min*	*Max*	Av.	*Min*	*Max*
Chattenden Barracks (CB)	**9**	*5*	*15*	**14**	*8*	*19*

3.3 Testing approach to cumulative assessment

The applications of the model described above can be combined to derive a wider assessment of cumulative impact.

For example, using the theoretical 300 m buffer distance from the south edge of the SSSI north of Peninsula Way in combination with assessment for Chattenden Barracks, an overall cumulative impact estimate of 26% is derived (Fig. 9).

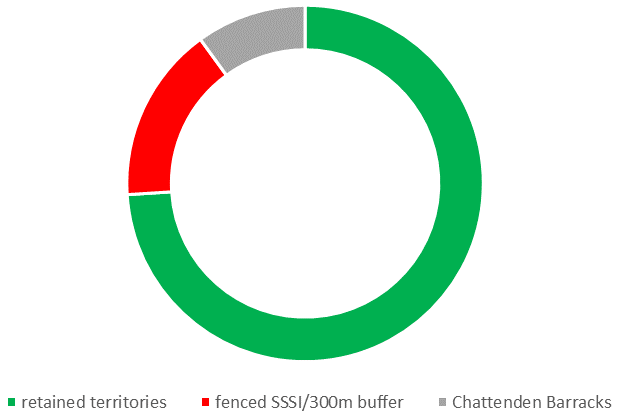


Fig. 9. Example of cumulative estimate of Nightingale territory loss (proportion of SSSI population) in scenario of application of a 300 m buffer from fenced SSSI. The results are differentiated according to combination of potential development north of Peninsula Way (red) and on the site of Chattenden Barracks (grey).

4.0 DISCUSSION: EVALUATING APPROACH TO MITIGATION

The following section provides an overview of different elements of potential mitigation and off-site compensation if required. This could address impacts of development adjacent to the SSSI which have been quantified in this report in terms of modelled territory losses.

The evaluation and recommendations are intended to be used alongside the evidence-based commentary which includes specific reference to the ecology of Nightingales to inform and justify potential approaches.

4.1 Spatial context of habitat initiatives

The model estimates in this report could be used to inform approaches and strategies to mitigation and compensatory habitat for Nightingales if required. This would be distinct from any management of the existing SSSI which may generate extra Nightingale territories but that would not be able to be considered part of any mitigation.

In this section, some key habitat related opportunities with respect to off-site mitigation are differentiated. Each is based on an understanding of Nightingale ecology, territory establishment, and likelihood of suitable habitat for the species being generated at different timescales.

Key spatial scales that can be considered if restoring habitat for Nightingales are:

i) Non-protected land located within existing outer SSSI boundary
ii) Other land adjacent to SSSI within Hoo Peninsula hinterland
iii) Land in Medway jurisdiction with potential for Nightingale initiative

4.1.1 Non-protected land located within existing outer SSSI boundary

The area of non-SSSI grassland located to the north of the ex-training area, owned by Homes England, would represent a solid opportunity to connect two key parts of the SSSI. Strategically, there is a very high likelihood of delivery territories in this area if scrub is allowed to develop, particularly along existing boundaries or through establishment of a scrub-grassland system featuring complex habitat mosaics.

Nightingale territories are already becoming established in this area as soon as new scrub habitat has reached suitable age and structure. Given the immediate proximity of the established concentrations of territories in the ex-training area and on northward slope at Rough Shaw, there will be a pool of juvenile Nightingales to recruit into new habitat. All else equal, one would expect territory densities in new habitat to align with occupancy elsewhere on the SSSI in the medium term. In the short term, new territories will be restricted to field boundaries/corners where new scrub is allowed to establish adjacent to existing scrub or woodland.

With respect to Homes England specific mitigation, it would be reasonable to estimate that restoration of sufficient scrub within a scrub-grassland mosaic on these fields could meet any compensatory requirements for territories affected by proposed residential development at Chattenden Barracks.

Given potential integration of these land parcels and adjacent areas into a mitigation strategy, a key aspect to be considered is ensuring access is kept at an appropriate level to facilitate use as an effective mitigation strand. In particular, there is likely to be a requirement for dogs to be kept on leads in some areas, particularly during the breeding season. Some footpaths may also require limited access during the breeding season. These measures will be important to ensure that disturbance is minimised and that new habitat provides the best opportunity to support new Nightingale territories.

4.1.2 Land adjacent to Chattenden Woods and Lodge Hill SSSI in Hoo Peninsula hinterland

Sites within the vicinity of the SSSI could be used to establish a connective framework for delivery of Nightingale habitat. Importantly, several sites have an established history of occupancy by Nightingales and regularly support multiple territories.

Other sites represent opportunities for woodland management or habitat restoration to (i) increase overall area of suitable habitat in the area and (ii) increase connectivity between current concentrations of Nightingale territories.

A focal area on the Hoo peninsula to the north of the SSSI could be established, optimising opportunities around woodland management along northern edge of the SSSI, potential land purchase, and scope for targeted agricultural stewardship.

4.1.3 Other land in jurisdiction of Medway Council

A wider plan to deliver suitable habitat for breeding Nightingales within the Medway area would strategically align with the species having been identified as a conservation priority by Kent Nature Partnership. There is potential that such a plan could be formulated through application of Biodiversity Net Gain. A high integrity approach to BNG could have a core objective of delivering an extensive connected suite of habitat with specific biodiversity related goals that are relevant to the Medway area. There could be scope for integration of species-based targets to complement the Defra based metrics around habitat condition.

Given the importance of Medway for Nightingales, a strategy with Nightingale as a key beneficiary of land used for BNG could establish an excellent model to demonstrate integration of locally relevant species into BNG initiatives. Generation of scrub/woodland habitat that is suitable for occupancy by Nightingales could be used as an additional feature for BNG habitat delivery with its condition assessed based on accepted criteria. Previous studies have shown that Nightingales can occur at variable territory densities depending on habitat availability, configuration of habitat patches, and density of conspecifics. In combination with Nightingale density information from Lodge Hill and other sites in Medway, these metrics could be used to model potential habitat occupancy and territory delivery at sites with created or restored habitat over the longer term.

4.2 Elements of a strategic plan for Nightingale mitigation

Informed by the results of this impact assessment, it is recommended that a joined up approach would need to integrate the following key elements in order to develop a putative plan aimed at Nightingale habitat:

4.2.1 Use of appropriate buffer between new development and southern edge of SSSI

The results of this impact assessment show implications of different buffer distances. Clearly, closer proximity of development to the SSSI is expected to lead to increased loss of territories through the combination of impacts considered.

Progression of a given buffer distance will therefore determine the scale of mitigatory and compensatory action that would be needed to offset expected impacts on Nightingale territories across the SSSI.

4.2.1 Alignment with habitat management of Chattenden Woods and Lodge Hill SSSI

There would be a need for strong synergy between approaches to mitigation and a habitat management plan for the SSSI. The latter has been drafted based around compartmentalisation of the site, rotational habitat management, and restoration of existing secondary woodland patches.

Funding model: Homes England as current SSSI land owner, oversight from Natural England

4.2.2 Resourcing to ensure cat/person proof perimeter fencing around ex-military training area

The difference in modelled estimates of territory loss between scenarios with and without cat-proof perimeter fencing of the ex-training area stresses the significance of ensuring retention and appropriate maintenance of the fence. Territory losses can be expected to be approximately double in the absence of secure perimeter fencing.

Funding model: a key element of proposed SEMS. Fencing costs TBC

4.2.3 Funded ranger service for the local area to progress key aspects of public engagement around Nightingale ecology, habitat, disturbance, and monitoring

There will be a requirement to devise an appropriate access strategy to ensure that an envisaged increase in footfall in the local area does not result in disproportionately detrimental impacts on the nightingale breeding population of the SSSI. This can be structured around the existing SAMMS framework currently being used to address access and disturbance on North Kent's coastal SPAs.

Funding model: SEMS. Estimated 30.5k / year; over 80 years in perpetuity

4.2.4 Monitoring of key project strands to facilitate an adaptive approach to mitigation and habitat initiatives

Monitoring of key parameters needs to be a key objective and responsibility of the ranger service. In order to ensure the potential for an adaptive approach, it will be important to integrate added value aspects of monitoring including habitat structure, habitat condition, invertebrate assemblage etc.

Funding model: SEMS. Monitoring costs TBC.

4.2.5 Enhancement of BTO demographic monitoring of Nightingales across the SSSI

Demographic parameters of breeding Nightingales in the ex-training area at Lodge Hill are currently monitored by BTO volunteers through a RAS (Rate of Adult Survival) study. This should be maintained through support if necessary, and expanded to include other areas within the SSSI and adjacent sites.

Funding model: SEMS to cover expenses of volunteer BTO citizen science.

4.2.6 Development of collaborative research to understand effectiveness of mitigation

The various strands listed here represent significant opportunities for research to inform and develop an evidence base associated to efficacy of land management. Collaboration with universities will provide a source of students to study aspects through either undergraduate or postgraduate research projects.

Funding model: University-led research grants, PhD studentships with match funding from SEMS.

4.2.7 Identification and harnessing of opportunity areas in local area for Nightingale-focused habitat management

There is opportunity for establishment of a locally led scheme to deliver habitat for local conservation priorities such as Nightingale. This could be structured around local nature recovery and harness developing financial models such as BNG finance and associated commitments.

Funding model: Development of BNG-led finance model? This would be Medway Council led – to include blended carbon finance targets.

4.3 Potential delivery mechanisms

The indicative approaches introduced above are summarised below in terms of long-term costs and further work recommended.

4.3.1 SEMS – summarised costs

Strategic element	Rationale	Core requirements	Financing approach	Total cost in perpetuity
SSSI management plan	Good condition of SSSI important for resilient local Nightingale breeding population	Commitment to scrub management, coppicing and conservation grazing within wider SSSI objectives.	Strategic partnership between ownership (Homes England), SEMS, Natural England, NGOs?	Costed via Homes England ecologists
Secure SSSI perimeter fencing	Exclusion of cats from core area of SSSI and restricted access by people is critical to maintain a resilient local Nightingale breeding population. Modelled loss of territories is at least doubled in absence of secure perimeter fencing.	Commitment to fund long term maintenance and replacement of any new fencing as deemed appropriate. Capital costs.	SEMS?	TBC. Average 15k pa? 1.2 m / 80y
Funded ranger service	Engagement and monitoring around access and disturbance	Funded position to align with work on other protected sites	SEMS?	30.5k pa 2.44 m / 80y
Long term monitoring	Understanding responses across suitable parameters is key to being able to adapt approaches and strategies if needed	Commitment to monitor key species, taxa, ecological and social variables periodically over long term.	SEMS? / integration with BNG?	15k pa? 1.2 m / 80y

Collaborative research	Added value from integration of academic research to answer questions to inform evidence based approaches to conservation management and blended finance models.	Partnership with relevant academics and research orgs to establish long term research platform.	SEMS match funding pot?	15k pa

4.3.1 BNG / blended finance

A bespoke blended finance model, integrating BNG and carbon, could have a key objective of generating suitable scrub and woodland habitat for Nightingale. Appropriate management costs, either through conservation focused grazing or rotational coppice, could be incorporated – as a transparent delivery model to address a local priority recognised through local nature recovery network.

This approach would be a method of delivering the right habitat in the right place for Nightingale, in doing so informed by the species' ecology and current distribution so as to maximise likelihood of success.

Task	Objective	Summary Outcome
1	Reference strategic, spatial and relevant policy documents	An understanding of essential areas to incorporate from (but not limited to) emerging strategic Plans, NPPF, Relevant Policies, SPD, Kent Biodiversity Strategy Biodiversity Opportunity Areas (BOAs), Climate and Ecological Action Plans, Kent Biodiversity Strategy 2020 – 2045 and Green and Blue Infrastructure Strategy
2	High level mapping	Incorporation of existing datasets and additional mapping tools Provision of assessment incorporating methodology, objectives and summary of findings Species specific layers
3	Focussed area mapping with particular species projects	Digitally mapped opportunities across the Borough with an emphasis on high value habitat potential and incorporation as a GIS data set with written assessment of methodology, objectives and summary of findings
4	Recommendations for next steps including	Digital Mapped opportunities for ecological creation, restoration and enhancement

	working with landowners and designing specific species projects	Outline areas where there are significant opportunities for BNG (including CC & NN) with technical reporting including evaluation from relevant metrics and valuation against known monetary values for units and credits
5	Support policy establishment	Input on policy with justification for supporting the LNRS and BNG strategy within the emerging Local Plan and / or as SPD guidance

5.0 ACKNOWLEDGEMENTS

The impact pathways used to model impact on Nightingales presented in this report were initially developed in consultation and through discussion with Dr Rob Fuller, operating independently.

Mapped GIS outputs in this report were produced by Amy Ross and Claudia Alonso of Kent Wildlife Trust Consultancy Services.

6.0 ACCOMPANYING REPORTS

This report 'Assessment of impact on Nightingales of developing adjacent to Chattenden Woods and Lodge Hill SSSI' is to be used in conjunction with the following other project outputs:

- Literature Review to inform understanding of impacts on Nightingales of developing adjacent to Chattenden Woods and Lodge Hill SSSI' – includes evidence-based commentary.

- Monitoring protocol and condition of perimeter fencing at Lodge Hill Camp ex-training area

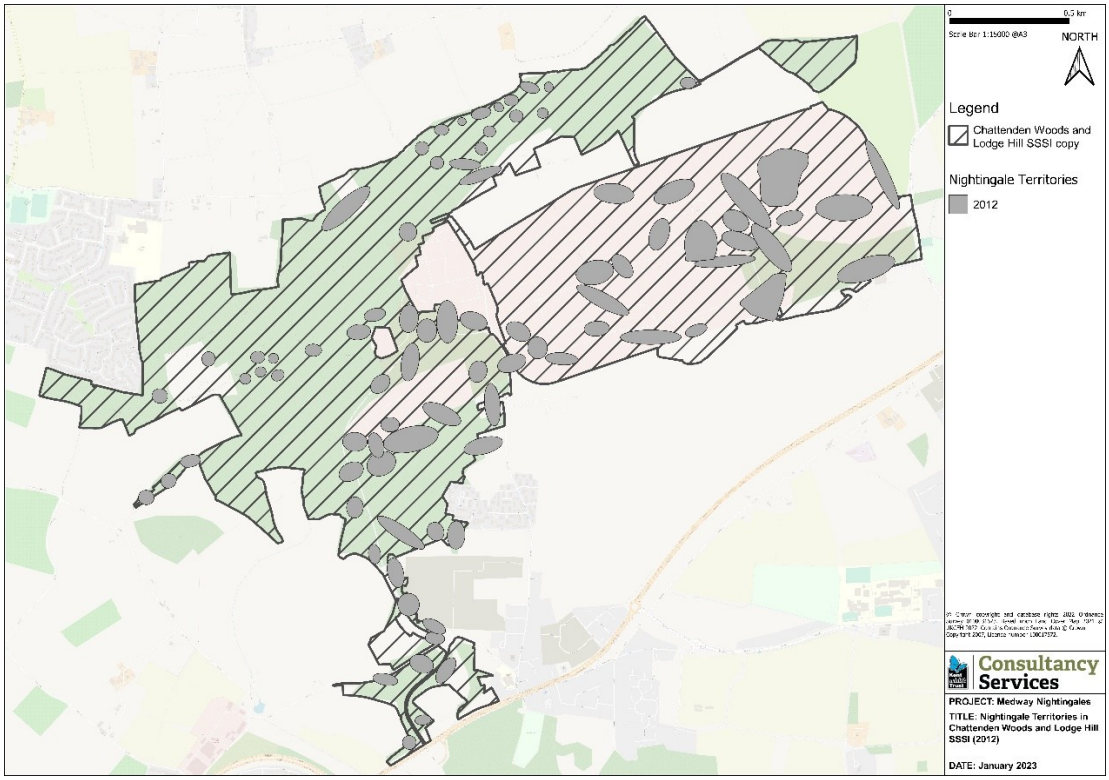
7.0 APPENDICES

[Appendix 1] Nightingale territory distribution at Chattenden Woods and Lodge Hill SSSI: maps of annual data

[Appendix 2] Nightingale impact assessment model results: annual data and model variation

APPENDIX 1

Nightingale territory distribution at Chattenden Woods and Lodge Hill SSSI: maps of annual data



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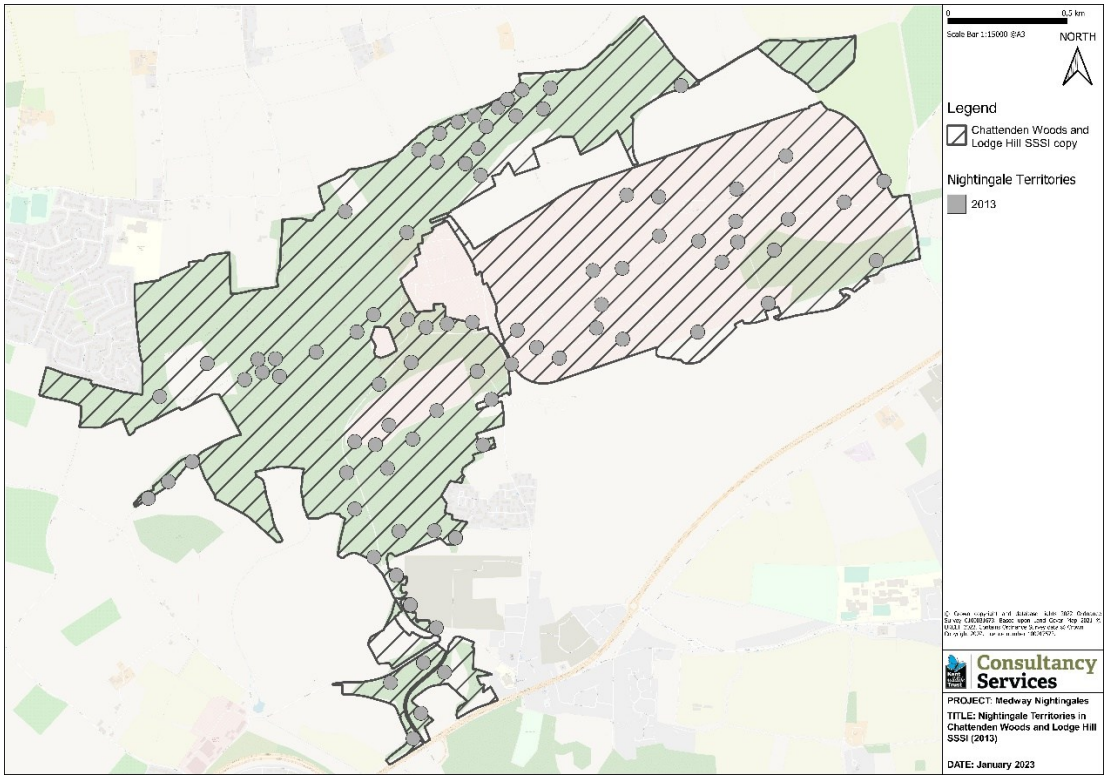
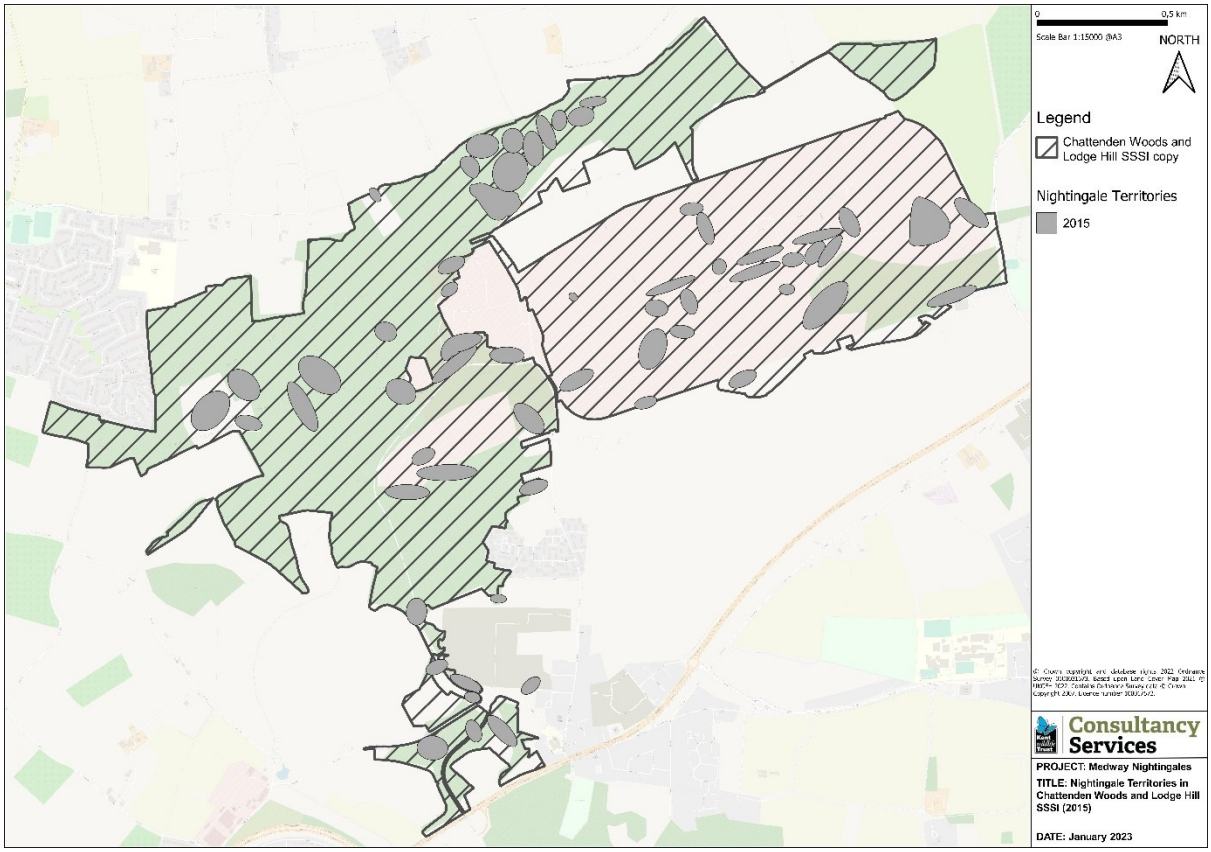


A1.2 Nightingale territories, 2013



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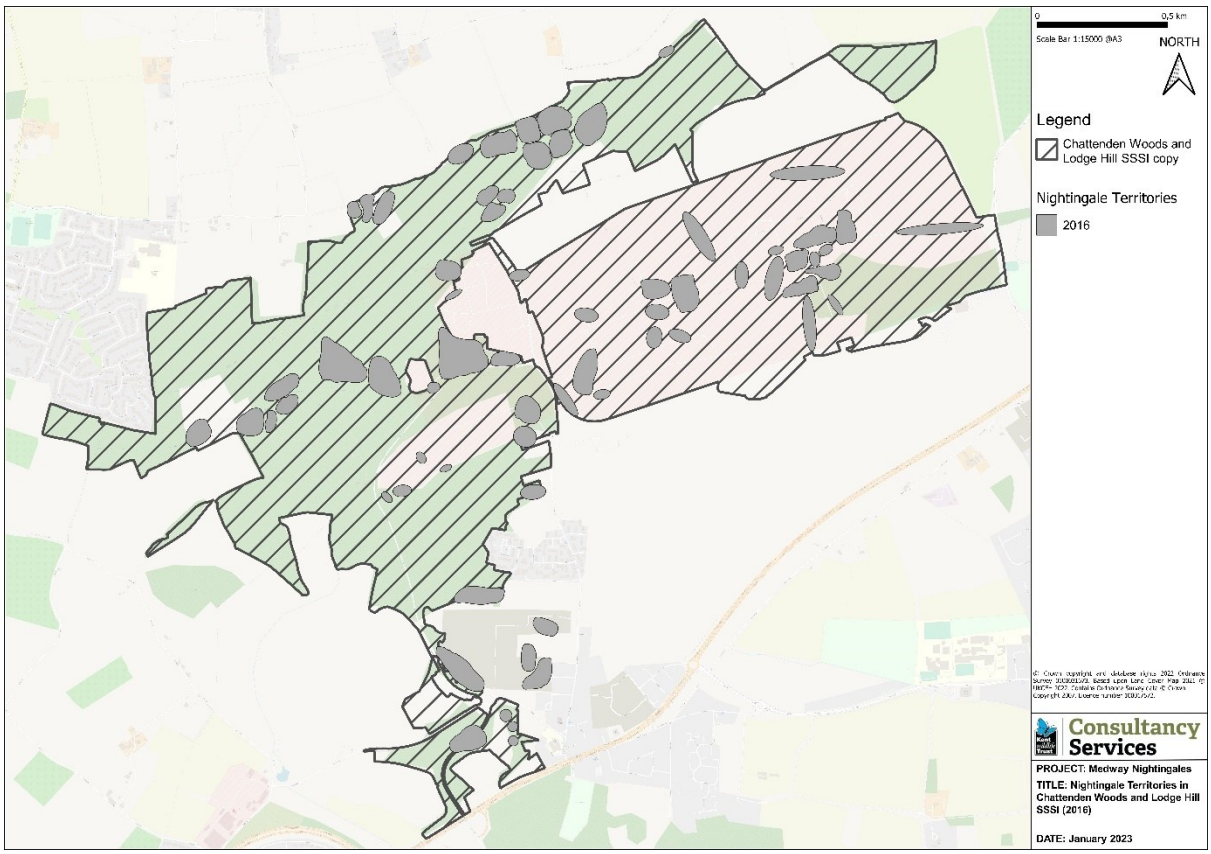

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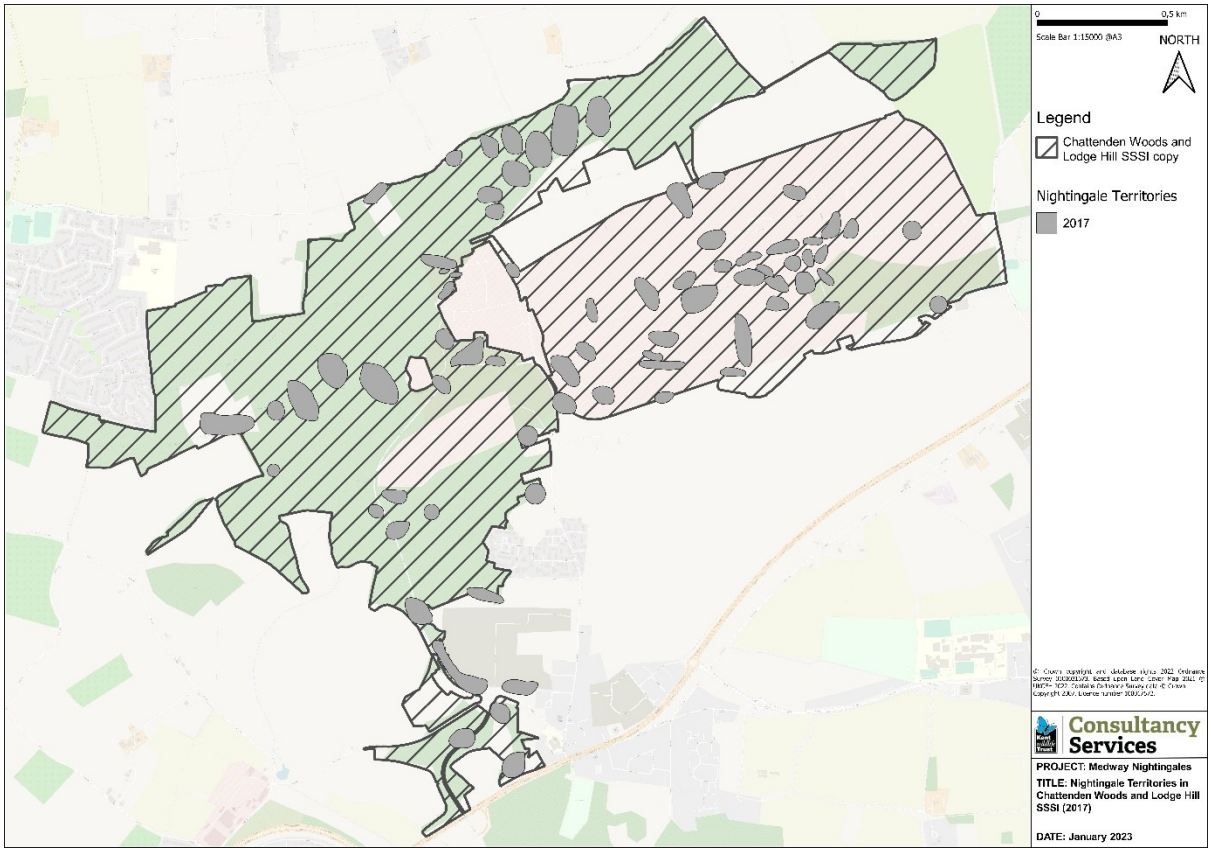
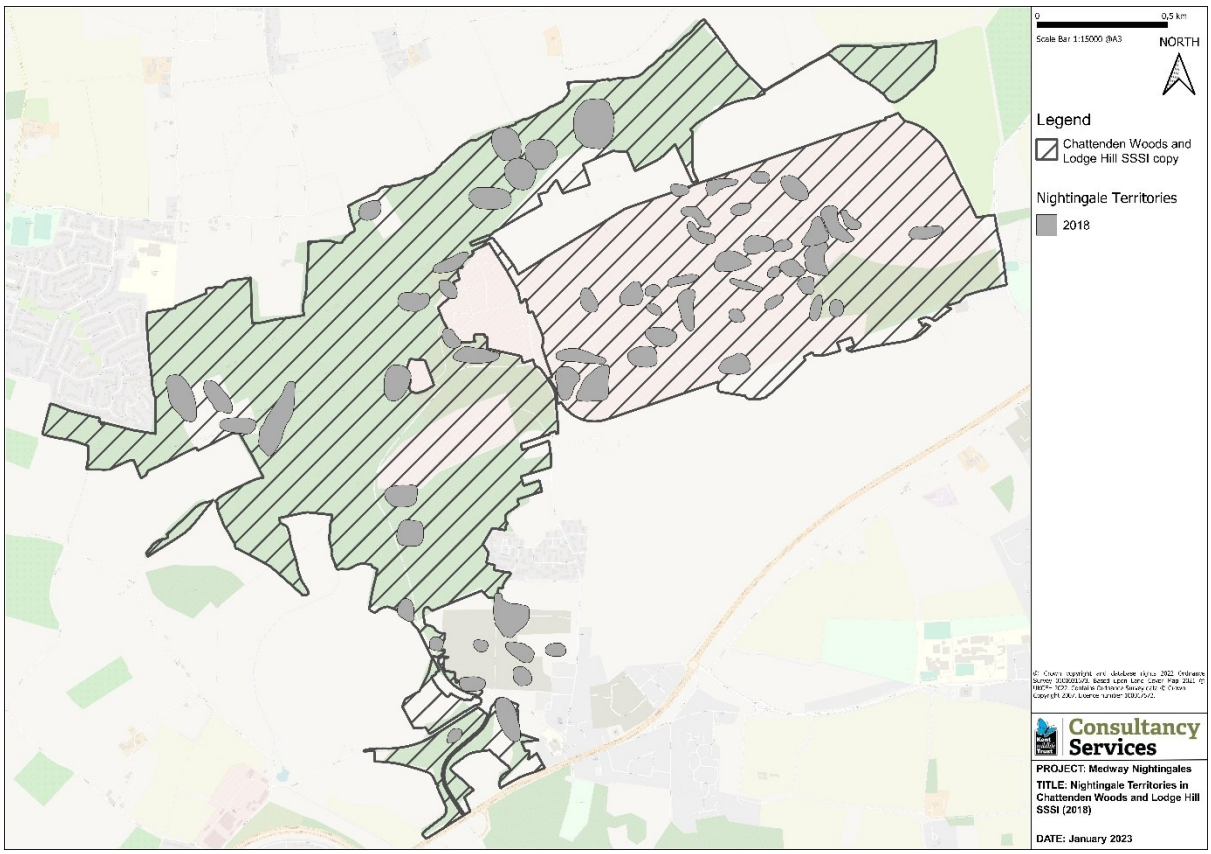
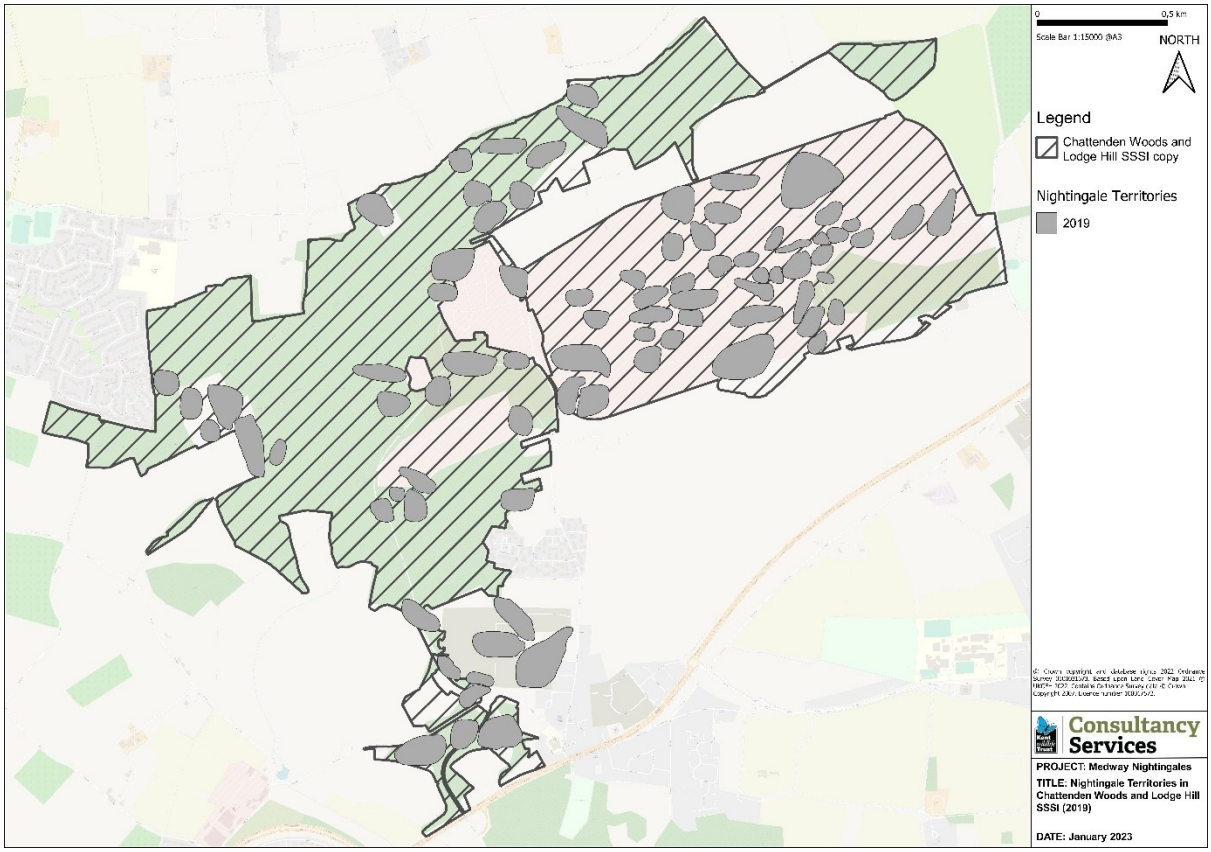


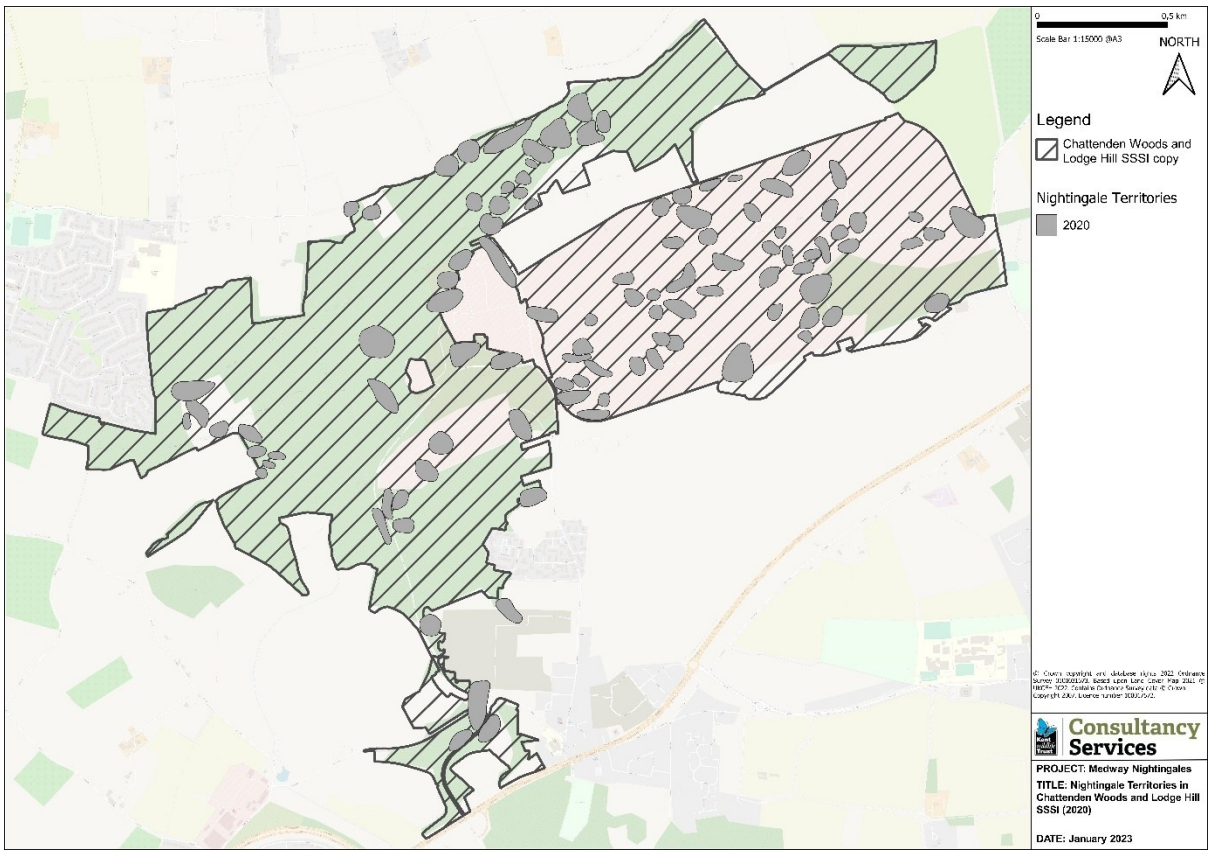
A1.1 Nightingale territories, 2017



A1.2 Nightingale territories, 2018



A1.1 Nightingale territories, 2019



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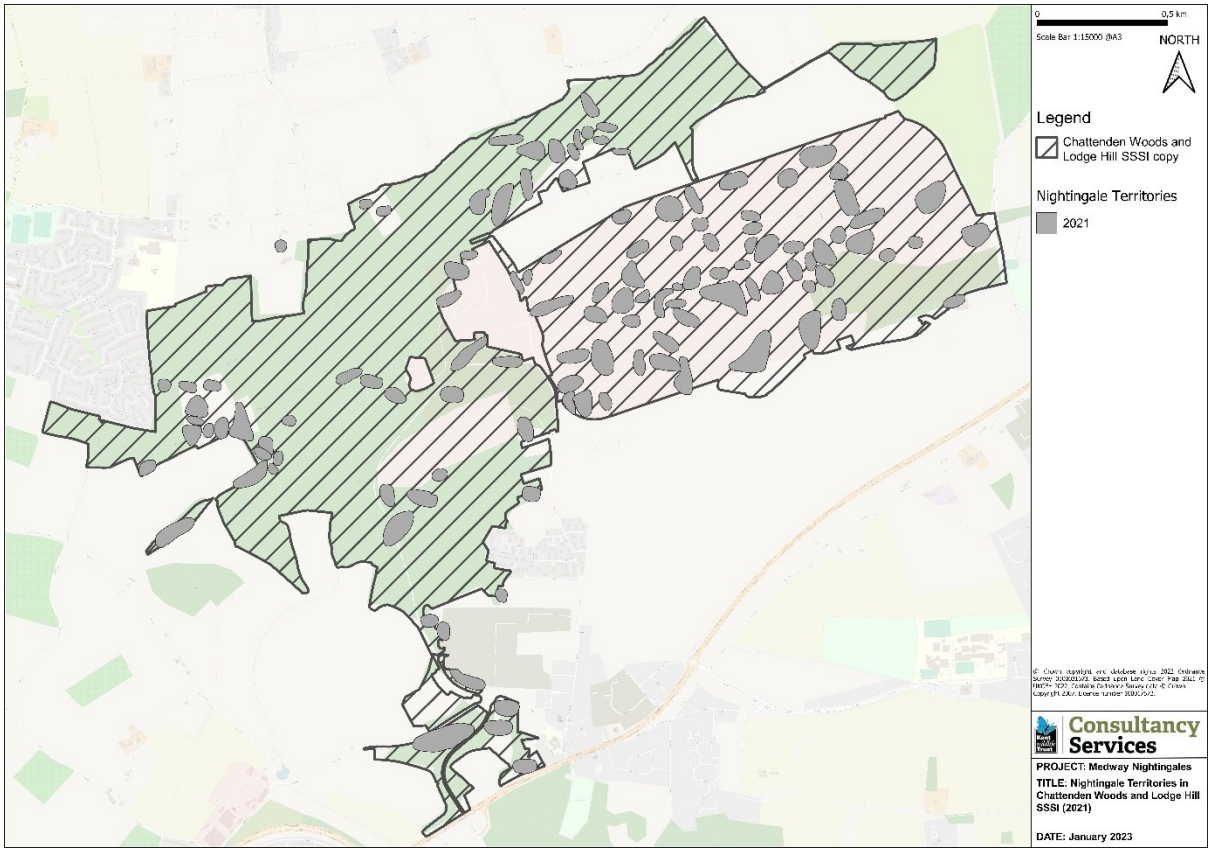

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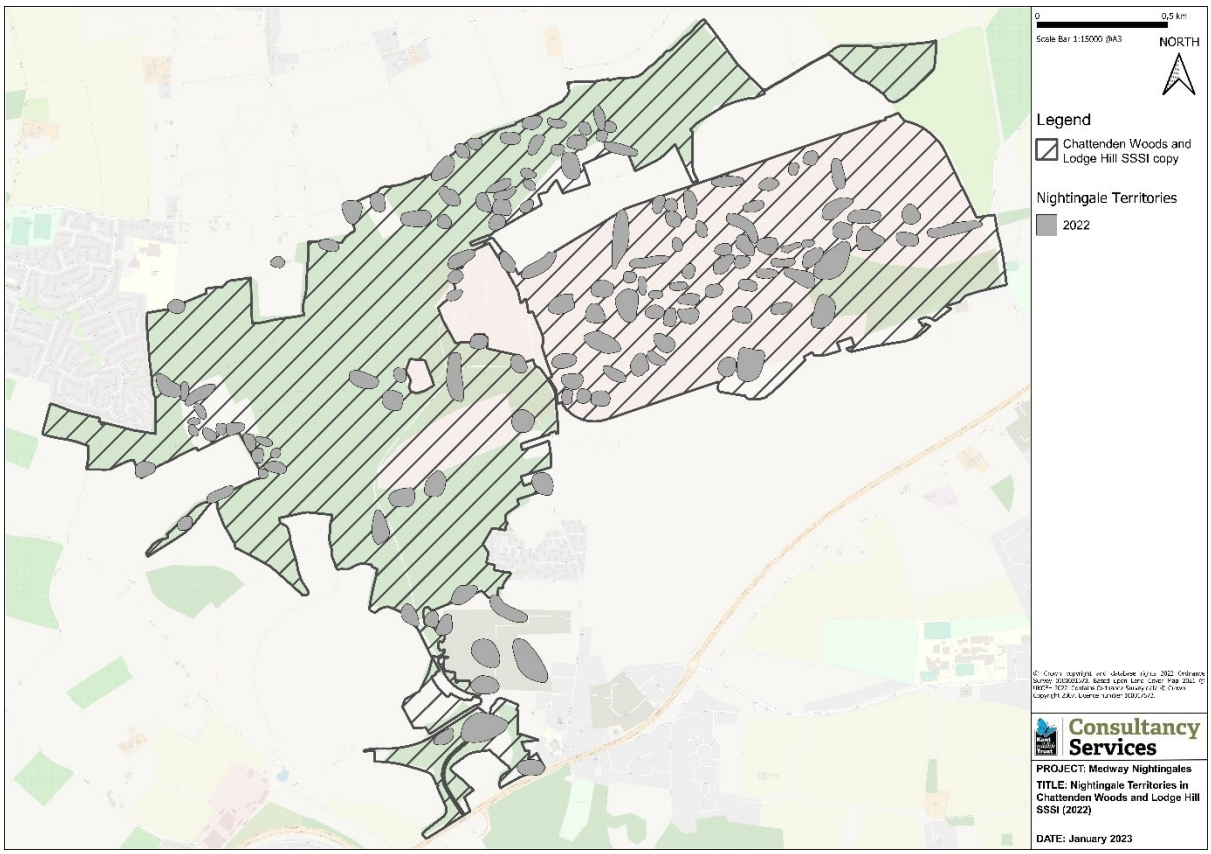
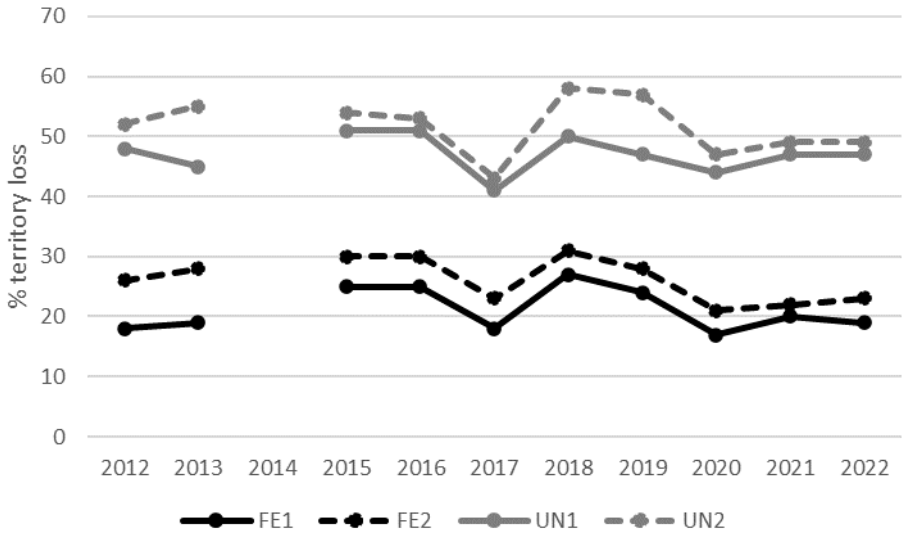


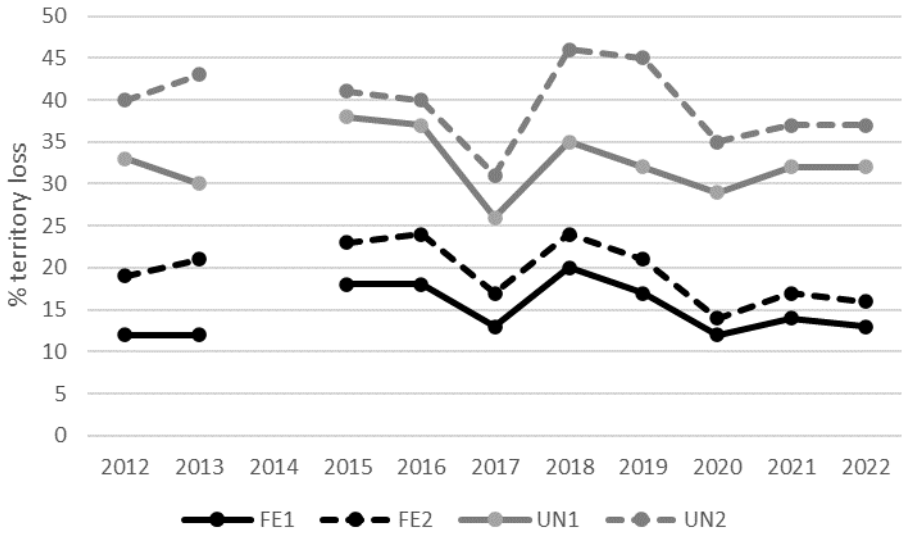
A1.2 Nightingale territories, 2022

APPENDIX 2

Modelled estimates of territory loss (proportion of SSSI population) under buffer distance and fencing scenarios: annual data and associated model variation



A2.1 Annual data and model variation for buffer distance 200 m



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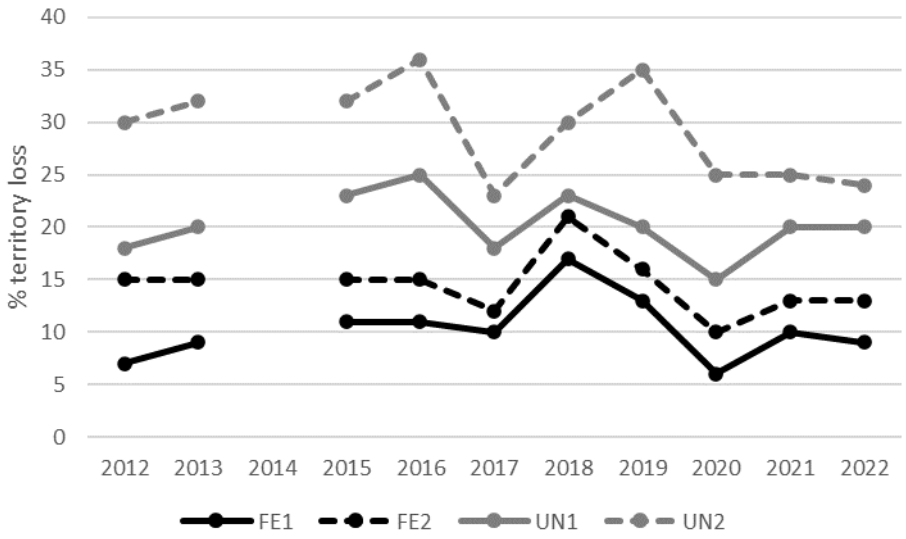

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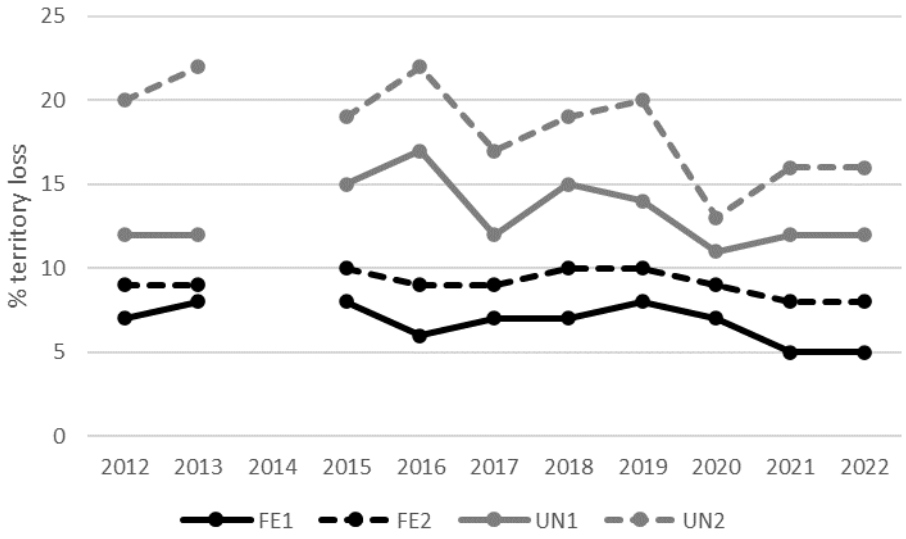

A2.4 Annual data and model variation for buffer distance 500 m