APPENDIX ES8.1

ECOLOGICAL IMPACT ASSESSMENT

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ECOLOGICAL IMPACT ASSESSMENT:

COOKS HOLE QUARRY AND THORNHAUGH LANDFILL SITE, PETERBOROUGH

FINAL

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Contents

Page

1 INTRODUCTION 1
1.1 OVERVIEW 1
2 LEGISLATION, PLANNING POLICY AND GUIDANCE 1
2.1 LEGISLATION 1
2.2 NATIONAL PLANNING POLICY 2
2.3 LOCAL PLANNING POLICY 3
2.4 LOCAL GUIDANCE 7
3 ASSESSMENT METHODOLOGY 7
3.1 OVERVIEW 7
3.2 DEFINING THE SENSITIVITY OF RECEPTORS 8
3.3 CHARACTERISING ECOLOGICAL IMPACTS AND EFFECTS 8
3.4 DEFINING SIGNIFICANCE CRITERIA 9
3.5 THE MITIGATION HIERARCHY 10
3.6 ASSESSMENT OF CUMULATIVE IMPACTS AND EFFECTS 10
3.7 DETERMINING THE SCOPE OF THE ASSESSMENT 11
3.8 CONSULTATIONS 13
4 BASELINE CONDITIONS 13
4.1 DESIGNATED SITES OF NATURE CONSERVATION IMPORTANCE 13
4.2 PROTECTED AND NOTABLE SPECIES 15
4.3 HABITATS, PLANT COMMUNITIES AND PLANT SPECIES 15
4.4 INVERTEBRATES 17
4.5 ASSESSMENT OF BIODIVERSITY IMPORTANCE 17
4.6 AMPHIBIANS 18
4.7 REPTILES 19
4.8 BIRDS 20
4.9 BATS 21
4.10 SUMMARY OF IMPORTANT ECOLOGICAL FEATURES 23
4.11 DATA LIMITATIONS 24
4.12 FUTURE BASELINE 24
5 DEVELOPMENT PROPOSALS 25
5.1 OVERVIEW 25
5.2 DEVELOPMENT DESIGN AND IMPACT AVOIDANCE 26
5.3 PHASING 26
6 LIKELY IMPACT AND EFFECTS OF THE PROPOSED DEVELOPMENT 26
6.1 OVERVIEW 26
6.2 BARNACK HILLS & HOLES SAC, BEDFORD PURLIEUS NNR AND OTHER SITES OF SPECIAL SCIENTIFIC INTEREST (SSSI) 27
6.3 THORNHAUGH CWS 29
6.4 WET WOODLAND HABITAT 29
6.5 HEDGEROWS 30
6.6 GRASSLAND AND SCRUB 30

6.7 INVERTEBRATES 31
6.8 AMPHIBIANS 32
6.9 REPTILES 33
6.10 BIRDS 34
6.11 BATS 36
6.12 SUMMARY OF PREDICTED RESIDUAL EFFECTS 37
7 ASSESSMENT OF CUMULATIVE EFFECTS 38
8 COMPENSATION, ENHANCEMENTS & CONCLUSIONS 39
9 REFERENCES 39

Annex 1 Ecology Baseline: Cooks Hole Quarry and Thornhaugh Landfill, Peterborough

Annex 2 Arboricultural Impact Assessment: Cook's Hole Quarry and Thornhaugh Landfill Site, Peterborough

ECOLOGICAL IMPACT ASSESSMENT: COOKS HOLE QUARRY AND THORNHAUGH LANDFILL SITE, PETERBOROUGH

1 INTRODUCTION

1.1 OVERVIEW

1.1.1 This document provides the ecological baseline for the identification and assessment of potential impacts associated with the restoration of Cooks Hole Quarry and Thornhaugh Landfill Site. For consistency and clarity, the document adopts the following terminology:

- Site – The full extent of land included within the development scheme area.
- Thornhaugh Landfill Site – The northern parcel of land consented for landfill.
- Cooks Hole Quarry – The southern parcel of land consented for mineral extraction.

1.1.2 The purpose of the report is to:

- Establish the current baseline ecological conditions at the Site.
- Identify any potentially significant ecological effects associated with the proposed development.
- Set out the measures necessary to effectively avoid or mitigate likely significant effects and to ensure compliance with nature conservation legislation and national/local planning policy objectives.
- Identify ecological enhancement measures to be delivered by the proposed scheme.
- Provide an assessment of the significance of any residual effects.

1.1.3 This document has three separate annexes:

- Annex 1: Ecology Baseline (desk study, methods and results of each survey).
- Annex 2: BS:5837 Arboricultural Impact Assessment.
- Annex 3: Biodiversity Net Gain Plan.

1.1.4 This assessment has been undertaken by ESL (Ecological Services) Limited (ESL).

2 LEGISLATION, PLANNING POLICY AND GUIDANCE

2.1 LEGISLATION

2.1.1 The assessment has taken into account the potential effects on sites that are:

- Of international importance, comprising Special Protection Areas (SPA) for birds and Special Areas of Conservation (SAC) created under the EC Birds Directive and Habitats Directive, together with sites created under the Ramsar Convention.

- Notified as Sites of Special Scientific Interest (SSSI) under the Wildlife and Countryside Act 1981 (as amended) (WCA).
- Designated by principal local authorities as Local Nature Reserves (LNR) under Section 21 of the National Parks and Access to the Countryside Act 1949.

2.1.2 The assessment has also taken into account habitats and species that are:

- Listed in Schedules 1, 5 and 9 of WCA.
- Covered by the Hedgerows Regulations 1997.
- Listed as habitats and species of principal importance by the Secretary of State in accordance with Section 41 (S41) of the Natural Environment and Rural Communities Act 2006 (NERC).
- Listed in the schedules of the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

2.2 NATIONAL PLANNING POLICY

2.2.1 The National Planning Policy Framework (NPPF), last revised in September 2023 (UK Government, 2023), sets out the Government's planning policies for England and how these are expected to be applied with regard to biodiversity:

- Section 11 'Making effective use of land' sets out the need for strategic planning, which considers the many functions that land parcels may need to fulfil and stresses that multiple benefits, including net environmental gains, should be obtained.
- Section 14 requires that the planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change.
- Section 15 of the NPPF includes the requirement for planning policies and decisions to contribute to and enhance the natural and local environment by:
    - Identifying and safeguarding local wildlife-rich habitats and wider ecological networks, including international, national and local sites of importance for biodiversity and the corridors and stepping stones that connect them.
    - Promoting the restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species.
    - Pursuing opportunities for securing measurable net gains for biodiversity.

2.2.2 The Government circular 06/2005 provides further guidance in respect of statutory obligations for biodiversity and geological conservation and their impact within the planning system.

2.2.3 As of January 2024, there will be a mandatory requitement for all qualifying development proposals (as defined in the Environment Act 2021) to deliver at least a 10% measurable Biodiversity Net Gain (BNG).

2.3 LOCAL PLANNING POLICY

Cambridgeshire and Peterborough Minerals and Waste Local Plan 2036, adopted July 2021.

Policy 19: Restoration and Aftercare.

2.3.1 All proposals relating to mineral extraction and waste management that are likely to be temporary in nature must be accompanied by a restoration and aftercare scheme proposal, secured, if necessary, by a legal agreement. Such a proposal must, where appropriate:

- Set out a phasing schedule so as to restore available parts of the site to a beneficial after-use as soon as is reasonably practicable to do so and to restore the whole of the site within an agreed timeframe. Only in exceptional circumstances, such as where the after-use is a reservoir or on very small sites where phasing is not practical, will a non-phased scheme be approved.
- Reflect strategic and local objectives for countryside enhancement and green infrastructure, including those set out in relevant Local Plans and Green Infrastructure Strategies in the Local Nature Partnerships vision and strategic proposals, as well as any applicable wider Development Plan objectives.
- Contribute, if feasible, to identified flood risk management and water storage needs (including helping to reduce the risk of flooding elsewhere) or water supply objectives and incorporate these within the restoration scheme.
- Demonstrate net biodiversity gain through the promotion, preservation, restoration and recreation of priority habitats, ecological networks and the protection and recovery of priority species populations, linked to national and local targets.
- Protect geodiversity and improve educational opportunities by incorporating this element within the restoration scheme, by leaving important geological faces exposed and retaining access to them.
- Incorporate within the restoration scheme amenity uses, such as formal and informal sport, navigation and recreation uses.

2.3.2 Where it is determined that restoring the land to agricultural use is the most suitable option (in whole or part), then the land must be restored to the same or better agricultural land quality as it was pre-development.

2.3.3 In the case of mineral workings, restoration schemes that will contribute to addressing or adapting to climate change will, in principle, be supported, e.g., through flood water storage, through biodiversity proposals that create habitats which enhance ecological networks (and thus assist species to adapt to climate change) and/or through living carbon sinks.

2.3.4 Any site-specific restoration and after-care requirements are set out in Policy 2: Providing for Mineral Extraction. Where there is a conflict between this policy and Policy 2, then the provisions of Policy 2 take precedence.

Policy 20: Biodiversity and Geodiversity.

2.3.5 **International Sites.** The highest level of protection will be afforded to international sites designated for their nature conservation or geological importance. Proposals having an adverse impact on the integrity of such areas, that cannot be avoided or adequately mitigated to remove any adverse effect, will not be permitted other than in exceptional circumstances. These circumstances will only apply where:

- There are no suitable alternatives.
- There are imperative reasons of overriding public interest.
- Necessary compensatory provision can be secured.

2.3.6 Development proposals that are likely to have an adverse effect, either alone or in combination, on European designated sites must satisfy the requirements of The Conservation of Habitats and Species Regulations 2017 (as amended), including determining site-specific impacts and avoiding or mitigating against impacts where identified.

2.3.7 **National Sites.** Development proposals on land within or outside a SSSI and which are likely to have an adverse effect on it (either individually or in combination with other developments) will not be permitted unless the benefits of the development clearly outweigh both the adverse impacts on the features of the site and any adverse impacts on the wider network of SSSIs.

2.3.8 **Local Sites.** Development likely to have an adverse effect on locally designated sites, their features or their function as part of the ecological network, including County Wildlife Sites (CWS) and Local Geological Sites (LGS), will only be permitted where the need and benefits of the development clearly outweigh the loss and the coherence of the local ecological network is maintained.

2.3.9 **Habitats and species of local and principal importance.** Where adverse impacts are likely on the protection and recovery of priority species and habitats, development will only be permitted where the need for and benefits of the development clearly outweigh these impacts. Where adverse impacts are likely on other locally important habitats and species as identified by the Cambridgeshire and Peterborough Biodiversity Partnership, the benefits of development must outweigh these impacts. In both cases, appropriate mitigation and/or compensatory measures will be required.

2.3.10 Biodiversity and Geodiversity in Development. All development proposals must:

- Conserve and enhance the network of geodiversity, habitats, species and sites (both statutory and non-statutory) of international, national and local importance commensurate with their status and give appropriate weight to their importance.
- Avoid negative impacts on biodiversity and geodiversity.
- Deliver a measurable net gain in biodiversity, proportionate to the scale of development proposed, by creating, restoring and enhancing habitats and enhancing them for the benefit of species.

- Where viable opportunities arise, contribute to the delivery of the Local Nature Partnership vision to 'double land for nature'.
- Where necessary, protect and enhance the aquatic environment within, adjoining or functionally-linked to the site, including water quality and habitat. Where appropriate, proposals should identify Water Framework Directive (WFD) (or equivalent, if superseded) waterbodies in the vicinity of the proposal and set out how WFD status will be protected and, if opportunities arise, improved, with any mitigation proposed being suitable and appropriate to the water body affected. For riverside development, proposals should consider options for riverbank naturalisation. In all cases, regard should be had to the Cambridgeshire Flood and Water Supplementary Planning Documents (SPD) or Peterborough Flood and Water SPD (or their successors).
- For mineral extraction proposals, enable periodic temporary access in order to record, sample and document the geodiversity.

2.3.11 Unless national policy or legislation provides an alternative but similar mechanism, mineral and waste management proposals must (unless a decision-taker would clearly not benefit from it) be accompanied by a completed biodiversity checklist (see respective planning authority website for details), must identify features of value on and adjoining the site and provide an audit of losses and gains in existing and proposed habitat. Where there is the potential for the presence of protected species and/or habitats, a relevant ecological survey(s) must be undertaken by a suitably qualified ecologist. The development proposals must be informed by the results of both the checklist and survey.

2.3.12 **Mitigation of Potential Adverse Impacts of Development**. Development should avoid adverse impact on existing biodiversity and geodiversity features as a first principle. Where adverse impacts are unavoidable, they must be adequately and proportionately mitigated. If full mitigation cannot be provided, compensation will be required as a last resort where there is no alternative.

The Peterborough Local Plan, adopted July 2019.

Policy LP28: Biodiversity and Geological Conservation.

2.3.13 Policy LP28 states that "…through the development management processes, management agreements and other positive initiatives, the council will…":

- Aid the management, protection, enhancement and creation of priority habitats, including limestone grasslands, woodlands and hedgerows, wet woodlands, rivers and flood meadows.
- Promote the creation of an effective, functioning ecological network throughout the district, consisting of core sites, buffers, wildlife corridors and stepping stones that link to green infrastructure in adjoining local authority areas to respond to and adapt to climate change.

- Safeguard the value of previously developed land where it is of significant importance for biodiversity and/or geodiversity.
- Work with developers and Natural England to identify a strategic approach to great crested newt (GCN) mitigation, where this is required, on major sites and other areas of key significance for this species.

2.3.14 LP28 goes on to set out its policies with regard to the effects of development on statutory sites, habitats and species and mitigation that mirror those of Policy 20 of the Cambridgeshire and Peterborough Minerals and Waste Local Plan 2036, adopted July 2021 (set out above).

Policy LP22: Green Infrastructure Network.

2.3.15 The council, working in partnership with conservation and environmental organisations, local communities, developers and statutory agencies, will seek to maintain and improve the existing green infrastructure network in Peterborough. This will be achieved by enhancing, creating and managing multi-functional green infrastructure, within and around settlements, that are well connected to each other and the wider countryside and that reflect the broad strategic framework set out in the Green Infrastructure and Biodiversity SPD.

2.3.16 The council will take into account the latest Open Space Strategy, Green Infrastructure and Biodiversity SPD and any other appropriate local evidence to guide applicants on what new green infrastructure will be required and how it should be delivered.

2.3.17 All development proposals should ensure that existing and new green infrastructure is considered and integrated into the scheme design from the outset. Where new green infrastructure is proposed, the design should maximise the delivery of ecosystem services and support healthy and active lifestyles.

2.3.18 Strategic and major development proposals should incorporate opportunities for green infrastructure provision, to reverse the decline in biodiversity and restore ecological networks at a landscape scale, reverse habitat fragmentation and increase connectivity of habitats and to preserve, restore and create priority and other habitats within and adjacent to development schemes.

2.3.19 Proposals will be expected to provide clear arrangements for the long-term maintenance and management and/or enhancement of green infrastructure assets. Where appropriate, the council may utilise planning conditions, Community Infrastructure Levy (CIL) or planning obligations to deliver green infrastructure projects.

2.3.20 Development must protect the existing linear features of the green infrastructure network that provide connectivity between green infrastructure assets, including public rights of way, bridleways, cycleways and waterways and take opportunities to improve such features.

2.3.21 Development proposals that cause loss or harm to the green infrastructure network will not be permitted, unless the need for and benefits of the development demonstrably outweigh any

adverse impacts. Where adverse impacts on the green infrastructure network are unavoidable, development will only be permitted if suitable mitigation measures for the network are provided.

2.3.22 Development proposals that are consistent with and support the delivery of the opportunities, priorities and initiatives identified in the Peterborough Green Infrastructure and Biodiversity SPD will be supported.

2.4 LOCAL GUIDANCE

Cambridgeshire Wildlife Sites Selection Criteria.

2.4.1 The criteria for selection as a CWS have been produced by the Cambridgeshire and Peterborough County Wildlife Sites Panel (2020). The Criteria seek to apply concrete definitions and local thresholds to standard concepts of ecological evaluation such as diversity, rarity, size and typicalness. Unless stated otherwise, all uses of the term 'Cambridgeshire' refer to both the current administrative county of Cambridgeshire and Peterborough City Council.

Cambridgeshire and Peterborough Additional Species of Interest.

2.4.2 The species on the Cambridgeshire and Peterborough Additional Species of Interest (CPASI) list were approved by the Cambridgeshire and Peterborough Biodiversity Partnership in 2016. This list includes species that are not UKBAP priority species but are still considered species of nature conservation interest in Cambridgeshire and Peterborough, as suggested by local experts. The CPASI list replaces the shorter list of former Local Biodiversity Action Plan (LBAP) species.

3 ASSESSMENT METHODOLOGY

3.1 OVERVIEW

3.1.1 The Ecological Impact Assessment (EcIA) has been undertaken in accordance with best practice guidance as issued by the Chartered Institute of Ecology and Environmental Management (CIEEM) (CIEEM, 2018, Version 2.1). The aims of the EcIA are to:

- Identify relevant ecological features that may be impacted as a consequence of the proposed developments.
- Provide a robust assessment of the likely ecological impacts and resultant effects of the proposed developments, which may be beneficial (i.e., positive) or adverse (i.e., negative).
- Determine the consequences of the proposed developments in terms of national, regional and local policies relevant to nature conservation and biodiversity.
- Set out the steps to be taken to ensure legal compliance.

3.1.2 CIEEM guidance makes clear that it is not necessary to assess the effects on all habitats and species with potential to occur within the zone of influence of a proposed development, simply those that are 'relevant'. Ecological features that are sufficiently widespread, unthreatened, resilient to project impacts and will remain viable and sustainable can be scoped out, although efforts should still be made to mitigate any adverse effects where possible.

3.2 DEFINING THE SENSITIVITY OF RECEPTORS

3.2.1 In order to inform the EcIA, there is a need to determine the scale at which the ecological features are important, i.e., the geographical level at which it matters and thus whether they require an impact assessment. The frames of reference used for this assessment, based on CIEEM guidance, are:

- International (generally within a European context).
- National (England).
- Regional (East of England).
- County (Cambridgeshire).
- District (Peterborough).
- Local (features that do not meet criteria for District level or higher but merit retention or mitigation).
- Site (below local)

3.2.2 All ecological features of Local value and above have been taken forward to impact assessment and are the 'relevant ecological features' for the purposes of impact assessment.

3.3 CHARACTERISING ECOLOGICAL IMPACTS AND EFFECTS

3.3.1 In-line with the CIEEM guidance, the terminology used within this EcIA defines impacts and effects as follows:

- Impact: actions resulting in changes to an ecological feature, for example, the removal of a hedgerow used by nesting birds.
- Effect: an outcome resulting from an impact, for example, the damage or destruction of a nest with eggs or young or a reduction in the availability of breeding habitat that may lead to an adverse effect on the conservation status of the species or population concerned.

3.3.2 The range of characteristics used to describe ecological impacts and effects are defined in Table 1. The assessment only needs to describe those characteristics relevant to understanding the ecological effect of the impacts and determining its significance.

TABLE 1. THE CHARACTERISTICS USED TO DETERMINE ECOLOGICAL EFFECTS.

Characteristic	Definition
Beneficial (Positive).	A change that improves the quality of the environment, e.g., by increasing species diversity, extending habitat or improving water quality. This may also include halting or slowing an existing decline in the quality of the environment.
Adverse (Negative).	A change that reduces the quality of the environment, e.g., destruction of habitat, removal of foraging habitat, habitat fragmentation and/or pollution.
Extent.	The extent is the spatial or geographical area over which the impact/effect may occur under a suitably representative range of conditions.
Magnitude.	The size, amount, intensity and volume (quantified if possible) and expressed in absolute or relative terms, e.g., the amount of habitat lost or gained, percentage change to habitat area and/or percentage change in a species population.
Duration.	To be defined in relation to ecological characteristics (e.g., life-times, breeding cycles) as well as months/years. Duration of the impact may differ from duration of the effect. Effects (defined in months or years) may be short-/medium-/long-term, permanent or temporary.
Frequency and Timing.	The number of times an impact/activity (e.g., walker/ dog/vehicle movements) occurs and the season in which it occurs. Seasonal sensitivity will also have a bearing on the resulting effect (e.g., breeding/summering/migration or wintering for birds).
Reversibility.	An irreversible effect is one from which recovery is not possible within a reasonable timescale (e.g., in terms of the lifetime of the species affected) or for which there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation. In some cases, the same activity can cause both reversible and irreversible effects.

3.4 DEFINING SIGNIFICANCE CRITERIA

3.4.1 For each ecological feature, only those characteristics relevant to understanding the ecological effect and determining the significance of that effect are described. The significance of effects has been determined based on the predicted effect on the structure, function or conservation status of relevant ecological features as follows:

- Not significant: no effect on structure, function or conservation status.
- Significant: structure, function or conservation status is affected.

3.4.2 Significant effects (both adverse and beneficial) are qualified with reference to the geographic scale at which the effect occurs (e.g., a moderate adverse effect significant at a County level).

3.4.3 CIEEM does not adopt a fixed-matrix approach to classify effects as this deviates from CIEEM guidance. To provide consistency with other assessments, the findings of the CIEEM assessment have been translated into the classification of effects scale and magnitude as outlined in Table 2.

TABLE 2. THE CHARACTERISTICS USED TO DETERMINE ECOLOGICAL EFFECTS.

Effect Classification	Terminology used in other ES chapters	Equivalent CIEEM assessment
Significant (beneficial).	Major beneficial.	Beneficial effect on function or conservation status at regional, national or international level.
	Moderate beneficial.	Beneficial effect on function or conservation status at District or County level.
	Minor beneficial.	Beneficial effect on function or conservation status at Site or Local level.
Non-significant.	Neutral.	No or negligible effect on function or conservation status.
Significant (adverse).	Major adverse.	Adverse effect on function or conservation status at Regional, National or International level.
	Moderate adverse.	Adverse effect on function or conservation status at District or County level.
	Minor adverse.	Adverse effect on function or conservation status at Site or Local level.

3.4.4 Any significant adverse effects will be mitigated or compensated for (where they cannot be avoided). Ecological enhancements are recommended where appropriate to meet planning policy objectives. Following the implementation of any mitigation and compensation, as appropriate, residual effects on ecological features have been identified.

3.5 THE MITIGATION HIERARCHY

3.5.1 Potentially significant impacts were identified as early as possible and the proposed development was designed to avoid or minimise them in accordance with the mitigation hierarchy in Table 3.

TABLE 3. MITIGATION HIERARCHY.

Measure	Definition
Avoidance.	Seek options that avoid harm to ecological features (for example by adjusting phasing or creating new habitat in advance of works).
Mitigation.	Negative effects should be avoided or minimised through mitigation measures, either through the design of the project or subsequent measures that can be guaranteed, for example, through a condition or planning obligation.
Compensation.	Where there are significant residual negative ecological effects despite the mitigation proposed, these should be offset by appropriate compensatory measures.
Enhancement.	Seek to provide net benefits for biodiversity over and above requirements for avoidance, mitigation or compensation.

3.6 ASSESSMENT OF CUMULATIVE IMPACTS AND EFFECTS

3.6.1 A cumulative effect can result from actions that may be individually insignificant but which, taken together, produce a significant result at a specific time or place. Different impacts resulting

from the same development, each individually not significant, may also combine to produce a significant negative effect. In some cases, there may be a known and measurable threshold so quantitative surveys (e.g., noise level, air quality) can inform the assessment. At other times, a judgement must be made using professional experience.

3.7 DETERMINING THE SCOPE OF THE ASSESSMENT

Zone of influence/study area.

3.7.1 The zone of influence for the development is the area over which ecologically valuable sites, habitats or species may be significantly affected by environmental changes resulting from the proposed project. It is not a set distance and is dependent on the sensitivity of the ecological features under consideration. For statutory and non-statutory designated sites (and for some species) present outside the Site boundaries, the potential zone of influence is reflected in the area of search in the desk study.

3.7.2 The minimum study area for all ecological field surveys comprises all land within the Site. For specific surveys, e.g., breeding birds/GCNs, the study area is expanded to include some adjacent land and this area is described in the relevant species/group appendices.

Desk study.

3.7.3 The Cambridgeshire and Peterborough Environmental Records Centre (CPERC) and the Northamptonshire Biodiversity Records Centre (NBRC) were asked to provide a data report and for citations of any SAC, National Nature Reserves (NNR) or SSSI within 5km of the Site and information on any local sites of conservation interest including CWS, Local Wildlife Sites (LWS) and Local Nature Reserves (LNR). Both records centres were also asked to provide records for any protected and/or notable species within a 2km search area. The desk study is provided in full in Annex 1, Appendix 3.

3.7.4 A considerable amount of ecological information has been gathered to inform previous planning applications. This information is summarised in the Baseline Conditions sections where it remains relevant to this assessment.

Field surveys.

3.7.5 A Preliminary Ecological Appraisal (PEA) was undertaken on 25 and 26 June 2023 by Luke Hartley ACIEEM in accordance with the standard survey method (JNCC, 2010). All habitats and plant communities within the Site were mapped and characterised by identifying the dominant and typical species and are described using the UK Habitat Classification System (UK Hab, 2023). All hedgerows were assessed for importance as defined by the Hedgerow Regulations 1997 and a search was made for any invasive non-native plant species listed on Schedule-9 of the WCA.

3.7.6 The results of the desk study and PEA were used to design a suite of surveys, the methods and timings for which are summarised in Table 4. Full details of the survey methods and results are given in Annex 1.

TABLE 4. SURVEY SCOPE, METHODS AND TIMINGS

Survey	Study Area	Methods	Timings
Habitats	Habitats within and adjacent to the Site.	Phase-1 (JNCC) and UK Habitat Classification System (Butcher *et al*., 2020)	Summer 2023.
Biodiversity Net Gain assessment	Habitats within the Site.	As per the Statutory Metric (DEFRA, November 2023)	Summer 2023.
Invertebrates	Habitats within the Site.	Initial Invertebrate Scoping Assessment, followed by further targeted surveys (Drake *et al.,* 2007).	April 2023, then June to September 2023 inclusive,
Great crested newts	All waterbodies within the Site.	Habitat Suitability Index (HSI) (Oldham *et al*., 2000). Population size class assessment (English Nature, 2001).	April to May 2023.
Reptiles	Suitable habitats within the Site.	Seven-visit presence/absence survey using artificial refugia (HGBI, 1998).	May to September 2023.
Birds	Habitats within the Site.	Six-visits using the Common Bird Census (CBC) methodology (Marchant, 1983).	March to June 2023.
Bats	Habitats within the Site.	Preliminary Ecological Appraisal and Activity Surveys (static detectors) (Collins, 2016).	Five nights in June and July 2023.
Badgers	Habitats within the Site.	Search for setts, dung pits/latrines and pathways (Harris *et al*., 1994).	May 2023, updated on each site visit.

Species scoped out of the assessment.

3.7.7 The habitats on Site were assessed for use by the following notable species but unless new information comes to light, they have been scoped out of the assessment:

- Water voles and otters: no nearby records, no records from previous surveys and no habitats on the Site suitable for use by either species.
- White-clawed crayfish: no desk study records, not known to be present in the local area and no habitats on the Site suitable for use by this species.
- Brown hares: only one historic record in the local area. None seen during field surveys and a general lack of habitat suitability. If present, this mobile species is likely resilient to any effects.
- Hedgehogs: no historic records, none seen during field surveys and a general lack of habitat suitability. If present, this species will benefit from protective measures implemented for other species.

- Deer: fallow, roe and muntjac deer were recorded during field surveys. All three species are highly mobile and are likely resilient to any effects.
- Hazel dormice: dormice were introduced into Bedford Purlieus in 2001. None was recorded on the Site during a nest-tube survey in 2009 and this species has since been scoped out of all subsequent assessments due to a lack habitat suitability in operational areas.

3.7.8 Badger surveys were carried out but, in accordance with accepted practice, all relevant information is provided in a separate, confidential report.

3.7.9 All other protected and priority species not mentioned above were scoped out of the assessment at this stage for one or more of the following reasons:

- The Site is outside the known geographic range for the species.
- The habitat required to support the species is not present on or adjacent to the Site or is too small, isolated or fragmented to support viable populations.
- The species, even if present, would likely be resilient to any effects of the scheme or any effect would be negligible.

3.8 CONSULTATIONS

3.8.1 A scoping opinion was provided by Peterborough City Council on 23 November 2023.

3.8.2 A site visit and informal discussions, largely with regard to Biodiversity Net Gain opportunities, were held with Peterborough City Council at the Augean offices on 16 August 2023.

3.8.3 Natural England has been engaged under their pre-screening advice service with regard to obtaining a Letter of No Impediment (LONI) to the granting of a licence for development affecting GCNs. The proposed mitigation strategy will be based upon utilising Licencing Policy 1 – 'Greater flexibility to dispense with exclusion and relocation activities where there is investment in habitat provision' and Licencing Policy 3 – 'Greater flexibility on exclusion measures where this will allow GCNs to use temporary habitat'.

4 BASELINE CONDITIONS

4.1 DESIGNATED SITES OF NATURE CONSERVATION IMPORTANCE

4.1.1 The results are summarised in Table 5. Full descriptions, including location maps and citations, are given in Annex1, Appendix 3.

TABLE 5. SITES WITH A STATUTORY OR NON-STATUTORY DESIGNATION FOR NATURE CONSERVATION WITHIN THE SEARCH AREA.

Name, Designation and Description	Proximity
Barnack Hills and Holes (SAC). Semi-natural dry grasslands and scrubland facies on calcareous substrates for which this is considered one of the best areas in the United Kingdom.	4.6km northeast.
Bedford Purlieus NNR, SSSI. An ancient woodland supporting a variety of woodland community types that nationally, are largely restricted to lowland England.	Adjacent to the west.
West, Abbot's & Lounds Woods SSSI. A range of lowland woodland types, many of which are scarce in Britain.	0.65km north.
Bonemills Hollow SSSI. Grassland of calcareous and marsh communities, some of which are restricted nationally.	1km northwest.
Wansford Pasture SSSI. Supports two main grassland types that are nationally scarce and uncommon in Cambridgeshire.	1.1km east.
Thornhaugh Quarry CWS. Site containing an important assemblage of amphibians including GCNs.	On-Site.
Bedford Purlieus - Wittering Road Verge CWS. Notable for its National Vegetation Classification (NVC) CG3 Upright Brome grassland and calcareous grassland indicator species.	0.3km north.
West Wood Meadow CWS. Notable for its M27, meadowsweet-wild angelica mire, stinging nettle-tufted vetch sub-community.	0.7km north.
Stone Pit Quarry LWS. An old quarry with particular significance for plants and invertebrates.	1km south.
Yarwell Quarry LWS. An old quarry with particular significance for calcareous plants, insects and reptiles.	1.1km southeast.
Standen's Pasture LWS. One of two Wildlife Trust reserves set on limestone grassland either side of a valley.	1.2km east.
Ring Haw Woodland LWS. An ancient woodland of predominately ash/oak with a number of ancient woodland species.	1.4km south.
Ring Haw Green Lane LWS. An ancient byway with a thick and varied hedgerow containing a variety of ancient woodland species.	1.4km south.
Wittering Valley CWS. Limestone grassland containing flushes, seepages or springs.	1.5km north.
Ring Haw Quarry Grassland LWS. Areas of species rich calcareous grassland amongst scrub and woodland.	1.55km south.
Ring Haw Quarry Gullet LWS. An old sand and ironstone gullet that provide a valuable habitat mosaic for wildlife and in particular invertebrates.	1.6km south.
Whiteland's Farm LWS. A grassland site adjacent to part of Old Sulehay Nature Reserve notable for its grassland.	1.7km south.
Fair Oak Sale Quarry LWS. An old quarry with particular significance for its open mosaic and calcareous grassland.	1.7km southwest.
Great Byards Sale LWS. An area of ancient woodland on the edge of the Rockingham Forest with a well-developed oak-ash canopy.	1.75km southwest.
River Nene CWS. A major river that is not grossly modified by canalisation or poor water quality and is notable for at least three species of Nationally Scarce *Potamogeton* spp.	1.8km southeast.

Name, Designation and Description	Proximity
Stibbings Pits CWS. A site notable for its NVC S4 common reed swamp (3biii); a type 10A waterbody and high invertebrate interest.	2km east.
Fair Oak Sale LWS. An area of Ancient Semi-Natural Woodland containing a good example of NVC W8.	2km southwest.

4.2 PROTECTED AND NOTABLE SPECIES

4.2.1 The results are summarised in Table 6. Pre-2003 records have been screened out, as have records of such low resolution as to be of no meaningful use.

TABLE 6. IMPORTANT SPECIES WITHIN THE SEARCH AREA.

Species/Group	Status	Nearest record
53 records for GCN *Triturus cristatus*, 2005-2022.	HSR	Thornhaugh Quarry CWS.
15 records for other amphibians comprising common frog *Rana temporaria*, common toad *Bufo bufo*, smooth newt *Lissotriton vulgaris* and palmate newt *Lissotriton helveticus*, 2004-2021.	S41	Bedford Purlieus NNR, SSSI.
53 records for reptiles comprising common lizard *Zootoca vivipara*, slow worm *Anguis fragilis* and grass snake *Natrix helvetica*, 2004-2021.	WCA5, S421	Bedford Purlieus NNR, SSSI.
33 records for badger *Meles meles*, 2003-2020.	PBA, WCA5	Thornhaugh Quarry CWS.
51 records for hazel dormouse *Muscardinus avellanarius*, 2003-2015.	HSR	Bedford Purlieus NNR, SSSI.
One record for harvest mouse *Micromys minutus*, 2014.	S5, S41	1.1km west.
One record for brown hare *Lepus europaeus*, 2016.	S41	1.3km south.
Two records for otter *Lutra lutra*, 2007.	HSR	River Nene, 1.8km east.
79 records for at least 11 species of bats, 2003-2019.	HSR	Bedford Purlieus NNR, SSSI.
580 records for at least 47 species of protected and priority birds, 2003-2022.	S1, S41	Bedford Purlieus NNR, SSSI.
4,777 records for protected and priority invertebrates, 2003-2022.	S41, RDB	Bedford Purlieus NNR, SSSI.
909 records for protected and priority plants, 2003-2022.	S41	Thornhaugh Quarry CWS.

Key: HSR - The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations, 2019; WCA - Wildlife and Countryside Act, 1981: S5 - Schedule 5 of the WCA; S1 - Schedule-1 of the WCA; BA - Badgers Act, 1992; NERC S41 - Section 41 of the Natural Environment and Rural Communities Act, 2006; RDB – Red Data Book (Invertebrates).

4.3 HABITATS, PLANT COMMUNITIES AND PLANT SPECIES

4.3.1 The Site comprises two areas, Thornhaugh Landfill Site to the north and Cooks Hole Quarry to the south. The Site borders Bedford Purlieus NNR to the west and a redundant quarry to the

south. The A47 bounds the Site to the north and east, with arable land use beyond. The distribution of habitats on-Site is shown on Figures 1 and 2 in Annex 1.

Thornhaugh Landfill Site.

4.3.2 The majority of Thornhaugh Landfill Site comprises an active landfill facility and comprises unvegetated surfaces, capped and unrestored cells, haul routes and material storage yards, as well as site offices a weighbridge and compounds. Amongst these areas are fragments of early colonising ruderal vegetation. The northern slope adjacent to the A47 has been restored to grassland.

4.3.3 Thornhaugh Quarry CWS (hereafter referred to as 'the CWS'), lies along the western edge of Thornhaugh Landfill Site adjacent to Bedford Purlieus. The CWS comprises a mosaic of grassland in various stages of succession, interspersed with ponds and patches of bare ground. The CWS was designated for its important amphibian assemblage. To the north of the CWS are a chain of ponds that were created as part of GCN mitigation works.

Cooks Hole Quarry.

4.3.4 Cooks Hole Quarry is separated from Thornhaugh by a gappy hedgerow with a haul road linking the two areas at the eastern end. The majority of the north-eastern part of Cooks Hole Quarry comprises large areas of bare ground with stockpiles and two water storage lagoons. The north-western part of Cooks Hole is a large area of agricultural grassland, stockpile and large waterbody.

4.3.5 Cooks Hole Quarry is split into two around the mid-point by a brook running west-to-east through an area of wet woodland either side of the uninhabited Grade II listed Cooks Hole Farmhouse. Land to the south-east of the brook is again largely bare ground as a result of previous mineral quarrying work, whilst land to the south-west is again largely former agricultural grassland.

Assessment of biodiversity importance.

4.3.6 **Habitats**. Wet woodland, ponds and open mosaic habitats on previously-disturbed land and both hedgerows qualify as S41 habitats of principal importance (Section 41 of NERC). When taken together, the CWS and the size and mosaic of S41 habitats present indicate the Site is likely of County Importance.

4.3.7 **Protected and priority plant species**. No nationally rare or nationally scarce plant species or S41 Species of principal importance were recorded on the Site. However, pyramidal orchid, wild liquorice and common valerian are listed as CPASI.

4.3.8 Carline thistle, common eyebright, common valerian and field scabious are listed as 'Near Threatened' species in England (Stroh *et al*., 2014). With the exception of field scabious, which was located adjacent to the central dry-stone wall, all these species were associated either with the CWS or within boundary features and will not be impacted by the scheme. In addition, the

data search provided 2,020 records from the CWS for dwarf spurge ('Vulnerable'), common cudweed, wild strawberry and corn mint ('Near Threatened').

4.3.9 The assemblage of plant species recorded within the Site is considered of Local importance.

4.3.10 **Non-native Invasive species**. No non-native invasive plant species listed on Schedule-9 of the WCA were recorded within the Site.

4.4 INVERTEBRATES

4.4.1 The Site comprises a range of habitats covering a single broad biotope, 'open habitats', with 'tree-associated' and 'wetland' also present on the Site. The habitat that is most prominent across all areas of the Site is the 'short sward and bare ground habitat', with 81 species of association. This is a very significant species total that includes 17 species noted by Pantheon as having a nationally significant status.

4.4.2 The second most speciose habitat on the Site is the 'tall sward and scrub habitat', with 67 species of association recorded. The resource is moderately diverse and includes two species with a nationally significant status, though one of these (*Dorycera graminum*) is considered not to be scarce or threatened and will lose its status in an upcoming review.

4.4.3 The butterfly resource is significant. Both dingy skipper and grizzled skipper, which are NERC S41 species, are widespread across the Site with the grizzled skipper seemingly most widespread and abundant. This species is listed by Butterfly Conservation as 'high priority' as it has declined by 49% since the 1970s. The dingy skipper is also 'high priority', according to Butterfly Conservation, having declined by 61% since the 1970s.

4.4.4 The suites of ground-nesting bees and wasps are also diverse and robust. Sixty-eight species are recorded, with 14 of these having a nationally significant status. However, a number of these are considered more common than their status suggests.

4.4.5 The wet woodland supports a range of habitats, including tree-associated and wetland biotopes, open habitats, tall sward and scrub. The survey recorded 105 species, with only *Dorycera graminum* recorded as having significant status, although this is not a wet woodland species and no longer warrants a nationally significant status.

4.5 ASSESSMENT OF BIODIVERSITY IMPORTANCE

4.5.1 The Site supports a moderately high invertebrate fauna that includes a low number of localised and specialised species, 15 of which currently have nationally significant status. In addition, habitats on the Site provide a potentially significant resource for early successional invertebrates including strong populations of early successional butterflies. It also supports an extensive list of species associated with scrub fringes and woodland edge. Taken together, the invertebrate assemblage is considered of County importance.

4.5.2 The current value of the wet woodland is considered quite high. However, the number of typical wetland species is small (with only 26 species of association) and scarce species previously-recorded in 2009 were not recorded during 2023. Most of these are craneflies and long-legged flies (the key group to compare with for future monitoring). It is likely this habitat has degraded in the intervening period but given the small area of wet woodland present, it is still considered a rich area of habitat and as a habitat mosaic, the wet woodland is considered of at least District importance for its invertebrate assemblage.

4.6 AMPHIBIANS

Great crested newts.

4.6.1 Between October 2004 and April 2005, 358 GCNs were translocated from the footprint of the Thornhaugh Landfill Site to a fenced off receptor site (since designated as the CWS), under a Natural England European Protected Species Licence (EPSL). In 2012, a second translocation was undertaken to enable the destruction of three ponds within proposed operational areas, with amphibians released into a new fenced-off GCN receptor to the north of the CWS, which included eight new lined mitigation ponds. Population monitoring was undertaken between 2005 to 2019. The annual results varied quite widely but on balance, indicate the Site sustained the upper range of a 'medium' sized population over that period.

4.6.2 Sixteen ponds were surveyed for the presence GCNs during 2023. Based on the distance between the ponds, historic land use and current habitat connectivity, the Site is considered to support three populations.

4.6.3 The core population of GCNs on the Site remains centred within the CWS (Ponds 1-4) and the chain of ponds running north along the eastern edge of Beford Purlieus (Ponds 9-16). The GCNs present in the large pond south of the CWS (Pond 18) have most likely colonised it from the CWS, which is less than 100m to the north, via Bedford Purlieus. Together, these ponds support a 'medium' population (peak count 25).

4.6.4 A 'small' population of GCNs (peak count 3) is present in Pond 17 (a surface water management lagoon in the east of Thornhaugh), around 700m to the east of the CWS and 400m north of Ponds 19 and 20.

4.6.5 A 'small' population of GCNs (peak count 4) is present in Ponds 19 and 20 (the mineral washing lagoons in the southeast of Cooks Hole). These are over 800m from the CWS.

4.6.6 The temporary amphibian fence installed as part of previous translocations remains in place between the CWS and the Thornhaugh Landfill Site. As translocations rarely capture every animal, the two 'small' populations to the east could be the offspring of animals that avoided capture during the 2013/2014 translocation; this would not be unusual on such a large site. There appears to be sufficient aquatic and terrestrial habitat to support these populations, although they are isolated so significant interchange with other populations is unlikely.

Other amphibians.

4.6.7 Palmate and smooth newts were recorded in most ponds in the CWS/western chain and in Ponds 17 and 18 but not in Ponds 19 and 20. No frogs or toads were recorded in any pond.

Assessment of biodiversity importance.

4.6.8 In 2023, of the 16 ponds on the Site, 14 held water during spring. GCNs were confirmed as present and breeding in all 14. Whilst a common and widespread species locally, GCNs are listed in the Schedules of The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019. Given the amphibian assemblage in Ponds 1-4 warranted the designation of CWS status and the range of all three species of newt is expanding on the Site, the amphibian assemblage is considered of County importance.

4.7 REPTILES

4.7.1 Bedford Purlieus is known to support populations of common lizard, slow worm and grass snake. Eleven slow worms and one common lizard were recorded along the western edge of Cooks Hole Quarry adjacent to Bedford Purlieus during reptile surveys undertaken in 2009 and 2010. One grass snake and two common lizards were recorded along the southern boundary of the Thornhaugh Landfill Site during surveys in 2011. It is assumed that any reptiles encountered during GCN translocation work were released into the CWS along with any amphibians.

4.7.2 During the 2023 survey, one grass snake was found under a survey tin at the western end of the central hedgerow between Thornhaugh Landfill Site and Cooks Hole Quarry adjacent to Bedford Purlieus. A common lizard was recorded by direct observation on the restored grassland in the northern part of Thornhaugh Landfill Site.

Assessment of biodiversity importance.

4.7.3 Given the levels of disturbance the Site has been subjected to over the past 20 years, the only habitats capable of supporting sustainable populations of reptiles are the hedgerow running east-to-west between Thornhaugh Landfill Site and Cooks Hole Quarry, the habitats along the Thornhaugh Brook corridor and more recently, the area of restored grassland along the northern boundary of Thornhaugh Landfill Site adjacent to the A47.

4.7.4 With no barriers to movement, it is likely the small numbers of reptiles present are part of the wider Bedford Purlieus metapopulation and are dependent on the movement of animals between the two areas to be sustainable. In contrast, Bedford Purlieus is not similarly reliant on this exchange of individuals and thus, the loss of habitats on the Site will not have an adverse effect on the reptile populations within the SSSI/NNR.

4.7.5 Whilst unlikely to be a significant constraint, all species of native reptiles are species of principal importance as identified in Section 41 of NERC. The Site's reptile assemblage is therefore considered of Local importance.

4.8 BIRDS

4.8.1 Twenty species of breeding bird were recorded from the Thornhaugh Landfill Site during breeding bird surveys undertaken in 2011. Further breeding bird surveys undertaken in 2014 recorded 34 species, most notable of which were little ringed plover and red kite, both listed on Schedule-1 of WCA.

4.8.2 Fifty-eight species were recorded during the six survey visits in 2023. Three Schedule-1 species comprised two pair of little ringed plover, confirmed as breeding within an area of bare ground in Cooks Hole Quarry. Repeat sightings and behaviour indicated red kites were nesting in the wooded stream valley between Cooks Hole Farmhouse and the A47. Redwing was also recorded and whilst a designated Schedule-1 breeding species, it is a winter visitor and only small numbers stay to breed in the UK, all in the far north of Scotland.

4.8.3 The assemblage also included ten S41 species of principal importance, including cuckoo and skylark, eight 'Red List' and seventeen 'Amber List' species. Suitable nesting habitat within the Site is present for all of them.

Assessment of biodiversity importance.

4.8.4 **Little ringed plovers** favour nest sites on transient areas of bare and sparsely-vegetated ground, such as those found in quarries, gravel pits and industrial sites. As the availability of such habitats has a direct effect on the population size, the loss of such habitats may reduce breeding success. The British Trust for Ornithology (BTO) reported the UK population to be around 1,250 breeding pairs in 2007. Bacon *et al*. (2013) report an estimate of the breeding population in Cambridgeshire to be 30–50 pairs between 2007-2011. More recently, the Cambridgeshire Bird Club report 2019, contains records of 306 sighting records at 28 sites, with breeding confirmed for eight pairs. On this basis, the confirmation of two breeding pairs of little ringed plover within Cooks Hole Quarry in 2023 would represent 20% of the total known breeding pairs in Cambridgeshire. Whilst this is likely to be an underestimate, given their habitat associations, the Site is considered of at least District level importance for this species.

4.8.5 **Red kites** have benefited from considerable conservation effort to restore them to their original breeding range following widespread persecution that reduced the UK population to fewer than 10 breeding pairs in the 1940s. This was achieved in part by the reintroduction of birds, including a release in Northamptonshire, 7km to the west of the Site in 1995. In 2016, the BTO reported the UK population to be around 4,400 breeding pairs with Harris *et al*. (2022) reporting a 1,935% increase over the period 1995–2020.

4.8.6 Red kites are a woodland nesting species and were recorded on every Site visit, often over the landfill site, although they are not dependent on it to maintain their numbers. Bedford Purlieus is likely to support multiple breeding pairs and competition may have resulted in the pair nesting in the wooded valley between Cooks Hole Farmhouse and the A47 in 2023. The Site is considered of Local importance to red kite. However, as the only nesting opportunities are limited to the unaffected brook corridor and this species has clearly habituated to Site activities, it is considered resilient to any effects and is not taken forward to the assessment stage.

4.8.7 **Sand martins**, whilst currently believed to not be of conservation concern are, like little ringed plovers, dependent on habitats that are often only created as a result of earthmoving and quarrying work. A sand martin colony, comprising at least 90 nest holes, was present in a spoil heap in Cooks Hole Quarry. Sand martin colonies have been recorded on the Site in previous years so the Site is considered of Local importance for this species.

4.8.8 **The breeding assemblage** includes several Red- and Amber-List bird species, although the numbers of probable breeding pairs are relatively small and typical of the habitats present. Many of the birds are woodland- and scrub-species or conversely (with the exception of sand martin), need open habitats such as grassland. Large areas of their preferred habitats will continue to be present throughout the progressive restoration phase; new habitats will be able to carry even greater numbers and a larger range of species than the Site does at present. Whilst many species will be resilient to any effects, the breeding assemblage is evaluated as being of Local importance. However, the phased approach will mean there will be habitats available for use by bird throughout the restoration and that it is reasonable to assume they will continue to be used. On the basis that standard measures will be implemented to protect active nests from damage during vegetation clearance, with the exception of little ringed plover and sand martin, the breeding bird assemblage is considered resilient to any effects and is not taken forward to the assessment stage.

4.9 BATS

Roost and habitat assessment.

4.9.1 No roosts were identified during the surveys. Previous surveys and those undertaken during 2023 indicate that roosting opportunities for bats on the Site are limited to Cooks Hole Farmhouse and barn and some of the mature trees along the brook corridor; all of which are unaffected by work. It is highly likely there are multiple maternity roosts with 2km of the Site and the more productive habitats on Site will lie within each colony's Core Sustenance Zone.

4.9.2 Thornhaugh Landfill Site comprises an active landfill with foraging opportunities limited to pockets of habitat that are poorly connected both internally and to the wider landscape. The most productive habitats are the interface between the Site and Bedford Purlieus along the western boundary. Thornhaugh Landfill Site is assessed as having 'low' suitability for commuting and foraging habitats, elevated to 'high' suitability along the boundaries.

4.9.3 Cooks Hole Quarry comprises large areas of open bare ground (former quarry) and a large area of open grassland. The most productive habitats are the brook/wet woodland corridor, the interface between the Site and Bedford Purlieus along the western boundary and to a lesser degree, the two internal hedgerows. Cooks Hole Quarry is assessed as having generally 'low' suitability for commuting and foraging habitats, elevated to 'medium' suitability along the internal hedgerows and 'high' suitability along the brook corridor and the western Site boundary interface with Bedford Purlieus.

Bat activity.

4.9.4 Eight species were identified from acoustic data, namely:

- Common pipistrelle.
- Soprano pipistrelle.
- Nathusius' pipistrelle.
- Noctule bat.
- Leisler's bat.
- Brown long-eared bat.
- Barbastelle bat.

4.9.5 Bats of the *Myotis* genus were not identified to species due to call convergence but the majority of those recorded are likely to be either Daubenton's bat or whiskered/Brandts bat.

4.9.6 The habitats with the greatest levels of bat activity were the brook corridor and interface with Bedford Purlieus. With a few notable exceptions, bat activity elsewhere was generally low. Whilst bat activity was recorded along the internal hedgerows to be lost and the southern and eastern boundaries to be retained, there was no significant difference between them other than for noctule bat.

4.9.7 Common pipistrelle activity around Cooks Hole Farmhouse was relatively high, although the timestamps of the calls were spread through the night and not weighted around the 30-minute sunset emergence or dawn re-entry period that might indicate swarming behaviour by a significant number of bats, although the presence of a small roost is a possibility.

4.9.8 In June, noctule bat calls were recorded in high numbers on the two internal hedgerows. Noctules are typically a high-flying, open-habitat species with high amplitude (easy to record) calls that are not reliant on linear landscape features such as hedgerows for commuting and foraging. The activity levels most likely represent short, intense bursts of foraging activity in proximity to the detectors but independent of the hedgerows. However, the timestamps of the calls suggest that there is a roost nearby, most likely in Bedford Purlieus.

4.9.9 This level of activity by Nathusius' pipistrelle is insignificant given the sampling effort and the Site is very unlikely to be of material importance to this species. The *Myotis* species were considered most likely to comprise a mixture of Daubenton's bat, Natterer's bat and whiskered/Brandt's bat. Regular use of hedgerows, including the central hedgerow, for

commuting was recorded by soprano pipistrelle, common pipistrelle and barbastelle but there was little evidence for commuting-use by other species, including brown long-eared bat.

4.9.10 Soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, Barbastelle bat and the Myotis bats were all recorded at low levels and again, primarily along the western Site boundary interface with Bedford Purlieus.

4.9.11 *Myotis* bat activity can most likely be attributed to Daubenton's bat or whiskered/Brandts bats. Again, the low levels of activity indicate the Site is not important to this species.

4.9.12 Brown long-eared bats tend to be under-represented in acoustic surveys due to their low amplitude calls. However, as this species predominantly feeds on moths, it tends to be associated with woodland and edge habitats so foraging opportunities within the Site are limited to the interface with Bedford Purlieus and the wooded brook corridor, both of which are unaffected.

Assessment of biodiversity importance.

4.9.13 All bat species are afforded strict legal protection under the Habitats Regulations and the Wildlife and Countryside Act 1981 (as amended). Barbastelle, noctule, soprano pipistrelle and brown long-eared bat are also S41 species. Bats are highly mobile animals and most species recorded as using the Site were doing so at relatively low levels. The most important habitats will be unaffected, whilst those to be lost will be replaced and in far higher proportions. As such, bats are likely resilient to the effects of the scheme. However, due to their conservation status, the assemblage is considered of Local importance.

4.10 SUMMARY OF IMPORTANT ECOLOGICAL FEATURES

4.10.1 The Important Ecological Features identified above are shown in Table 7, together with the geographical area over which they are considered important. The number of designated sites taken forward to assessment includes only those specified in the Natural England scoping response plus any others for which a potential effect would constitute a material consideration in determining the application; all others have been scoped out.

4.10.2 Features considered important at a less than Local level are not carried forward to the assessment stage as they are unlikely to be subject to effects that would constitute a material consideration in determining the application, however, many will benefit from habitat creation and enhancement measures undertaken for other species.

TABLE 7. SUMMARY OF IMPORTANT ECOLOGICAL FEATURES.

Important Ecological Feature	Geographic Context	Justification
Barnack Hills and Holes (SAC).	International	Conservation status.
Bedford Purlieus SSSI and NNR.	National	Conservation status.
West, Abbot's & Lounds Woods SSSI.	National	Conservation status.
Bonemills Hollow SSSI.	National	Conservation status.
Wansford Pasture SSSI.	National	Conservation status.
Thornhaugh Quarry CWS.	County	Conservation status.
Wet woodland (as a habitat).	County	NERC S41 habitat.
Amphibian assemblage (including GCNs).	County	Habitats on Site used by WCA Schedule-5 species.
Little ringed plover.	County	Habitats on Site used by WCA Schedule-1 species.
Site habitats (for inverts).	County	Functional - Providing feeding areas and shelter for NERC S41 and notable species.
Invertebrate (assemblage).	District	Both dingy skipper and grizzled skipper are NERC S41 species.
Hedgerow network.	Local	Functional - Providing feeding areas and shelter for a range of priority species.
Reptiles.	Local	Habitats on Site used by WCA Schedule-5 species
Bat assemblage.	Local	Barbastelle, noctule, soprano pipistrelle and brown long-eared bat are all NERC S41 species.

4.11 DATA LIMITATIONS

4.11.1 The information provided by the desk study, consultations and the suite of field surveys described above is fully adequate for the assessment of potential impacts and identification of mitigation measures.

4.12 FUTURE BASELINE

4.12.1 If the proposed revised restoration scheme was not approved and implemented, then the operations would continue at Cooks Hole until 2042 and the operations at Thornhaugh would continue to 2035. Cooks Hole would be restored to agricultural grassland with some tree and shrub planting. Thornhaugh would be restored a mixture of woodland, hedgerows, shrub, scrub and calcareous grassland. The opportunity to provide significant BNG in Cooks Hole would not be realised. The potential to extend the range of habitats with a view to providing a significant contribution to the wider aspirations for the enhancement of Rockingham Forest as described in Section 6 would also not be realised.

5 DEVELOPMENT PROPOSALS

5.1 OVERVIEW

5.1.1 The details of the proposed scheme are presented in full in the application documents. A summary of the scheme, relevant to the ecology of the Site and its surroundings, is given below:

- The continuation of landfilling at Thornhaugh with non-hazardous waste and stable non-reactive hazardous waste.
- Extraction of mineral to facilitate the construction of the permitted landfill cells.
- The continuation of materials stockpiling imported to the Site for use in landfill engineering operations.
- Amendment of the restoration profiles for Thornhaugh and Cooks Hole to form one integrated coherent landform.
- Continuation of the use of the existing Thornhaugh access for waste imported for deposition at Thornhaugh, material for use in landfill engineering at Thornhaugh and material for the restoration of Cooks Hole.
- The Importing of clean, naturally-occurring material from the East Northants Resource Management facility (ENRMF) to create the landform of Cooks Hole and to tie in with the landform at Thornhaugh. It is proposed that the landform to the south of Thornhaugh brook be created first.
- The continuation of materials processing from mineral stockpiles at Cooks Hole.
- The continuation of crushing and screening of imported soil forming materials and minerals arising from the construction operations at Thornhaugh.
- The extraction and re-deposition or processing of historically deposited waste from Phases 1 and 2 at Thornhaugh.
- Use of amenity access from the A47 at Cooks Hole following restoration and the provision of a small car park for approximately 12 cars.
- The retention of the Site management infrastructure at Thornhaugh for continued monitoring and management of landfill gas and leachate.
- The retention of Cooks Hole Farmhouse and the associated outbuildings for the duration of the operations at the Site. The future use of the listed building and associated outbuildings will be the subject of a separate application.
- Continuation of operations at the Site until February 2042.
- Establishment of a surface water runoff management system at the Site.
- The restoration of the Site will be to nature conservation interest and the habitats currently included in the approved restoration scheme at Thornhaugh will be extended across to include and be integrated with Cooks Hole. It is anticipated that the revised restoration scheme for Cooks Hole will deliver considerably more BNG compared with the previously consented restoration scheme.

- The Site will be subject to an aftercare and maintenance period following the completion of restoration. The length of the aftercare period will be subject to agreement with Peterborough City Council.

5.2 DEVELOPMENT DESIGN AND IMPACT AVOIDANCE

5.2.1 Measures to avoid or minimise ecological effects have been considered at various stages of the proposed developments' design in accordance with the mitigation hierarchy. These are embedded into the scheme design.

5.2.2 The construction phase will comply with industry good practice and environmental protection legislation in relation to the prevention of surface- and ground-water pollution, dust management, noise prevention and artificial light pollution. Full details of these measures and how they will be implemented to ensure legal compliance will be set out in a number of schemes. The schemes are included as appendices to the Environmental Statement (ES).

5.2.3 Habitat/species-specific measures are set out in next section. The assessment of impacts and predicted effects takes account of these measures already being in place.

5.3 PHASING

5.3.1 The restoration will be undertaken as per the Proposed Phasing Plan (ES drawing ref: AU/CH/11-23/24064revA), starting in the southwest corner of Cooks Hole and gradually working north, with the restoration of Thornhaugh being completed after operations on Site come to an end in February 2042

5.3.2 With the exception of the CWS, wet woodland/stream corridor, eastern boundary and previously restored areas on Thornhaugh, all the terrestrial habitats on the Site will be impacted at some point. However, these impacts will be phased over a number of years and in many cases, new habitats will be created before the entirety of similar habitats is lost. The continuance of habitat availability greatly reduces the adverse effects on many species, to the point that mobile species are likely resilient to most impacts.

6 LIKELY IMPACT AND EFFECTS OF THE PROPOSED DEVELOPMENT

6.1 OVERVIEW

6.1.1 This section identifies the likely impacts and effects resulting from the proposed development and assesses any potential cumulative effects, which are determined in accordance with the identified methodology.

6.1.2 From an ecological perspective, the activities associated with landfilling, earthmoving and restoration are similar during both the construction and operational phases and as they are likely to take place simultaneously in different parts of the Site, they are considered together.

6.1.3 The assessments of any effects are made in the absence of any mitigation measures that are not embedded in the project design. Any residual effects (those requiring additional mitigation) are carried forward into the next section.

6.2 BARNACK HILLS & HOLES SAC, BEDFORD PURLIEUS NNR AND OTHER SSSI

6.2.1 There are four SSSIs in Table 7 for which a planning risk zone includes all or part of the Site. These designated sites support a large number of ecologically important habitats and species and any damage to them would constitute a 'Major' significant adverse effect. Due to the distance from the Site to Barnack Hills and Holes SAC and with no potential pathways, there will be no impacts as a result of the proposed development on Barnack Hills and Holes. Since the planning issues identified for the closest zone to Bedford Purlieus NNR/SSSI include all the issues identified for the relevant zones of the other SSSIs, it is assumed that any measures required to protect the former will also protect the sites further away. Relevant issues identified on the MAGIC Site Check Report for these SSSIs are addressed in turn below.

The continuation of landfilling at Thornhaugh with non-hazardous and stable non-reactive hazardous waste.

6.2.2 Thornhaugh Landfill Site is and will continue to be the subject of an Environmental Permit (EP) for the non-hazardous waste and stable non-reactive hazardous waste landfilling operations. Environmental monitoring during the operational and aftercare phases while the Site is managed will be carried out to confirm that the levels of contaminants in a range of media relevant to potential exposure pathways such as landfill gas, air emissions, leachate, surface water, groundwater and dust will not exceed the environmental thresholds that are set for the landfill site within the EP.

6.2.3 Samples are taken to an agreed programme specified in the EP and follow protocols approved by the Environment Agency with the resulting monitoring data reported to it. The monitoring regime provides assurance that the landfill site is performing as expected and that the design, construction and operating standards of the landfill site are effective in eliminating or controlling any exposure risks.

Dust smothering of designated habitats.

6.2.4 The proposed development has the potential to generate dust through cell excavation and engineering, soil handling and restoration, mineral extraction operations, materials handling, on-Site transportation, waste processing, stockpiles and exposed surfaces together with off-Site transportation. The dust emissions from the restoration operations at Cooks Hole will be controlled using best practice control measures such as dampening-down. The dust emissions from Thornhaugh are controlled and monitored under the EP. The thresholds in the EP are set to protect both human health and the environment. Dust in the air is monitored at the boundary of the Site as deposited dust and as PM_{10}. Large dust particles are deposited fairly rapidly and

usually close to the point of arising at most, whereas smaller particles, including PM_{10}, have the potential to travel greater distances from the point of arising. No air quality threshold is set for PM_{10} for the protection of ecosystems however, the estimated annual mean PM_{10} background concentration obtained from the Department for Environment, Food and Rural Affairs (DEFRA) for 2022 at the Site is between 11.64µg/m³ and 14.29µg/m³ with mean of 13.09µg/m³, which is well below 40micrograms/m^3, which is the annual mean air quality target concentration.

Changes in air quality due to traffic during both operation and restoration.

6.2.5 The traffic numbers associated with the proposed development are lower than the traffic numbers associated with the historic operations at the Site. There will be no additional impacts on air quality as a result of traffic resulting from the proposed development.

Combustion.

6.2.6 Gas emissions from the landfill are collected in an active gas collection system and the gas is burnt in the flare stack. The EP specifies air quality emission limits from the gas flare.

Changes in surface water quality due to pollution/siltation.

6.2.7 Surface water will be managed at Cooks Hole in accordance with the surface water management scheme. This includes management of silt-laden water. Monitoring for the existing landfill site shows that the engineered containment measures are effective and that groundwater quality adjacent to the Site is not affected by the landfill activities. The surface water and groundwater quality at Thornhaugh will continue to be monitored in accordance with schemes agreed with the Environment Agency through the EP.

Effects on trees along the western edge of Bedford Purlieus.

6.2.8 Trees along the western edge of Bedford Purlieus could suffer impacts to their root systems as a result of earthmoving and land forming. The Site is separated from Bedford Purlieus by Old Oundle Road, which is an adopted highway subject to a traffic order (cars are prohibited). The root protection area for Bedford Purlieus falls outside the western boundary of the Site. Full details are set out in the Arboricultural Impact Assessment in Annex 2.

Summary of predicted effects on statutory sites.

6.2.9 Based on compliance with the EP and implementation of the schemes for dust and surface water management, there will be no effect or a negligible effect on the function or conservation status of any statutory site. The predicted effect is assessed as being Neutral, not significant. In the long-term, the restoration will provide new and enhanced links to existing habitats, most notably extending the capacity of Bedford Purlieus to support notable species and contributing to conservation aims of Nature Recovery Networks within the wider Rockingham Forest area. This is predicted to have to have a ‘Major’ beneficial effect, significant at a Regional level.

6.3 THORNHAUGH CWS

6.3.1 No works will be undertaken in the CWS as a result of the proposed development. The CWS is currently protected from terrestrial impacts by the temporary amphibian fencing (TAF) that was installed as part of previously-licensed translocation work (as shown on Figure 3 in Annex 1). The TAF also provides a buffer between Site activities and the chain of ponds to the north. The TAF will be retained in situ until the point at which it needs to be removed to allow re-grading of the adjacent land in order to achieve the proposed restoration profile. This work will be carried out carefully under an ecological watching brief. In addition, measures put in place to protect Bedford Purlieus will also benefit the CWS. As a result, there will be no or negligible effect on the function or conservation status of the CWS. The predicted effect is assessed as being Neutral, not significant.

6.4 WET WOODLAND HABITAT

Impacts.

6.4.1 The wet woodland currently occupies around 390m of the brook corridor's 1.15km total. It is an S41 habitat and is of particular importance for its invertebrate assemblage, although surveys indicate that its value is declining in the absence of management. The re-profiling of the adjacent landscape could result in an increased rate of water flowing into the brook. An increase or decrease in water levels and/or change in water quality could alter the species composition and degrade the conservation value of the wet woodland and the assemblage of species that it supports, contrary to nature conservation objectives.

Embedded mitigation.

6.4.2 The whole brook corridor will be buffered from any direct effects of earthmoving and re-profiling operations by the implementation of a Construction Exclusion Zone (CEZ) to protect trees, as per the Arboricultural Impact Assessment in Annex 2.

6.4.3 Leachate, groundwater and surface water monitoring is undertaken in Thornhaugh in accordance with the EP and the monitoring results will be reported to the Environment Agency in accordance with the EP. The surface water runoff from the Site will be managed in accordance with the surface water management scheme.

6.4.4 Measures to enhance the wet woodland will be included in the Habitat Management and Monitoring Plan, which will be submitted to discharge an appropriately worded planning condition. This will include a monitoring protocol using the current information as a baseline and utilising changes in the botanical composition and invertebrate assemblage as indictors of a response to Site activities during restoration and subsequent management.

Predicted effects.

6.4.5 It is considered likely that in the short-term, the implementation of protective measures will result in a negligible effect on function or conservation status of the wet woodland, although in the absence of management, the gradual process of succession is likely to see it continue to decline naturally over time as it dries out, with a concomitant loss of invertebrate interest. This can be reversed and with appropriate management, the area of wet woodland can be increased, benefiting a range of species. In the medium- to long-term, the effect of management could be Moderate beneficial, significant at a District or County level.

6.5 HEDGEROWS

Impacts.

6.5.1 Two sections of hedgerow totalling 835m will be lost, most likely in stages. This will result in a temporary but reversible loss of an S41 habitat that provides foraging opportunities for invertebrates and bats and nesting habitat for birds.

Embedded mitigation.

6.5.2 On completion, the restoration will result in the planting of 3,376m of species-rich hedgerow. 500m of hedgerow will be planted in Phase A and 280m in Phase C in 3 to 5 years following the commencement of the development. 240m will be planted in Phase D. The total hedgerow planting in these three phases is 1,020m, thus exceeding no net loss within around seven years of commencement. It is likely to take 5-7 years for the hedgerows to reach a functional state so the loss is likely to vary from short- to medium-term for most species affected.

6.5.3 Retained hedgerows and trees will be protected from damage by strict adherence to the measures set out in the Tree Protection Plan (Figure 1 in the Arboricultural Impact Assessment in Annex 2) and new plantings will be protected by fencing as necessary. Dust control measures will continue to be implemented at the Site as set out in ES Chapter 14.

Predicted effects.

6.5.4 Once established, the overall length (and quality) of new hedgerow will exceed that to be lost by over 400%. The predicted effect is assessed as being Minor beneficial, significant at the Local level.

6.6 GRASSLAND AND SCRUB

Impacts.

6.6.1 With the exception of the CWS, the currently restored areas of Thornhaugh, the brook corridor and around half the grassland around the new ponds within the Conservation Area in the south west of Cooks Hole, it is reasonable to assume that all other grassland and scrub on Site will

be lost. It is difficult to quantify the total area accurately but this will result in a gradual, temporary but reversible loss of habitat that provides foraging opportunities for all of the species recorded using the Site and breeding/nesting habitats for invertebrates and ground-nesting birds.

Embedded mitigation.

6.6.2 On completion, the restoration will result in the creation of around 49ha of varied grassland types including calcareous (specifically to benefit certain invertebrates) and neutral. It is likely to take 2-3 years for the grassland to reach a functional state so the loss is likely to be short-term for most species affected. The restoration will also deliver almost 11ha of mixed scrub.

Predicted effects.

6.6.3 Once established, the overall area and quality of grassland and scrub will exceed that to be lost and there is currently a paucity of these habitats on the Site. Both habitat types provide terrestrial habitat connectivity for all of the group/species recorded using the Site, with the greatest beneficiaries being invertebrates and nesting birds. The predicted effect is assessed as being Minor beneficial, significant at the Local level increasing to Moderate beneficial, significant at a District level, once the habitats are established and under appropriate management.

6.7 INVERTEBRATES

Impacts.

6.7.1 The phased operations of the Site will result in the gradual loss (and phased replacement) of grassland, scrub hedgerows and areas of open mosaic habitats, which in combination with retained habitat, are important to a broad range of invertebrates, including two S41 butterflies: dingy and grizzled skipper. It is difficult to quantify the total areas accurately but this will result in a gradual, temporary but reversible loss of habitats that provide breeding, nesting and foraging opportunities for invertebrates, with the greatest effects on more sedentary species and those with limited or specific foodplants.

Embedded mitigation.

6.7.2 The phased approach to the operation and restoration will ensure that as far as possible, areas of key habitats will remain available for use by invertebrates throughout the development.

Predicted effects.

6.7.3 Whilst the retention of the CWS, brook/wet woodland corridor and Site boundary features will mitigate the effects to some degree, earthmoving and re-profiling will inevitably result in an adverse impact on the species diversity and numbers of individuals using the Site. In the case of the most notable species, any effects are likely to be short-term, for example, key habitats

for dingy and grizzled skipper lie within the CWS and restored grassland in the north of Thornhaugh. Whilst further expansion will be temporarily limited until new habitats are established, viable populations will be maintained in readiness to colonise them. This principle is applicable to most invertebrates that have been recorded using the Site.

6.7.4 In the long-term, the mosaic of habitats to be created as a result of the restoration will provide more opportunities for the current assemblage of invertebrates to increase and for the Site to be colonised by new species, for example, other S41 butterflies such as brown and black hairstreak (both scrub/woodland species). The new habitats will also extend the capacity of Bedford Purlieus to support notable species.

6.7.5 With appropriate long-term management (including that of the CWS and wet woodland), the effects on the invertebrate assemblage are predicted to be Moderate beneficial, significant at a District or County level.

6.8 AMPHIBIANS

Impacts.

6.8.1 Three ponds (Ponds 18, 19 and 20) will be destroyed to enable the creation of the new landform. With the exception of the CWS, wet woodland/brook corridor and currently restored areas on Thornhaugh, it is likely that all the terrestrial habitat on Site that is used by amphibians will be impacted at some point.

Embedded mitigation.

6.8.2 The mitigation strategy has been designed to enable Natural England to grant a licence on the grounds of Licencing Policy 1 – 'Greater flexibility to dispense with exclusion and relocation activities where there is investment in habitat provision' and Licencing Policy 3 – 'Greater flexibility on exclusion measures where this will allow GCNs to use temporary habitat'. These Policies can only be relied on where Natural England are confident the quality and quantity of compensatory habitats, together with their long-term management, are sufficient to meet Favourable Conservation Status under The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 without the need to remove GCNs from the impact area by way of conventional fencing and trapping.

6.8.3 The TAF that was installed as part of previously-licensed translocation work will be retained in situ and will be removed strategically in sections when it is no longer required to provide a barrier to movement.

6.8.4 Prior to the loss of any waterbody, there will be a supervised drawdown and removal of any amphibians present. Prior to clearance, all high value habitats will be assessed and hand-searched where deemed necessary. In all cases, amphibians will be recorded and released into place of safety.

6.8.5 With the exception of ponds 18, 19 and 20, all other ponds will be retained and have been incorporated into the restoration plan. In addition, twelve new purpose-built ponds will be created (a ratio of 4:1 for those lost, equalling the compensation requirements of District Level Licensing). The ponds will be clay-lined and will be planted-up with locally-native species. The ponds will be located in a dedicated Conservation Area to be created in the south-western corner of Cooks Hole, north and south of the brook, contiguous with the western edge of Bedford Purlieus and the CWS in order to provide optimal habitat connectivity.

6.8.6 The Conservation Area will be protected and separated from the rest of the Site by new species-rich hedgerows. A gate will be installed to facilitate access for management purposes. The terrestrial habitats within the Conservation Area will comprise a mosaic of neutral/calcareous grassland with 'islands' of scrub. A minimum of 12 hibernacula will be created, comprising large piles of inert rubble and timber capped with membrane and turves. The grassland will be cut annually, late in the season to benefit invertebrates and managed on rotation to ensure there are always areas of taller, undisturbed vegetation. Population size class assessments will be undertaken annually in order monitor progress towards achieving favourable conservation status.

Predicted effects.

6.8.7 The location of the Conservation Area in relation to Bedford Purlieus and the CWS will facilitate the interchange of animals between populations, enabling genetic mixing. The combined total of 26 ponds set in extensive, managed, connected habitats will ensure the long-term sustainability of a range of amphibian species. Once established, the Conservation Area could be incorporated into the CWS. The south-western part of the Conservation Area will be created in Phase A (the first 12-18 months of the development), with the north-western part following four to five years later in Phase D. There will be no barriers to movement so amphibians are free to colonise these areas at any point in time. Any adverse effects on amphibians are considered reversible and short-term. Once new habitats are established, the overall long-term effect is predicted to be Moderate beneficial, significant at the County level.

6.9 REPTILES

Impacts.

6.9.1 Surveys indicate the Site is unlikely to be important to reptiles and suitable habitats on Site that will be impacted by work are limited to the hedgerow running east-to-west between Thornhaugh Landfill Site and Cooks Hole Quarry and the associated rough grassland headlands either side. Elsewhere, only small pockets of suitable habitat will be affected.

Embedded mitigation.

6.9.2 Habitats suitable for use by reptiles will undergo habitat manipulation so that any reptiles present are able to displace from these areas prior to vegetation clearance. Where necessary,

targeted destructive searches will be undertaken in order to demonstrate that reasonable effort has been made to avoid killing and injury of reptiles and ensure legal compliance.

6.9.3 The restoration will result in the creation of a habitat mosaic that will benefit reptiles, including ponds (for grass snakes), grassland for foraging and hedgerows for cover and connectivity with adjacent habitats (most notably Bedford Purlieus), encouraging the free movement of animals between these areas.

Predicted effects.

6.9.4 In the short- to medium-term, the effects on reptiles are predicted to be Neutral, non-significant, with no or negligible effect on function or conservation status. In the medium term, reptiles will benefit as each phase of the restoration is completed. In the long term, once new habitats are established, the effect is predicted to be Minor beneficial, significant at a Local level.

6.10 BIRDS

Little ringed plovers.

Impacts.

6.10.1 In 2023, two pair of little ringed plovers were confirmed as breeding within an area of bare ground in Cooks Hole Quarry. Little ringed plovers are summer visitors to Britain, arriving as early as mid-March and nesting from April to July/August. They are highly territorial and favour broken, sparsely vegetated ground, which is the dominant habitat in both the north-eastern and south-eastern parts of Cooks Hole. As a result, any future nesting attempts could be made anywhere in these areas.

6.10.2 As a Schedule-1 listed species, little ringed plovers are protected from disturbance while building a nest or whilst on or near a nest containing eggs or young. Dependent young are also protected from disturbance. Any damage to an active nest(s) and/or disturbance to breeding adults or young would be a breach of legislation and contrary to nature conservation objectives.

Embedded mitigation.

6.10.3 Habitats suitable for use by little ringed plovers will be identified and scanned for behaviour indicating active nest sites each spring annually, commencing in the 2024 breeding season. This information will be relayed to Site staff and an appropriate buffer zone will be set up to prevent damage to nests and to avoid disturbance. Nest monitoring will continue at intervals until the young have fledged.

6.10.4 A 5,538m² area of bare ground has been demarcated as little ringed plover habitat in the restoration plan. This will be created in Phase J3, approximately twelve-to-fourteen years into the scheme. In order to provide habitat continuity and to not miss a breeding season, six detention basins totalling approximately 22,320m^2 will be created. These comprise bare ground

left to colonise naturally. Their function is to temporarily hold excess surface water during storm events and it is anticipated that some or all will be dry in the summer, making the stony, sparsely-vegetated margins available for use by little ringed plovers. Importantly, all six detentions areas will be created before the loss of the area used in 2023: two in Phase A, two in Phase B and two in Phase F (which is immediately adjacent to the nesting area used in 2023). This approach will ensure that sufficient habitat remains available to support at least two breeding pairs at all times throughout the operations.

Predicted effects.

6.10.5 Habitat will be available for use by little ringed plovers throughout the restoration and it is likely this species will benefit as each phase of the restoration is completed. In the long term, once new habitats are established, the number of suitable nesting areas and the physical distance between them (which is an important factor for a territorial species), may make it possible for the Site to support additional nesting pairs. Whilst this would clearly result in a beneficial effect if it occurred, there may not be sufficient numbers of little ringed plover in need of such habitat by the time it becomes available. Thus, there is currently sufficient confidence to predict that the overall effects are likely to be Neutral - non-significant, the restoration has the potential to have a Moderate beneficial effect, significant at the District level if the number of breeding pairs of little ringed plover resulted in a sustainable increase over time.

Sand martins.

Impacts.

6.10.6 In 2023, the sand martin colony was present in a bank within Phase J2. Sand martins are summer visitors to Britain, arriving in mid-March and nesting through to July. They are gregarious birds that nest in colonies, excavating nest burrows in steep-faced banks of material, often either the exposed face of an excavation or a stockpile. Such transient habitats are frequent on the Site so future nesting attempts could be made anywhere where there is suitable habitat.

6.10.7 Unlike little ringed plovers, sand martins are not protected against disturbance so only active nest sites need protecting. Any damage to active nests would be a breach of legislation and contrary to nature conservation objectives.

Embedded mitigation.

6.10.8 Habitats suitable for use by sand martins will be identified and scanned for behaviour indicating active nest sites each spring annually, commencing in the 2024 breeding season and can be combined with surveys designed for little ring plovers. This information will be relayed to Site staff and an appropriate buffer zone will be set up. Nest monitoring will continue at intervals until the young have fledged.

6.10.9 The clearance of habitat suitable for use by sand martins will be undertaken outside the breeding season.

6.10.10 New nesting provision for sand martins will be created in Phase D, approximately five-to-seven years into the operations and before the nest site in Phase J2 that was used in 2023 will be lost.

Predicted effects.

6.10.11 On the assumption that suitable habitats were available for use by sand martins returning to the Site each year, there will be no effect on their conservation status and the predicted effect is assessed as being Neutral, not significant. In the long-run, the restoration will increase the invertebrate biomass available for sand martins (and other insectivorous birds) potentially resulting in an increase in the survival rates and thus their populations. Thus, the predicted effect is assessed as being Minor beneficial, significant at a local level.

6.11 BATS

Impacts.

6.11.1 Only the buildings at Cooks Hole Farmhouse and the mature trees along the brook corridor are currently suitable for use by roosting bats. None will be affected by work and there is a sufficient buffer from working areas that disturbance is not an issue. Elsewhere, there are currently other trees with potential for use by roosting bats, although this could change over time, for example, woodpeckers excavate new nest holes every year and do not re-use them; trees are also liable to rot, decay and storm damage, all of which can create suitable roost features for bats.

6.11.2 The majority of commuting and foraging activity currently takes place along the more productive and continuous wet woodland corridor and Site boundaries. The gappy hedgerows crossing the Site and open grassland are also used by foraging bats but to a lesser degree; the impact of their loss is likely negligible.

6.11.3 The surface water management lagoons provide a constant source of drinking water through the summer, which is especially important to nursing females during the maternity period.

6.11.4 As nocturnal mammals, all species of bats are light phobic to one degree or another and the inappropriate illumination of roosts or important commuting and foraging areas can result in unnecessary disturbance.

Embedded mitigation.

6.11.5 The planting of 3,376m of species-rich hedgerow will provide bats with acoustic markers to aid commuting routes and once established, will attract more invertebrates and provide a valuable foraging resource.

6.11.6 As features suitable for use by bats can be created quickly, any trees subject to felling will be re-assessed in advance in accordance with best practice guidelines and appropriate mitigation measures will be implemented.

6.11.7 In order to provide additional roosting opportunities for bats, 20 Schwegler 1FF woodcrete bat boxes (or similar) will be fixed to suitable trees. In addition, three pole-mounted Eco Rocket bat boxes (or similar) will be installed close to ponds in the GCN Conservation Area.

6.11.8 Twelve new waterbodies will be created in Phase A and D before the surface water management lagoons are lost during Phases F and J3. This will ensure that there is a continual supply of drinking water for bats and other species. In addition, as the ponds mature, the invertebrate biomass will increase, providing a valuable foraging resource for all bat species.

6.11.9 There will normally be no night-time working and the Site will not be floodlit so bats will not be subject to disturbance by light, noise or dust. If lighting is necessary for health and safety reasons, it will be directed downward to minimise light spill in accordance with best practice guidelines.

Predicted effects.

6.11.10 The restoration has been designed to maximise habitat connectivity, both within the Site and between the Site and adjacent habitats, in particular Bedford Purlieus. The significant increase in linear habitats such as hedgerows will result in a far more connected landscape than currently exists, providing new flyways and commuting routes. The areas of new grassland, woodland and scrub planting will provide sheltered foraging opportunities. Once established, the overall area and quality of these habitat will greatly exceed those to be lost.

6.11.11 The phased approach will result in habitat loss and subsequent habitat creation taking place simultaneously over years. As bats are highly mobile species, they are likely to switch foraging areas quickly in response to food availability. As a result, in the short term, bats are likely resilient to any effects. In the medium- to long-term, the predicted effects are assessed as being Minor beneficial, significant at the Local level, potentially increasing to Moderate beneficial, significant at the District or County level if the bat boxes are occupied by a maternity colony of a scarcer species such as barbastelle bat.

6.12 SUMMARY OF PREDICTED RESIDUAL EFFECTS

6.12.1 It is considered likely that any adverse effects of the proposed development can be mitigated in full by the implementation of the numerous measures set out above and that no residual effects are predicted.

7 ASSESSMENT OF CUMULATIVE EFFECTS

7.1.1 Peterborough City Council (PCC) has identified five projects requiring assessment for potential cumulative effects. These are described in Table 8.

TABLE 8. LIST OF PROJECTS THAT HAVE BEEN ASSESSED FOR POTENTIAL CUMULATIVE EFFECTS.

No	Site name	Planning permission reference and date that planning permission was granted	Comments
1	Thornhaugh II	M25/1/3 – M25/1/6 (97P0071) February 1999	The operations of winning and working of minerals and the deposit of mineral waste must cease no later than 21 February 2025. It is understood that operations in the main part of Thornhaugh II ceased a number of years ago.
		APP/J0540/A/12/2179541/NWF 8 May 2013	Recycling of residual waste and infilling up to ground levels (approx. 6 hectares of Thornhaugh II). Development had to commence by May 2016.
2	Thornhaugh IIB	14/01716/MMFUL 10 April 2015	5-year operation to extract 700.000 tonnes of limestone and restore to ground levels with imported inert materials. The operations had to commence by 2021 and will be completed by 2026.
3	Cross Leys Quarry Leicester Road	19/01530/WCMM, 10 December 2020	Restoration of quarry workings to agriculture and woodland through the importation and deposit of inert restoration materials and quarry waste. Operations had to commence by December 2023 and the operations are anticipated to be completed in 7 years.
		19/01370/WCMM 10 December 2020	
		19/01365/MMFUL 10 December 2020	
4	A47 Wansford to Sutton	Development Consent Order 2023 (S.I. 2023 No. 218) 17 February 2023	Various highways works including dualling the A47 from the Wansford eastern roundabout for 2.6km and improvement of the on/off ramps for the A1. The works must commence within 5 years of the date of the grant of the order.
5	East Northants Resource Management Facility (ENRMF)	Development Consent Order (SI 2023 No.110) 23 January 2023	Hazardous waste and LLW waste landfill and waste treatment and recovery facility with restoration to nature conservation habitats. The operations are ongoing. The operations must cease at the site by 31 December 2046.

7.1.2 When considered in combination with the proposed development, none of the above projects contributes to a cumulative effect.

8 COMPENSATION, ENHANCEMENTS & CONCLUSIONS

8.1.1 Replacement habitats are embedded within the design, fully mitigating all adverse effects and providing additional enhancement therefore, no compensation is necessary.

8.1.2 The proposed restoration will create a mosaic of woodland with shrubby edges, a large area of calcareous and neutral grassland, scattered trees, a network of hedgerows, waterbodies and areas of open mosaic habitats. Taken together, these will provide new and enhanced links to existing habitats, most notably extending the capacity of Bedford Purlieus to support notable species and contributing to conservation aims of Nature Recovery Networks within the wider Rockingham Forest area.

8.1.3 The proposed new and extended habitats will generate significant BNG in excess of that specified in the Environment Act 2021and is fully in accordance with both national and local nature conservation policy objectives.

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TECHNICAL ANNEX 1:

ECOLOGY BASELINE: COOKS HOLE QUARRY AND THORNHAUGH LANDFILL, PETERBOROUGH

FINAL

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Contents **Page**

1 INTRODUCTION 1
2 DESK STUDY 1
2.1 METHODS 1
2.2 RESULTS 2
3 HABITATS, PLANT COMMUNITIES AND SPECIES 4
3.1 METHODS 4
3.2 RESULTS 5
3.3 ASSESSMENT OF BIODIVERSITY IMPORTANCE 13
4 INVERTEBRATES 13
4.1 DESK STUDY 13
4.2 METHODS 14
4.3 RESULTS 15
4.4 ASSESSMENT OF BIODIVERSITY IMPORTANCE 17
5 AMPHIBIANS 19
5.1 DESK STUDY 19
5.2 METHODS 21
5.3 RESULTS 22
5.4 ASSESSMENT OF BIODIVERSITY IMPORTANCE 24
6 REPTILES 25
6.1 DESK STUDY 25
6.2 METHODS 25
6.3 RESULTS 26
6.4 ASSESSMENT OF BIODIVERSITY IMPORTANCE 26
7 BREEDING BIRDS 27
7.1 DESK STUDY 27
7.2 METHODS 27
7.3 RESULTS 28
7.4 ASSESSMENT OF BIODIVERSITY IMPORTANCE 29
8 BATS 30
8.1 DESK STUDY 30
8.2 METHODS 30
8.3 RESULTS 31
8.4 ASSESSMENT OF BIODIVERSITY IMPORTANCE 35
9 OTHER NOTABLE/PRIORITY SPECIES 35
10 REFERENCES 36
APPENDIX 1 38
APPENDIX 2 48
APPENDIX 3 52
APPENDIX 4 53
APPENDIX 5 54

APPENDIX 6 55
APPENDIX 7 56

Figures.

1 Habitat map (Thornhaugh Landfill Site).
2 Habitat map (Cooks Hole Quarry).
3 Pond locations.
4 Reptile tin locations.
5 Bat detector locations.

TECHNICAL ANNEX 1: ECOLOGY BASELINE. COOKS HOLE QUARRY AND THORNHAUGH LANDFILL, PETERBOROUGH

1 INTRODUCTION

1.1 This document provides the detailed desk study, survey methods and results of the various ecological studies undertaken to inform the assessment of potential impacts associated with the restoration of Cooks Hole Quarry and Thornhaugh Landfill Site. For consistency and clarity, the document adopts the following terminology;

- Site – The full extent of land included within the development scheme area.
- Cooks Hole – The southern parcel of land consented for the quarrying of minerals.
- Thornhaugh – The northern parcel of land consented for landfill.

1.2 English names for species are used throughout the text with a full list of all species recorded from the Site, together with their scientific names, given in Appendix 1. Where names of species not recorded are referred to, the scientific name is also given in the text. English and scientific names for higher plants are given according to Stace (Stace, 2019).

1.3 A summary of the legal protection for statutorily protected species relevant to the assessment is provided in Appendix 2.

1.4 This document has been prepared by ESL (Ecological Services) Limited (ESL).

2 DESK STUDY

2.1 METHODS

2.1.1 The Natural England 'MAGIC' and 'Nature on the Map' websites were consulted to obtain information on any internationally protected sites germane to terrestrial ecology and for citations of any Sites of Special Scientific Interest (SSSI) or National Nature Reserves (NNR) within 5km of the Site. Information was also sought on any Local Nature Reserves (LNR) within a 2km radius of the Site.

2.1.2 The Cambridgeshire and Peterborough Environmental Records Centre (CPERC) and the Northamptonshire Biodiversity Records Centre (NBRC) were asked to provide a data report on local sites of conservation interest including County Wildlife Sites (CWS) and Local Wildlife Sites (LWS), together with notable species within a 2km search area. The desk studies are provided in full as Appendix 3.

2.1.3 This document also makes use of the extensive ecological information gathered to inform previous planning applications.

2.2 RESULTS

Data search.

2.2.1 The results are summarised in Tables 1 and 2 below. Pre-2003 records have been screened out, as have records of such low resolution as to be of no use. For the purposes of this report, 'Important Species' are those:

- Having statutory protection under The Conservation of Habitats and Species Regulations 2017, as amended (HSR).
- Listed as Species of Principal Importance according to Section 41 of the Natural Environment and Rural Communities Act 2006 (NERC) (formerly UK BAP species), hereafter referred to as S41 species.
- Listed in the Vascular Plant Red List for England (Stroh *et al*., 2014).
- Listed within Cambridgeshire and Peterborough Additional Species of Interest (CPASI; The Cambridge and Peterborough Biodiversity Group, Updated 2021).
- Listed in the Northamptonshire Biodiversity Action Plan (Northamptonshire Local Nature Partnership, 2016).

TABLE 1. Sites with a statutory or non-statutory designation for nature conservation within the search area.

Name, Designation and Description	Proximity
Barnack Hills and Holes Special Area of Conservation. Semi-natural dry grasslands and scrubland facies on calcareous substrates for which this is considered one of the best areas in the United Kingdom.	4.6km northeast.
Bedford Purlieus NNR, SSSI. This is an ancient woodland supporting a variety of woodland community types that are largely restricted (nationally) to lowland England. Noted for its diversity of herbaceous plants, associated fauna and for the wide range of coppice woodland types.	Adjacent to the west.
West, Abbot's & Lounds Woods SSSI. This site holds a range of lowland woodland types, many of which are scarce in Britain. These include a stand of plateau alder wood (a type known from no other ancient woodland in Cambridgeshire). Some typical ancient woodland plants are recorded.	0.65km north.
Bonemills Hollow SSSI. This area supports grassland communities of calcareous and marsh types. The calcareous grassland is of the Jurassic limestone type, which is restricted nationally.	1km northwest.
Old Sulehay Forest SSSI. One of an important group of ancient woodlands on calcareous strata in the north-eastern part of Rockingham Forest. The varied soil conditions give rise to several coppice types, notably the nationally-restricted acid birch-ash-lime and acid pedunculate oak-lime stand types. A diverse ground flora includes a number of species of rare occurrence in Northamptonshire.	1km southeast.
Wansford Pasture SSSI. Supports two main grassland types, notably a species-rich flush and Jurassic limestone grassland. These grassland types are now nationally scarce and are particularly uncommon in Cambridgeshire.	1.1km east.
Collyweston Great Wood & Easton Hornstocks NNR and SSSI. The largest Northamptonshire remnant of the ancient Purlieu coppices of Rockingham Forest. A complex mosaic of vegetation occurs, closely correlated with soil characteristics. A nationally uncommon coppice type is present.	1.8km west.
Thornhaugh Quarry CWS. Site containing water bodies where more than 50 individual great crested newts (GCN) can be counted during the breeding season.	On-site.

Name, Designation and Description	Proximity
Bedford Purlieus - Wittering Road Verge CWS. The site qualifies because it contains at least 0.05ha of National Vegetation Classification (NVC) community CG3 upright brome grassland and because it supports frequent numbers of at least six strong calcareous grassland indicator species.	0.3km north.
West Wood Meadow CWS. The site qualifies as it contains 0.25ha of M27 meadowsweet - wild angelica mire, stinging nettle - tufted vetch sub-community.	0.7km north.
Stone Pit Quarry LWS. An old quarry that has developed an open mosaic habitat that supports a fairly advanced calcareous scrub with colonizing vegetation on the bare, rocky ground in between, all interspersed with small paths and tracks. The abundance of flowers attracts many insects, providing an excellent hunting territory for dragonflies and damselflies breeding in the flooded areas of the east pit. A very important site, with particular significance for plants and invertebrates.	1km south.
Yarwell Quarry LWS. An old quarry with large areas of bare sandy ground interspersed with species-rich calcareous grassland, pools and areas of woodland and scrub. The site is an invaluable habitat for calcareous plants, a variety of insects and reptiles and qualifies as an LWS under the Open Mosaic Habitat Criteria, as well as with the areas of calcareous grassland (15 calcareous grassland indicators, including 11 strong).	1.1km southeast.
Standen's Pasture LWS. One of two wildlife trust reserves set on limestone grassland either side of a valley. Twenty neutral grassland (eight strong) indicators recorded alongside 14 calcareous grassland (seven strong), qualifying it as an LWS.	1.2km east.
Ring Haw Woodland LWS. An ancient woodland of predominately ash/oak, with a good mixture of other trees and a number of ancient woodland species.	1.4km south.
Ring Haw Green Lane LWS. An ancient byway with a thick and varied hedgerow containing a variety of ancient woodland species. As it stands though, the Lane seems to be well-used by birds and invertebrates.	1.4km south.
Wittering Valley CWS. Supports limestone grassland containing flushes, seepages or springs that are not appreciably degraded.	1.5km north.
Ring Haw Quarry Grassland LWS. Areas of species-rich calcareous grassland amongst scrub and woodland.	1.55km south.
Ring Haw Quarry Gullet LWS. An old sand and ironstone gullet that has retained areas of bare ground and developed areas of species-rich grassland. Alongside the pools and scrub, this provides a valuable habitat mosaic for wildlife, in particular, invertebrates.	1.6km south.
Whiteland's Farm LWS. A grassland site adjacent to part of Old Sulehay Nature Reserve on the site of an ex-pig farm. The site has calcareous influences, 16 calcareous grassland (nine strong) and 12 neutral grassland (five strong) were recorded, easily qualifying it as an LWS.	1.7km south.
Fair Oak Sale Quarry LWS. An area of old quarry workings that has developed an open mosaic habitat with a large extent of early successional species-rich calcareous grassland that is developing well on thin soils. The site qualifies as an LWS under the open mosaic and calcareous grassland criteria with 23 calcareous indicators recorded of which 14 were strong.	1.7km southwest.
Great Byards Sale LWS. An area of ancient woodland on the edge of the Rockingham Forest with a well-developed oak-ash canopy, decent shrub layer with derelict coppice in places and a well-developed herb layer in places. The woodland qualifies as a Wildlife Site as an area of extant ancient woodland with 15 ancient woodland indicator species recorded.	1.75km southwest.
River Nene CWS. A major river that is not grossly modified by canalisation or poor water quality. Part is a Grade C site in JNCC ISR. At least three species of *Potamogeton* spp., a nationally scarce vascular plant species, are noted, together with plant species that are rare in the county.	1.8km southeast.
Stibbings Pits CWS. The site contains at least 0.5ha of NVC S4 common reed swamp (3biii), a type 10A waterbody with more than 15 submerged, floating and emergent species (4bii) and has an overall invertebrate index exceeding 500 (11.6a).	2km east.
Fair Oak Sale LWS. An area of Ancient Semi-Natural Woodland containing over 25% broad-leaved cover and a good example of NVC W8. This site qualifies as a Wildlife Site for its ancient woodland with 48 woodland plants recorded, of which 14 are Ancient Woodland Indicator species.	2km southwest.

TABLE 2. Important species within the search area.

Species/Group	Status	Proximity
53 records for GCN, 2005-2022.	EPS	Closest on-site from Thornhaugh Quarry CWS.
15 records for other amphibians comprising common frog *Rana temporaria*, common toad, smooth newt and palmate newt, 2004-2021.	S41	Closest from Bedford Purlieus NNR, SSSI.
53 records for reptiles comprising common lizard, slow worm *Anguis fragilis* and grass snake, 2004-2021.	S41	Closest from Bedford Purlieus NNR, SSSI.
33 records for badger, 2003-2020.	PBA	Closest on-site from Thornhaugh Quarry CWS.
51 records for hazel dormouse *Muscardinus avellanarius*, 2003-2015.	EPS	Closest from Bedford Purlieus NNR, SSSI.
One record for harvest mouse *Micromys minutus*, 2014.	S41	1.1km west.
One record for brown hare *Lepus europaeus*, 2016.	S41	1.3km south.
Two records for otter *Lutra lutra*, 2007.	EPS	Closest from River Nene, 1.8km east.
79 records for at least 11 species of bats, 2003-2019.	EPS	Closest from Bedford Purlieus NNR, SSSI.
580 records for at least 47 species of protected and priority birds, 2003-2022.	S41, Red List WCA-S1	Closest from Bedford Purlieus NNR, SSSI.
4777 records for protected and priority invertebrates, 2003-2022.	RDB	Closest from Bedford Purlieus NNR, SSSI.
909 records for protected and priority plants, 2003-2022.	S41	Closest on-site from Thornhaugh Quarry CWS.

Key: EPS – European Protected Species. RDB – Red Data Book (Invertebrates). WCA – Wildlife and Countryside Act 1981 (as amended). S5 – Schedule-5 of the WCA. S1 – Schedule-1 of the WCA. Red List – Birds of Conservation Concern 4. PBA – Protection of Badgers Act 1992.

3 HABITATS, PLANT COMMUNITIES AND SPECIES

3.1 METHODS

3.1.1 A Preliminary Ecological Appraisal (PEA) was undertaken on 25 and 26 June 2023 by Luke Hartley ACIEEM in accordance with the standard survey method (JNCC, 2010). All habitats and plant communities within the Site were mapped and characterised by identifying the dominant and typical species and are described using the UK Habitat Classification System (UK Hab, 2023). All hedgerows were assessed for importance as defined by the Hedgerow Regulations 1997 and a search was made for any invasive, non-native plant species listed on Schedule-9 of the Wildlife and Countryside Act 1981 (as amended). The PEA also included an assessment of all habitats for their suitability for use by a range of protected species in order to design the scope of further investigations.

3.2 RESULTS

Local context.

3.2.1 The Site consists of two areas: Thornhaugh to the north and Cooks Hole Quarry to the south. It comprises a diverse mix of land-use and habitat, including active landfill, restored land following past mineral extraction, early successional habitats, agricultural grassland, the Thornhaugh Quarry CWS (hereafter referred to as the 'CWS'), a scrub- and wet-woodland corridor, various waterbodies and hedgerows. The Site borders Bedford Purlieus NNR to the west and a redundant quarry to the south. The A47 bounds the Site to the north and east, with arable land use beyond. The distribution of habitats on-site is shown on Figures 1 and 2.

Thornhaugh.

Sparsely vegetated urban land (u1f): Ruderal or ephemeral [81], Landfill [831].

3.2.2 The majority of Thornhaugh comprises an active landfill facility, comprising largely unvegetated surfaces, capped and unrestored cells, haul routes and material storage yards, as well as site offices and compounds (Photographs 1 and 2). Amongst this, fragments of early colonising ruderal vegetation are present with frequent butterfly bush throughout.

Photograph 1. View from the northwest, looking southeast.

Photograph 2. View from the south, looking northwest.

Other neutral grassland (g3c): Scattered scrub [10], Re-created habitat [61], Bare ground [510].

3.2.3 The area north of the CWS (Photograph 3), the area around the Weighbridge facilities and the area around a surface water management lagoon in the east comprise land that has colonised naturally following restoration. As a result, low-growing herbs are abundant, including frequent common bird's-foot trefoil, creeping cinquefoil, scentless mayweed, oxeye daisy, common ragwort, black medic, colt's-foot and common centaury. Patches of wood small-reed, goat's-rue, teasel and bramble are interspersed with patches of bare ground.

3.2.4 The northern slope has a much more established sward of abundant false-oat grass (Photograph 4). The herb layer includes creeping cinquefoil, ribwort plantain, dove's-foot crane's-bill, creeping thistle, upright hedge-parsley, common ragwort, teasel, wild parsnip and

common bird's-foot trefoil. Scattered shrub planting is present, including field maple, hawthorn, silver birch and wayfaring tree.

3.2.5 In the most northernly part of the Site, an annual plant community is present on a small area of sandy north-facing slope, comprising selfheal, common centaury, yellow-wort, fairy flax and blue fleabane. To the north of the surface water management lagoon a similar sandy patch, which also supports wild basil and pyramidal orchid.

Photograph 3. Naturally-colonised slope in foreground and more established sward beyond.

Photograph 4. More established grassland with occasional planted shrubs.

Other neutral grassland (g3c): Scattered scrub [10], Open mosaic habitats on previously developed land [80].

3.2.6 Within the CWS is a patchy mosaic of grassland in various stages of succession, interspersed with patches of bare ground. In order of most-to-least frequent, these plant communities comprise:

- Short herb grassland and annual plant communities such as common bird's-foot trefoil, silverweed, creeping cinquefoil, selfheal, common centaury and eyebright.
- Sparsely vegetated dry chalk grassland communities such as salad burnet, carline thistle, wild strawberry and wild liquorice (Photograph 5).
- Tall herb grassland communities such as common knapweed, oxeye daisy, perforated St.-John's wort and yellow rattle.

3.2.7 Throughout this area is self-set scrub, comprising abundant butterfly bush and species such as silver birch, hawthorn, grey willow and elder. The woodland edge is more densely scrubby and has abundant butterfly bush.

Aquatic marginal vegetation (f2d).

3.2.8 A series of lined ponds has been created in the CWS along the western boundary as part of a GCN mitigation scheme, some of which have been colonised by tall marginal and fen-type vegetation, including purple loosestrife, water mint, lesser pond-sedge, sharp-flowered rush, meadowsweet, marsh-bedstraw and brookweed (Photograph 6). Sea club-rush is also present (a deliberate translocation from elsewhere on Site some time ago).

	
Photograph 5. Sparsely vegetated sandy soil comprising dry chalk plant species.	**Photograph 6.** Marginal aquatic vegetation within a series of created ponds/depressions.

Other standing waters (r1g): Pond (priority habitat) [40], Freshwater – artificial [49].

3.2.9 The CWS originally comprised one 'natural' pond, with three more lined ponds constructed to create a GCN receptor site (ponds 1-4). A further eight ponds were created to extend the carrying capacity for GCNs. These ponds comprise:

- **Pond 1**: Situated on a higher elevation within the CWS, the water column is dominated by emergent common spike-rush and mosses, with frequent emergent bulrush and water mint and marginal hard rush.
- **Pond 2**: Similarly vegetated as Pond 1 on an area of lower elevation, additional species present comprise frequent water plantain and water figwort (Photograph 7).
- **Pond 3**: Fringed to the west and south by dense scrub and to the east and north by tall emergent vegetation including bulrush, great willowherb, hard rush and soft rush. There is much open surface water with abundant broad-leaved pondweed and occasional water plantain.
- **Pond 4**: Not lined and is the result of past material excavation works that have created a 'gorge' with a cliff of exposed bedrock along the woodland edge. Towards the south, it is deeper and fringed by birch scrub on its eastern bank. An aquatic assemblage of broad-leaved pondweed over submerged plants such as water forget-me-not and a fringe of sea club-rush is present. Towards the north, much shallower water is dominated by lesser pond-sedge.
- **Ponds 9-16**: A series of much smaller ponds running north along the woodland edge. Much of these do not hold sufficient water and/or are established by much vegetation due to their small size. They currently provide variation to the plant communities and habitat structure along the woodland edge, however, their function as 'ponds' is fairly limited.

3.2.10 An additional surface-water management lagoon (Pond 17) is present in the east of Thornhaugh (Photograph 8). It is concrete-lined and fed with water by a lined channel that runs along the north-eastern boundary of Thornhaugh. The lagoon forms part of the Site's water management system. Bulrush and common spike-rush are abundant and the water surface is covered by broad-leaved pondweed.

Photograph 7. View of pond 2.

Photograph 8. View of Pond 17 (surface water management lagoon).

Mixed scrub (h3h).

3.2.11 Dense mixed scrub is present within the CWS and along the edge of Bedford Purlieus comprising a mix of elder, butterfly bush, silver birch, bramble and grey willow over a ground flora dominated by common nettle and ground ivy.

3.2.12 Along the northern boundary hedgerow, there is extensive dense mixed scrub, largely comprising blackthorn together with elder, ash, oak, wild privet, dog rose and bramble with rare cherry laurel over tall herbs such as hemlock and greater burdock.

Other broadleaved woodland (w1g).

3.2.13 To the southern end of the CWS, an area of broadleaved woodland has established on the banks leading down towards Pond 4. This comprises sycamore and ash, with occasional field maple and an understorey of hawthorn, transitioning into a canopy of primarily grey willow and silver birch as it descends down the slope. Woodland ground flora comprises herb robert, common nettle and false-brome.

3.2.14 A small area of plantation is present to the south of the Thornhaugh site, bound by the current landfill, comprising Scots pine, horse chestnut and hawthorn.

Other native hedgerow (h2a6): Dry stone wall [114].

3.2.15 The southern boundary of Thornhaugh is marked by a hedgerow that runs from Bedford Purlieus east to the A47. This comprises abundant hawthorn with occasional elder and blackthorn. It is largely unmanaged and has grown to a height and width of ~3-3.5m (Photograph 9). The hedgerow becomes increasingly gappy towards the west and for a large part of the central section, the hedgerow gives way to patches of dense blackthorn and a length of dry-stone wall where species such as field scabious and common agrimony are present (Photograph 10). A public footpath runs along the southern side of this hedgerow.

Photograph 9. Southern boundary hedgerow.

Photograph 10. Dry-stone wall and public footpath.

Other native hedgerow (h2a6): Hedgerow with trees [11].

3.2.16 A hedgerow with occasional trees is present along the entire length of the northern boundary with the A47 (Photograph 11). The hedgerow is unmanaged and comprises abundant hawthorn with frequent elder, as well as ash and oak trees. This hedgerow continues the entire length of the boundary of the Site.

Other standing waters (r1g): Ditch [191], Dry [500].

3.2.17 Running along the northern boundary and the eastern side of the north slope are lined drainage ditches that form part of the surface water management system. At the time of the survey, this feature was dry (Photograph 12).

Photograph 11. Northern boundary hedgerow with developing blackthorn scrub in front.

Photograph 12. Lined drainage ditch.

Cooks Hole Quarry.

Sparsely vegetated urban land (u1f): Bare ground [510].

3.2.18 The majority of the northeast and most of the central area to the south comprise bare ground that is yet to be colonised (Photograph 13 below).

Sparsely vegetated urban land (u1f): Scattered scrub [10], Ruderal or ephemeral [81], Bare ground [510].

3.2.19 Towards the southeast, the bare ground is being sparsely colonised by ruderal vegetation, with a greater abundance of butterfly bush and birch scrub (Photograph 14).

Photograph 13. Extent of bare ground.

Photograph 14. Bare ground with limited early colonisers and scattered scrub.

Modified grassland (g4).

3.2.20 The western and south-western fields are utilised as agricultural grassland and had been cut at the time of the survey. Frequent grass species here comprise false oat-grass, perennial rye-grass, cock's-foot and Timothy, with occasional common nettle, ragwort, nodding thistle and creeping thistle. Towards the most southwestern extent, the field has a finer sward heavy with Yorkshire-fog and a greater herb assemblage including creeping buttercup, white clover, creeping cinquefoil and bird's-foot trefoil. This also extends into a mosaic of grassland and scrub habitat found within a ravine extending from the building to Bedford Purlieus in the west.

3.2.21 Areas south of Cooks Hole Farmhouse, adjacent to a wet woodland corridor comprise false oat-grass with dense stands of common nettle.

Other neutral grassland (g3c).

3.2.22 Where the landform descends towards a large lagoon on the western boundary (Pond 18) the grassland sward transitions to a more species-rich assemblage (Photograph 16) including species such as yarrow, red bartsia, wild mignonette, wild carrot, red clover, bird's-foot clover, black medic, perforate St.-John's wort and beaked hawk's-beard.

Other neutral grassland (g3c): Ruderal or ephemeral [81].

3.2.23 Scattered spoil mounds are present (particularly in the east and south) and many support dense vegetation comprising tall herbs, grasses and ruderals such as false oat-grass, cock's-foot, ragwort, curled dock, spear thistle, nettle, great willowherb, creeping thistle and abundant creeping cinquefoil.

Photograph 15. Typical view of relatively species-poor modified grassland.

Photograph 16. Grassland in the west of Cooks Hole Quarry with a more diverse sward.

Other standing waters (r1g): Pond (priority habitat) [40], Freshwater – artificial [49].

3.2.24 Three large lagoons are present within Cooks Hole Quarry, comprising:

- **Pond 18**: Situated along the western boundary with Bedford Purlieus, Pond 18 is the result of past mineral quarrying (Photograph 17). The western bank comprises exposed bedrock whereas the eastern bank grades very gently into the adjoining grassland. Aquatic vegetation is limited to broad-leaved pondweed.
- **Ponds 19 and 20**: Two mineral washing lagoons in the west of Cooks Hole Quarry (Photograph 18). These are steep-sided with deep clear water. The banks have been colonised by scattered willow, butterfly bush and silver birch scrub. Patches of emergent and marginal vegetation comprise common reed and sea club-rush. Aquatic vegetation is limited to broad-leaved pondweed and abundant hornwort.

Photograph 17. Pond 18, looking north.

Photograph 18. Pond 19.

Mixed scrub (h3h).

3.2.25 Within the ravine running from Cooks Hole Farmhouse west to Bedford Purlieus, the mosaic of habitats comprises mature and young scrub dominated by hawthorn with elder, ash, sycamore silver birch and bramble.

Wet woodland (w1d): Ditch [191].

3.2.26 An area of wet woodland is present around Cooks Hole Farmhouse and along a corridor running east to the A47 (Photograph 19). The canopy comprises crack willow with ash, oak and horse chestnut becoming more common where the ground is drier, particularly towards the east. On the west side of Cooks Hole Farmhouse, typical wet woodland ground flora occurs (Photograph 20), including species such as water mint, remote sedge, marsh marigold, water forget-me-not, marsh bedstraw, marsh horsetail, fool's watercress, water figwort, meadowsweet, wood dock, reed sweet-grass, creeping soft-grass, square-stalked St.-John's wort and creeping jenny. Where the canopy is more open, dense common nettle beds and stands of pendulous sedge occur.

Photograph 19. Cooks Hole Farmhouse and surrounding wet woodland.

Photograph 20. Typical wet woodland ground flora.

Other broadleaved woodland (w1g): Young trees – planted [201].

3.2.27 Along the boundary of Cooks Hole Quarry with the A47 is an 8m-wide belt of woodland planting (Photograph 21). Species include oak, hazel, hawthorn, silver birch, wayfaring tree and wild service tree.

Other native hedgerow (h2a6).

3.2.28 A relatively short section of hawthorn-dominated hedgerow runs from Cooks Hole Farmhouse to the northern boundary (Photograph 22).

Photograph 21. Young planted trees.

Photograph 22. Central, north-south hedgerow.

3.3 ASSESSMENT OF BIODIVERSITY IMPORTANCE

Habitats.

3.3.1 Wet woodland, ponds, open mosaic habitats on previously disturbed land and hedgerows qualify as S41 Habitats of Principal Importance (Section 41 of NERC). Due to their S41 status and ecological function, these habitats are important ecological features of the Site. When taken together, the CWS and size/mosaic of S41 habitats present indicate the Site is likely of County Importance.

Protected and priority plant species.

3.3.2 Carline thistle, common eyebright, common valerian, wild strawberry and field scabious ('*Near Threatened*' species in England; Stroh *et al*., 2014) were recorded infrequently.

3.3.3 No nationally rare or nationally scarce plant species or S41 Species of Principal Importance were recorded on the Site. However, pyramidal orchid, wild liquorice and common valerian are listed as CPASI (The Cambridge and Peterborough Biodiversity Group, Updated 2021).

3.3.4 With the exception of field scabious, which was located adjacent to the central dry-stone wall, all these species were either associated with the CWS or with boundary features and will not be impacted by the scheme.

3.3.5 The data search provided 2,020 records from the CWS comprising dwarf spurge ('*Vulnerable*' species in England; Stroh *et al*., 2014), common cudweed and corn mint ('*Near Threatened*' species in England; Stroh *et al*., 2014).

3.3.6 The assemblage of plant species recorded within the Site is considered of Local importance.

Non-native Invasive species.

3.3.7 No non-native invasive plant species listed on Schedule-9 of the Wildlife and Countryside Act 1981 (as amended) were recorded.

3.3.8 The data search provided one 2011 record of Japanese knotweed from Thornhaugh, as well as one 2020 record of wall cotoneaster from the CWS.

4 INVERTEBRATES

4.1 DESK STUDY

4.1.1 The desk study contained 4,777 records for protected and priority invertebrates dated between 2003-2022, the majority originating from Bedford Purlieus NNR.

Previous Site surveys.

4.1.2 Invertebrate surveys undertaken to inform the 2015 planning application for Thornhaugh assessed the terrestrial invertebrate assemblage to be of District importance and the aquatic invertebrate assemblage of the CWS to be of County importance.

4.1.3 Historic survey data for Cooks Hole appears to be limited to the wet woodland. A survey in 2009 reported the presence of six nationally scarce invertebrate species. Subsequent monitoring reports from 2014, 2016 and 2019 make assessments as any changes in flora and habitat composition but are absent any invertebrate monitoring.

4.2 METHODS

4.2.1 An initial Invertebrate Scoping Assessment was undertaken by Andy Jukes MCIEEM FRES of Conops Entomology Ltd in April 2023, followed by a full assessment of the Site. A baseline survey of the wet woodland was also carried out in order to determine the current invertebrate assemblage and inform future management. The Site and Wet Woodland assessments are set out below, with the wet woodland management and monitoring included in the EcIA. All three reports are provided in full in Appendices 4, 5 and 6.

4.2.2 The methods used for the assessment are those recommended in the Natural England guidance document *Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation* (Drake *et al.*, 2007).

- **Sweep netting.** This method provides the main proportion of the survey element and is the most efficient method for cataloguing a site's invertebrate resource. Sweep netting involves the use of a long-handled sweep net being swept over vegetation such as stands of grasses or flowers or along scrub fringes in order to gather invertebrate material.
- **Spot sampling.** Spot sampling is employed to collect large, conspicuous invertebrates such as bees and wasps from flowering plants and to supplement the sweep samples. Spot sampling is often the most effective method for recording species from high-fidelity niches.
- **Vacuum sampling.** Vacuum sampling took place on areas of short and tall swards as well as patchy bare ground.
- **Pitfall trapping.** No pitfall traps were used owing to the presence of GCNs.

Target groups – Site.

4.2.3 The groups targeted for the survey are those that are key indicators of a range of habitats and features, as defined by Drake (2007). The principal groups are:

- Heteropteran bugs (range of habitats including bare ground, short turf and scrub fringes).
- Various fly families including hoverflies and robberflies.
- Beetles (including leaf beetles, ground beetles and weevils).
- Aculeate Hymenoptera (bare ground, structural complexity, flowering plants).

Target groups – wet woodland.

4.2.4 The groups targeted for the survey are those that are key indicators of wet woodlands, as defined by Drake (2007). The principal groups are as follows:

- Heteropteran bugs (range of habitats including lush vegetation and trees).
- Various fly families including hoverflies and craneflies.
- Beetles (including leaf beetles, ground beetles and weevils).
- Aculeate Hymenoptera (owing to the historic presence of *Cleptes semiauratus*).

Survey dates and weather.

4.2.5 The Site was visited on four occasions. The survey dates and weather conditions are given in Table 3.

TABLE 3. Dates and weather conditions for the invertebrate surveys in 2023.

Visit No	Survey date	Weather conditions
1	2 June 2023	Wind and sunny, 17–20°C
2	5 July 2023	Sunny, 21–22°C
3	15 August 2023	Sunny, 20–23°C
4	4 September 2023	Sunny, 22–27°C

Survey constraints.

4.2.6 2023 experienced extremes in weather, from a dry and cold spring to a hot and dry June followed by a wet July and August, off the back of 2022, which saw a protracted drought and a series of heatwaves. Little-to-no rain for many months over the two years coupled with extreme heat events has been widely reported as having had a significant impact on invertebrate numbers. This rapid decline of invertebrates has resulted in a difficulty recording species diversity as many species are now at very low densities and numbers.

4.2.7 Results are therefore, on average, slightly lower than expected. However, the species recorded still reflect the Site's primary feature of conservation value; the early successional mosaic. It is therefore possible to assess the value of the Site with sufficient confidence.

4.3 RESULTS

Site (Thornhaugh & Cooks Hole).

4.3.1 One-hundred and seventy-six species from the sampled groups were recorded during the surveys. Twenty-one species recorded have a national status (11.9% of those recorded), though it is recognized by many of the national recording schemes that a number of these no longer warrant their current status and that they may need revising. This total does not include research-only moths. Table 4 gives a breakdown of the Site's invertebrate resources and highlights any species of significance recorded during the surveys.

TABLE 4. Species of importance within the Site.

Scientific name	Vernacular name	National/local status	Habitat preferences and species notes
Andrena similis	A mining bee	Notable b	Nest in patchy bare ground. A calcareous-fidelity species. Forages from a range of plants.
Aphanus rolandi	A ground bug	Notable a	Open short swards and bare ground.
Aulacobaris picicornis	A weevil	Notable b	A strict calcareous-fidelity species. Found on mignonettes (*Reseda* spp.).
Cerceris quinquefasciata	A solitary wasp	Red Data Book 3*; NERC Act Section 41 species	Open sandy sites. Now much more common than its status suggests and should be downgraded.
Coenonympha pamphilus	Small heath butterfly	NERC Act Section 41	Requires fine-leaved grassland, ideally with areas of very short turf or bare ground for basking.
Dasypoda hirtipes	A mining bee	Notable b*	Nests in bare and patchy bare ground. Feeds from yellow composites. No longer warrants a nationally significant status.
Dorycera graminum	Phoenix fly	Provisionally Nationally Scarce; provisionally near Threatened*; NERC Act Section 41 species	Clear habitat preferences unknown but it is much more common than its status suggests and no longer deserving of a nationally significant status.
Erynnis tages	Dingy skipper	NERC Act Section 41	Early succession with bird's-foot trefoil (*Lotus* spp.).
Evagetes dubius	A spider-hunting wasp	Notable b	Open short swards, friable soils.
Hedychrum niemelai	A rubytail wasp	Red Data Book 3*	A parasite on *Cerceris quinquefasciata.* Expanded its range significantly and now requires a downward revision in its status.
Hylaeus signatus	A yellow-faced bee	Notable b*	Feeds on mignonettes (*Reseda* spp.). No longer warrants a nationally significant status.
Lasioglossum malachurum	A solitary bee	Notable b*	Nests in bare and patchy bare ground. Feeds from a range of flowers, especially yellow composites. No longer warrants a nationally significant status.
Lasioglossum puncticolle	A solitary bee	Notable b	Nests in bare and patchy bare ground. Feeds from a range of flowers, especially yellow composites.
Microdynerus exilis	A solitary wasp	Notable b	Nests in deadwood. Feeds on small beetles. No longer warrants a nationally significant status.
Nomada fucata	A nomad bee	Notable a*	Parasite on the mining bee *Andrena flavipes.* No longer warrants a nationally significant status.
Nysson dimidiatus	A solitary wasp	Notable b*	A parasite on the solitary wasp *Harpactus tumidus.* No longer warrants a nationally significant status.
Odynerus melanocephalus	Black-headed mason wasp	Notable a*; NERC Act Section 41	Has exacting requirements from a site including presence of water, clay and grassland. May now be increasing in range and require status revision.
Ophonus azureus	A ground beetle	Nationally Scarce	Short turf and bare ground.

Scientific name	Vernacular name	National/local status	Habitat preferences and species notes
Philanthus triangulum	Bee wolf	Red Data Book 2*	A sandy-ground-nesting wasp. Feeds on honeybees. Requires a significant downward revision in its status.
Pyrgus malvae	Grizzled skipper	NERC Act Section 41	Early succession with prostrate-growing Rosaceae.
Sphecodes crassus	A cleptoparasitic bee	Notable b*	Brood parasite *of Lasioglossum* mining bees. Probably more common than its status suggests.

***Accepted as being more common than this status suggests; likely to be downgraded.**

Wet woodland.

4.3.2 One-hundred and five species from the sampled groups were recorded during the surveys. A single species recorded has a national status, though it is recognized by many of the national recording schemes that it no longer warrants its current status and that it will need revising. Table 5 give a breakdown of the Site's invertebrate resources and highlights any species of significance recorded during the surveys.

TABLE 5. Species of importance within the wet woodland.

Scientific name	Vernacular name	National/local status	Habitat preferences and species notes
Dorycera graminum	Phoenix fly	Provisionally Nationally Scarce; provisionally near Threatened*; NERC Act Section 41 species	Clear habitat preferences unknown but it is much more common than its status suggests and no longer deserving of a nationally significant status.

Analysis of the species assemblage for the Site and wet woodland.

4.3.3 The survey data from the Site and wet woodland were entered into the Pantheon software package, an analytical tool developed by Natural England and the Centre for Ecology & Hydrology to assist invertebrate nature conservation in England. Pantheon is also capable of other outputs such as Specific Assemblage Types (SATs). The Resource Usage and SAT tables are provided in the respective assessment reports in Appendices 5 and 6.

4.4 ASSESSMENT OF BIODIVERSITY IMPORTANCE

Site (Thornhaugh & Cooks Hole).

4.4.1 **Habitats.** The Site comprises a range of habitats broadly covering a single broad biotope, the 'open habitats', with the 'tree-associated' and 'wetland' also present on the Site. The Site's primary feature of conservation value is nestled within the open habitat's biotope, however, the other biotopes do contribute to the overall complexity of the Site and are therefore still deemed relevant and important to the discussion.

4.4.2 The habitat that is the most prominent across all areas of the Site is the short sward and bare ground habitat with 81 species of association. This is a very significant total of species and includes 17 species noted by Pantheon as having a nationally significant status.

4.4.3 The second most speciose habitat on the Site is the tall sward and scrub habitat, with 67 species of association recorded. The resource is moderately diverse and thought to be reflective of the limited area of this habitat type on the Site, which is largely restricted to a few defined and peripheral areas. It includes two species with a nationally significant status, though one of these (*Dorycera graminum*) is considered not to be scarce or threatened and will lose its status in an upcoming review.

4.4.4 There is a range of other habitat on the site, associated with either trees (decaying wood) or wetlands such as marshes and seepages. These are represented only by a few species from each habitat. Although not significant in terms of the species numbers, they do contribute to the overall mosaic of the site, particularly when considered with water sources, their value is high.

4.4.5 **Species.** The Site survey recorded 176 species, 21 of which were identified by Pantheon as being of value; a number of species are more common now than their status suggests so in time, this number would be revised downward as further status reviews are completed.

4.4.6 Owing to the challenging weather conditions over much of the 2023 survey season, the species lists are slightly shorter than expected but they do still present a very strong cross-section of species that are reflective of the habitats on the Site, in particular the bare ground and patchy swards.

4.4.7 The butterfly resource is significant. Both dingy skipper (*Erynnis tages*) and grizzled skipper (*Pyrgus malvae*), which are S41 species, are widespread across the site with the grizzled skipper seemingly most widespread and abundant. This species is listed by Butterfly Conservation as 'high priority' as it has declined by 49% since the 1970s. The dingy skipper is also 'high priority', according to Butterfly Conservation, having declined by 61% since the 1970s.

4.4.8 The suites of ground-nesting bees and wasps are also diverse and robust. Sixty-eight species are recorded, with 14 of these having a nationally significant status. However, a number of these are considered more common than their statuses suggest. It is suggested that should a focused survey of this group be undertaken, the Site's totals would likely be much greater than the total recorded from this current survey.

4.4.9 The proximity of the Site to Bedford Purlieus NNR presents opportunities to species that live along woodland edges. The red wood ant (*Formica rufa*) within the GCN mitigation area is a notable species for the Site. The wood ant, although not currently listed as scarce or threatened, is a species with a restricted distribution and is confined to areas of high tree cover. It lives along the edges of paths, rides and woodland edges. Its presence on the Site is a

positive component to the overall value of the site for invertebrates, not only those indicative of early succession but those dependent upon woodland or scrub edges.

4.4.10 **Site evaluation.** The Site supports a moderately high invertebrate fauna that includes a low number of localised and specialised species, 15 of which currently have nationally significant status. In addition, habitats on the Site provide a potentially significant resource for early successional invertebrates including strong populations of early successional butterflies. It also supports an extensive list of species associated with scrub fringes and woodland edge. Taken together, the invertebrate assemblage is considered of County importance.

Wet woodland.

4.4.11 **Habitats.** The wet woodland supports a range of habitats including tree-associated and wetland biotopes, open habitats tall sward and scrub.

4.4.12 **Species.** The survey recorded 105 species, with only *Dorycera graminum* recorded as having significant status, although this is not a wet woodland species and no longer warrants a nationally significant status.

4.4.13 Six previously recorded scarce species were not re-recorded in 2023. Three of these no longer have a nationally significant status and the remaining three were most likely not recorded owing to habitat degradation brought about by external impacts, including nitrogen runoff. The hot and dry 2020 and more recent 2022 may also have impacted these species, as wetland species are sensitive to hydrological changes, particularly a lowering of the water table.

4.4.14 **Site evaluation.** The range of species recorded is typical of woodlands and shady places including suites of wet woodlands species. The current value of the wet woodland is considered to be quite high, especially when factoring in the tight constraints on the recording effort within the shaded woodland boundary. However, the number of typical wetland species is small, with only 26 species of association. Most of these are craneflies *(Tipuloidea*) and long-legged flies (*Dolichopodidae*). This is the key group to compare with for future monitoring. As a habitat mosaic, the wet woodland is considered of at least District importance for its invertebrate assemblage.

5 AMPHIBIANS

5.1 DESK STUDY

Local records.

5.1.1 The data searches produced 53 records for GCNs within 2km of the Site, including the records from Thornhaugh Quarry CWS and Thornhaugh Quarry itself, along with other notable populations from Nassington, Rockingham Forest Industrial Park 1.5km southwest and Cross Leys Quarry 1.5km northwest.

5.1.2 Only 15 records for other amphibian species were provided, with palmate newt, smooth newt, common frog and common toad all recorded within 2km, most notably from the adjacent Bedford Purlieus.

Translocation of GCNs from Thornhaugh Landfill Site under European Protected Species Licence between 2004 and 2005.

5.1.3 Amphibians were initially cleared from the footprint of the Thornhaugh Landfill Site under a Natural England European Protected Species Licence (EPSL) between October 2004 and April 2005. Three-hundred and fifty-eight GCNs were translocated to a fenced-off receptor site along the western site boundary bordering Bedford Purlieus NNR. The receptor site comprised one extant pond and three new mitigation ponds (hereafter referred to as Ponds 1 to 4). This area is now designated a CWS due to its important amphibian populations, comprising GCN, palmate newt and smooth newt.

Translocation of GCNs from Thornhaugh Landfill Site under EPSL between 2013 and 2014.

5.1.4 In 2012, a second EPSL (ref: EPSM 2012-4014F) was granted to enable the destruction of Ponds 5, 6 and 7 (within proposed operational areas). Amphibians were trapped over 2013-2014 and were released into a new fenced-off GCN receptor to the north of the CWS, which included eight new lined mitigation ponds (referred to hereafter as Ponds 9-16).

Population monitoring.

5.1.5 Peak counts have been collated from population monitoring undertaken between 2005 and 2019 (AECOM, 2019) (Table 6). Whilst the number of ponds varied from year to year, surveys were undertaken by different surveyors from different consultancies and there were Site-specific constraints (i.e., weather, water depth and vegetation density), the data provide useful background information to inform the current assessment and subsequent mitigation design.

TABLE 6. Peak count of GCNs at Thornhaugh Quarry 2005 to 2019.

Year	Peak GCN count	Comments
2005	42	
2006	62	
2007	53	
2008	41	
2009	186	
2010	No data	
2011	83	Ponds 1-4 in the CWS plus Ponds 5 & 6.
2012	No data	
2013	No data	

Year	Peak GCN count	Comments
2014	256	The first survey post-translocation and in optimal conditions.
2015	84	High water levels had an impact on survey access.
2016	97	
2017	74	
2018	140	Ponds 1-4 in the CWS plus mitigation ponds 9-16.
2019	38	Ponds 1-4 in the CWS plus mitigation ponds 9-16. Ponds 11, 12 and 15 were dry. Survey hampered by dense vegetation.

Other amphibians.

5.1.6 Palmate newt and smooth newt were also recorded on the Thornhaugh site. No historic amphibian survey reports could be found for the Cooks Hole site.

5.2 METHODS

5.2.1 Sixteen ponds were identified during the 2023 walkover. Pond locations are shown on Figure 3. For continuity, the numbering system used in this assessment is the same as that used in previous EPSL monitoring surveys (shown in Table 6), with the exception of Pond 8 (not previously surveyed), which is now Pond 17.

Habitat Suitability Index.

5.2.2 A quantitative measure of all waterbodies' suitability for GCNs was made using the Habitat Suitability Index (HSI) endorsed by Natural England (Oldham *et al*., 2000). Ten variables are used to take into account the aquatic habitat, the surrounding terrestrial habitat and local pond density, providing a score considered to reflect overall habitat quality. The HSI was undertaken on 3 May 2023.

Population size class assessment.

5.2.3 All waterbodies were surveyed using a combination of methods as per English Nature guidance (2001) by a team of four surveyors: Grant Berky, Steve Hughes, Luke Hartley and Holly Bennett, Natural England GCN survey licence numbers 2015-6880-CLS-CLS, 2020-44841-CLS-CLS, 2020-44842-CLS-CLS and 2015-18523-CLS-CLS respectively. The survey dates and weather conditions are given in Table 7.

TABLE 7. Dates and weather conditions for GCN surveys in 2023.

Visit number	Date of visit	Weather
1	4 April 2023	6°C, dry, light wind.
2	12 April 2023	10°C, dry, light wind, cloudy.
3	25 April 2023	7°C, light rain, light wind.

Visit number	Date of visit	Weather
4	3 May 2023	8°C, dry, light wind.
5	10 May 2023	11°C, light drizzle, light wind.
6	16 May 2023	12°C, dry, light wind.

5.2.4 Ponds were surveyed by torchlight between dusk and midnight. The surveyor walked slowly around the margin, where safe to do so, shining a 500,000cp Clulite torch onto the surface of the water. Particular attention was paid to areas around marginal vegetation for egg-laying females and patches of open water (used by displaying males).

5.2.5 Bottle traps were placed in areas of accessible shoreline at a density of one trap per 2m. All traps were set between 18:30 and 23:00hrs and were removed between 08:30 and 10:50hrs.

5.2.6 A representative sample of the aquatic plants present was carefully examined for the presence of newt eggs. In addition, artificial egg-laying strips were placed in the margins of ponds with little or no suitable vegetation for egg-laying. To minimise disturbance, no further egg searching was carried out in a waterbody once a single GCN egg had been found there. Unused egg-strips were all removed on the last visit, with any used egg strips removed later in the year when all viable eggs had hatched.

Survey constraints.

5.2.7 Ponds 19 and 20 could not be bottle trapped due to health and safety constraints (steep, friable banks). Pond 17 could not be bottle trapped due the stone substrate. Population size class assessments for these ponds are based on torch data with an egg search undertaken in the daytime.

5.2.8 As reported in the 2018 and 2019 surveys, dense bulrush was present in Ponds 1 and 2 and dense sea club rush in Ponds 9 and 10. This hampered both bottle trapping and torching efforts; counts are assumed to be an underestimate. In addition, water levels in Pond 4 were high and the banks are becoming overgrown with scrub. This limited access to what has historically been the most productive GCN pond.

5.3 RESULTS

Habitat Suitability Index.

5.3.1 The waterbody numbers, types, locations and HSI score for each pond is given in Table 8. For clarity, Ponds 5, 6 and 7 were destroyed under EPSL in 2013/2014. Pond 8 was excluded from EPSL monitoring surveys and has been re-numbered as Pond 17 in 2023. Ponds 18, 19 and 20 were first surveyed in 2023.

TABLE 8. Pond locations, HSI and GCN suitability.

Pond No	Pond location	Grid Reference	HSI Score	HSI suitability
1	In the CWS	TF 04672 00028	0.88	Excellent
2	In the CWS	TF 04651 00043	0.83	Excellent
3	In the CWS	TF 04643 00024	0.88	Excellent
4	In the CWS	TL 04640 99977	0.92	Excellent
9	Western boundary north of CWS	TF 04621 00093	0.66	Average
10	Western boundary north of CWS	TF 04613 00136	0.66	Average
11	Western boundary north of CWS	TF 04609 00154	0.78	Good
12	Western boundary north of CWS	TF 0460800172	0.74	Good
13	Western boundary north of CWS	TF 04605 00190	0.66	Average
14	Western boundary north of CWS	TF 04594 00218	0.66	Average
15	Western boundary north of CWS	TF 04591 00254	0.71	Good
16	Western boundary north of CWS	TF 04585 00296	0.57	Below average
17	Surface water management lagoon in the east of Thornhaugh	TF 05343 00177	0.87	Excellent
18	Pond on north-western boundary of Cooks Hole	TL 04725 99705	0.76	Good
19	Mineral washing lagoon in south east of Cooks Hole	TL 05564 99845	0.67	Average
20	Mineral washing lagoon in south east of Cooks Hole	TL 05631 99890	0.66	Average

Population size class assessment.

5.3.2 The results of the population size class assessment are given in Table 9. Data for Ponds 18, 19 and 20 are derived from torching, all other results are from bottle trapping.

TABLE 9. Summary of peak GCN counts and breeding status for each pond in 2023.

Pond No	Peak GCN count	Breeding confirmed?	Comments
1	1	Yes	Dense bulrush limiting survey access/visibility
2	3	Yes	Dense bulrush limiting survey access/visibility
3	2	Yes	
4	3	Yes	Water levels high and banks overgrown with scrub limiting survey access/visibility
9	1	Yes	Dense sea club rush limiting survey access/visibility
10	1	Yes	Dense sea club rush limiting survey access/visibility
11	1	Yes	
12	0	Yes	
13	2	Yes	
14	Dry	No	Pond dry

Pond No	Peak GCN count	Breeding confirmed?	Comments
15	3	Yes	
16	Dry	No	Pond dry
17	3	Yes	Stone substrate - torch only
18	8	Yes	
19	0	Yes	H&S constraints – torch/egg search only
20	4	Yes	H&S constraints – torch/egg search only

5.4 ASSESSMENT OF BIODIVERSITY IMPORTANCE

Great crested newts.

5.4.1 The maximum number of GCNs on any survey visit across all ponds within the population (peak count) can be used to class populations as:

- '*Small'* for maximum counts up to 10.
- '*Medium*' for maximum counts between 11 and 100.
- '*Large'* for maximum counts over 100.

5.4.2 For the purposes of the assessment, based on distance between ponds, historic land use and current habitat connectivity, the Site is considered to support three populations of GCN:

- CWS and chain of ponds to the north (Ponds 1-4, 9-16 and 18) - '*medium*' population (peak count 25).
- Permanent water storage lagoon (Pond 17) - 'small' population (peak count 3).
- Temporary water storage lagoons (Ponds 19 and 20) - 'small' population (peak count 4).

5.4.3 The core population of GCNs on the Site remains centred within the CWS (Ponds 1-4) and the chain of ponds running north along the eastern edge of Beford Purlieus (Ponds 9-16).

5.4.4 The GCNs present in Pond 18 (lake south of the CWS) have most likely colonised it from the CWS, which is less than 100m to the north, via Bedford Purlieus.

5.4.5 Pond 17 (permanent water storage lagoon) is around 700m to the east of the CWS and 400m north of Ponds 19 and 20. GCNs could have colonised this pond by migrating along the central hedgerow from the CWS or via the surface water management ditch along the north-eastern boundary of Thornhaugh. Alternatively, as translocations rarely capture every animal, they could be the off-spring of animals that were present in Ponds 5, 6 or 7 that were destroyed as part of the 2013/2014 translocation work. There appears to be sufficient aquatic and terrestrial habitat to support this population, although the pond is isolated so significant interchange with other populations is unlikely.

5.4.6 Ponds 19 and 20 (temporary water storage lagoons) are over 800m from the CWS and as with Pond 17, could have been colonised by residual animals from the 2013/2014 translocation

work. Given the bare-ground that currently surrounds these ponds, this small population is effectively isolated within the sub-optimal habitats in Cooks Hole Quarry.

5.4.7 GCNs and their habitats are afforded strict legal protection under the Habitats Regulations 2017 and the Wildlife and Countryside Act 1981 (as amended).

Other amphibians.

5.4.8 Palmate and smooth newts were recorded in most ponds in the CWS/western chain and in Ponds 17 and 18 but not in Ponds 19 and 20. No frogs or toads were recorded in any pond.

Importance.

5.4.9 Given that the amphibian assemblage in Ponds 1-4 warranted the designation of CWS status and the range of all three species of newt is expanding on the Site, the amphibian assemblage is considered of County importance.

6 REPTILES

6.1 DESK STUDY

6.1.1 The data search produced 53 records for common lizard, grass snake and slow worm, with most of the records coming from the adjacent Bedford Purlieus.

Previous Site surveys.

6.1.2 One grass snake and two common lizards were recorded along the southern of the Thornhaugh site during a standard seven-visit reptile survey in 2011. Eleven slow worms and one common lizard were recorded along the western edge of Cooks Hole adjacent to Bedford Purlieus during reptile surveys undertaken in 2009 and 2010. It is assumed that any reptiles encountered during work to clear GCNs from Thornhaugh under previous EPSLs were relocated to the CWS.

6.2 METHODS

Artificial Cover Objects ('tins') and direct observation.

6.2.1 Eighty Artificial Cover Objects (0.5m² black corrugated bitumen sheets often called 'tins') were placed in areas of suitable reptile habitat to determine the presence of any reptiles on the Site (Figure 4). The tins were placed in both exposed and more sheltered locations including hedgerows and areas of bramble scrub in order to sample various habitat types under different conditions (Gent and Gibson, 2003). The reptile survey focussed on habitats to be lost to the scheme. Retained habitats, including the restored grassland in the northern part of Thornhaugh and the CWS, were not surveyed.

6.2.2 Each tin was inspected seven times in weather conditions when any reptile species present could reasonably be expected to be active (English Nature, 1994). In addition, direct observation of areas of suitable habitat was carried out on subsequent site visits in an attempt to locate any reptiles basking or foraging in open areas (HGBI, 1998). The survey dates and weather conditions are given in Table 10.

6.3 RESULTS

6.3.1 One grass snake was found under a survey tin at the western end of the central hedgerow between the two sites adjacent to Bedford Purlieus. Common lizard was recorded by direct observation on the restored grassland in the northern part of Thornhaugh.

TABLE 10. Survey dates and weather conditions during the reptile surveys.

Visit No.	Date	Time of day Weather Conditions	Results
1	12 April 2023	Early evening. 12°C, dry, light wind, 6/8 cloud.	No reptiles
2	3 May 2023	Early afternoon. Dry 14°C, breeze, 4/8 cloud	No reptiles
3	15 June 2023	Late morning. Dry, very warm, 24°C, no cloud	No reptiles
4	25 June 2023	Early afternoon. Dry, warm, 20°C, 4/8 cloud	1 grass snake west end of central hedge (under a tin). 2 common lizards, restored northern grassland (direct observation).
5	5 July 2023	Late morning. Dry, warm, 18°C, 4/8 cloud	No reptiles
6	11 July 2023	Early afternoon. Dry, warm, 16°C, 7/8 cloud	No reptiles
7	15 August 2023	Early afternoon. Dry, warm, 22°C, 7/8 cloud	1 grass snake west end of central hedge (under a tin). Same animal as on 25 June?

6.4 ASSESSMENT OF BIODIVERSITY IMPORTANCE

6.4.1 Given the levels of disturbance the Site has been subjected to over the past 20 years, the only habitats capable of supporting sustainable populations of reptiles are the hedgerow running east-to-west between Thornhaugh and Cooks Hole, the habitats along the brook corridor and more recently, the area of restored grassland along the northern boundary of Thornhaugh.

6.4.2 With no barriers to movement, it is likely that the small numbers of reptiles present are part of the wider Bedford Purlieus metapopulation and are dependent upon the movement of animals between the two areas to be sustainable. In contrast, Bedford Purlieus is not similarly reliant on this exchange of individuals and thus, the loss of habitats on the Site will not have an adverse effect on the reptile populations within the SSSI.

6.4.3 Whilst unlikely to be a significant constraint, as all native species of reptiles are species of principal importance as identified in Section 41 of NERC, the Sites reptile assemblage is considered of Local value.

7 BREEDING BIRDS

7.1 DESK STUDY

7.1.1 The data search generated over 580 bird records due to the proximity of the Site to a number of nationally- and regionally-popular sites for birdwatching, including Bedford Purlieus.

Previous Site surveys.

7.1.2 Twenty species of breeding bird were recorded from the Thornhaugh site during breeding bird surveys undertaken in 2011. Further breeding bird surveys undertaken in 2014 recorded 34 species, most notable of which were little ringed plover and red kite, both listed on Schedule-1 of the Wildlife and Countryside Act 1981 (as amended).

7.2 METHODS

7.2.1 Six visits were made to all different habitats on Site by experienced ornithologist Brian Hedley MCIEEM during the spring and early summer of 2023 to record and map all birds seen or heard, using Common Bird Census (CBC) species codes and activity symbols (Marchant, 1983). Start and finish times of surveys varied but all surveys were carried out within an hour of sunrise.

7.2.2 The survey included an evening visit in order to record species that call at dusk and into the night such as grasshopper warbler, nightingale, nightjar and owl. The survey route, direction walked and sources of disturbance were recorded on the fieldwork maps to aid analysis. Species using the boundary features of the Site are included in the totals as they could be affected by the development proposals. Survey dates, times and weather conditions are shown in Table 11.

7.2.3 Casual records of notable bird species were made on other Site visits.

TABLE 11. Breeding bird survey dates, times and weather conditions.

Visit No.	Date	Survey times (sunrise)	Weather Conditions
1	27/03/2023	07:15-10:15 (06:49)	Mainly sunny (2/8 to 3/8 cloud cover), dry, 2-5ºC, F2 NNW to N wind
2	11/04/2023	06:40–09:50 (06:14)	Sunny (1/8 to 2/8 cloud cover), dry, 5-8ºC, F3 SW wind
3	28/04/2023	06:00–09:30 (05:37)	Overcast and misty at first (8/8 cloud cover) but then hazy sunshine (4/8 to 5/8 cloud cover), dry, 11-12ºC, F2-3 SW wind
4	12/05/2023	18:30-21:46 (evening visit with sunset: 20:46)	Mainly overcast (6/8 to 8/8 cloud cover), dry, 12-11ºC, F3-4 NE wind
5	24/05/2023	05:20-08:30 (04:53)	Sunny (1/8 to 2/8 cloud cover), dry, 10-13ºC, F2 NW wind

6	14/06/2023	05:05 08:15 (04:38)	Sunny (1/8 cloud cover), dry, 11-16ºC, F2-3 N to NE wind

7.3 RESULTS

Species assemblage.

7.3.1 From a total of 58 species recorded during the six survey visits in 2023, 27 were priority species as defined by S41 of NERC and those of high conservation concern as defined by per Stanbury *et al.* (2021). The species conservation status and an estimate of the likely number of pairs, taking into account any breeding behaviour and the presence of suitable nesting habitat, is given in Table 12. The full species list is given in Appendix 7.

7.3.2 Four Schedule-1 species were recorded. Two pair of little ringed plover were confirmed as breeding within an area of bare ground in Cooks Hole Quarry. Repeat sightings and behaviour indicated that red kite was nesting in the wooded stream valley east of Cooks Hole Farmhouse, near the A47. Redwing was also recorded and whilst a designated Schedule-1 breeding species, it is a winter visitor and only small numbers stay to breed in the UK, all in the far north of Scotland.

7.3.3 The assemblage also included ten S41 species of principal importance, including cuckoo and skylark, eight Red List and seventeen Amber List species. Suitable nesting habitat within the Site is present for all of them.

7.3.4 From the remaining 'Green' list of birds (those not currently believed to be of conservation concern), of particular note was sand martin; a colony comprising at least 90 nest holes was present in a spoil heap in Cooks Hole Quarry. Sand martin colonies have been recorded in previous years so the Site is considered to be particularly important to this species.

TABLE 12. Likely number of confirmed or probable breeding pairs of priority bird species recorded on Site during the 2023 bird survey.

Species	*Conservation Status	Survey dates						Likely No. of pairs
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	
Greylag Goose	A	6	-	2	2	4	2	1-2
Mallard	A	4	3	11	4	2	6	2
Moorhen	A	-	1	-	-	-	1	1
Red Kite	Sch 1	2	4	2	4	4	5	1
Kestrel	A	-	-	-	-	-	1	0
Green Sandpiper	A	-	4	-	-	-	-	-
Oystercatcher	A	-	-	-	1	-	1	1
Little Ringed Plover	Sch 1	-	-	1	1	4	3	1-2
Curlew	R, S41	-	-	-	-	2	-	0

Species	*Conservation Status	Survey dates						Likely No. of pairs
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	
Black-headed Gull	A	-	-	-	2	3	2	0
Woodpigeon	A	28	40	26	74	34	31	15-20
Stock Dove	A	4	11	10	8	13	7	5-6
Cuckoo	R, S41	-	-	-	-	-	1	1
Skylark	R, S41	4	3	4	-	7	6	4-6
Meadow Pipit	A	7	-	-	-	1	-	1
Wren	A	5	5	15	3	15	18	10-15
Song Thrush	A, S41	4	2	4	1	2	2	2-3
Redwing	A, Sch 1	3	-	-	-	-	-	0
Wheatear	A	-	-	1	-	-	-	0
Common Whitethroat	A	-	-	4	1	6	6	3-4
Dunnock	A, S41	10	6	12	-	8	4	4-5
Marsh Tit	R, S41	-	-	-	-	-	1	0
Starling	R, S41	-	-	-	-	2	1	1
House Sparrow	R, S41	2	-	-	-	-	-	0
Linnet	R, S41	10	9	7	1	14	13	5-6
Bullfinch	A, S41	-	-	-	-	1	-	0
Yellowhammer	R	2	-	-	-	-	-	0

***Key to status: R (Red List) and A (Amber) – Birds of Conservation Concern (2021).**

Sch 1 – Schedule-1 species (Wildlife and Countryside Act 1981 (as amended)).

S41 – Species of Principal Importance (NERC).

7.4 ASSESSMENT OF BIODIVERSITY IMPORTANCE

Little ringed plover.

7.4.1 Little ringed plover favour nest sites on transient areas of bare and sparsely vegetated ground such as those found in quarries, gravel pits and industrial sites. As the availability of such habitats has a direct effect on the population size so the loss of such habitats may reduce breeding success. The British Trust for Ornithology (BTO) reported the UK population to be around 1,250 breeding pairs in 2007. Bacon, *et al,* (2013) report an estimate of the breeding population in Cambridgeshire to be 30–50 pairs between 2007 and 2011. More recently, the Cambridgeshire Bird Club report 2019 contains records of 306 sighting records at 28 sites, with breeding confirmed for eight pairs. Consequently, the confirmation of two breeding pairs of little ringed plover within Cooks Hole in 2023 would represent 20% of the total known breeding pairs in Cambridgeshire. Whilst this is likely to be an underestimate, the Site is considered of County importance for this species.

Red kites.

7.4.2 Following widespread persecution, the UK population was reduced to fewer than 10 breeding pairs in the 1940s; considerable conservation effort has resulted in the restoration of red kites to their original breeding range. This was achieved in part by the reintroduction of birds, including a release in Northamptonshire, 7km to the west of the Site, in 1995. The BTO reported the UK population to be around 4,400 breeding pairs in 2016 with Harris *et al.* (2022) reporting a 1,935% increase over the period 1995 to 2020.

7.4.3 Red kites are a woodland-nesting species and were recorded on every site visit, often over the landfill site, although they are not wholly dependent upon it to maintain their numbers. Bedford Purlieus is likely to support multiple breeding pairs and competition may have resulted in the pair nesting in the wooded stream valley east of Cooks Hole Farmhouse in 2023. The Site is considered of Local importance to red kite.

Other species.

7.4.4 Whilst the Site's breeding assemblage includes several Red and Amber List bird species, the numbers of probable breeding pairs is relatively small and is typical of the habitats present. On balance, the breeding assemblage is evaluated as being of Local importance.

8 BATS

8.1 DESK STUDY

8.1.1 The data search produced 14 likely bat roost records. The majority relate to the nearby villages of Wansford and Thornhaugh to the east and Whittering to the north. However, one pipistrelle roost is noted in Bedford Purlieus.

8.1.2 Species including common and soprano pipistrelle, barbastelle, serotine, noctule, brown long-eared bat, whiskered and natterer's have all been recorded either on Thornhaugh Quarry or within the adjacent Bedford Purlieus.

Previous Site surveys.

8.1.3 No bat roosts have been identified before within the Site. Transects of Thornhaugh undertaken in summer 2011 recorded low levels of foraging by common pipistrelle, soprano pipistrelle and noctule bats.

8.2 METHODS

Preliminary Ecological Appraisal.

8.2.1 A Site walkover was undertaken on 15 June 2023 by David Hughes, Natural England bat survey class licence number 2015-14463-CLS-CLS CL20 (Bat Conservation Trust (BCT): Level 5,

CIEEM competency level: Specialist). The redundant buildings at Cooks Hole Farmhouse were inspected for signs of use by bats. All trees on the Site were examined from the ground using close-focusing binoculars for Potential Roost Features (PRF) such as woodpecker holes, rot holes, cavities, snag ends and lifted bark. The habitats on Site and its connectivity to the wider landscape were then assessed for use by foraging and commuting bats in order to inform the design and extent of further work as per BCT guidelines (Collins, 2023).

Activity surveys – static detectors.

8.2.2 In order to determine the species assemblage and assess habitat use, automated static bat detectors (Anabat Express) were deployed to run over five consecutive nights during June and July 2023. The detectors were placed in habitats to be lost as well as those to be retained, with a particular focus on determining important flightlines and habitat connectivity. The detectors were programmed to switch on 20 minutes before sunset and switch off 20 minutes after sunrise. Weather conditions on all survey nights was fine with no overnight rain. The location of each detector is shown on Figure 5.

Data analysis.

8.2.3 Call analysis was undertaken by experienced bat ecologist Emily Cook, Natural England bat survey class licence number 2015-14463-CLS-CLS (CL18), using Anabat insight software. Bat data was collated based on the number of passes (sound files) per bat at each sample point per sample night. The times of the first and last bat passes relative to sunset and sunrise were compared with published emergence times in order estimate the likelihood of there being a roost site in the vicinity. Clusters of calls, especially those by *Pipistrellus* species along linear features, can often be attributed to repeat foraging passes by the same bat or low numbers of individuals. The same calls by noctule bats are often recorded on multiple detectors due to the high amplitude of their calls. Conversely calls by brown long-eared bat and barbastelle bat are often under recorded due to their low amplitude calls. In addition, the numbers of passes cannot be equated to numbers of bats so the interpretation of acoustic data involves a degree of subjectivity. The number of passes is therefore used as a proxy for how important each habitat is likely to be for bats and the potential effects on each species needs to be assessed individually.

8.3 RESULTS

Preliminary Ecological Appraisal.

8.3.1 Cooks Hole Farmhouse comprises a derelict farmhouse and adjacent barn, both constructed of solid stone wall under pitched roofs covered by Collyweston stone slates on a lathe-and-plaster liner. The farmhouse (Photograph 23) is two-storey, with the first floor extending into the roof space leaving only a small roof void. The building is boarded up for health and safety reasons, preventing a full internal inspection. However, its construction, unglazed/broken

windows together with its location in a wooded valley with excellent connectivity to Bedford Purlieus indicates it has 'high' suitability for use by bats.

8.3.2 The adjacent barn is single-storey with an enclosed addition to the western gable and a corrugated tin-covered lean-to against the southern elevation (Photograph 24). Internally it is open to the roof apex. Whilst missing slates have increased ambient light levels, there are still multiple opportunities for bats to roost in the structure. As with the farmhouse, these features, together with its location, indicates it has 'high' suitability for use by bats.

Photograph 23. Cooks Hole Farmhouse from the north

Photograph 24. Cooks Hole Barn from the south.

8.3.3 There are a number of mature crack willows and ash trees with potential for significant use by roosting bats within the brook corridor but none is affected by work.

8.3.4 The Thornhaugh site comprises an active landfill with foraging opportunities limited to pockets of habitat that are poorly connected both internally and to the wider landscape. The most productive habitats are likely to be the interface between the Site and Bedford Purlieus along the western boundary. As per Table 4.1 in the BCT guidelines, the bulk of Thornhaugh is assessed as having 'low' suitability for commuting and foraging habitats, elevated to 'high' suitability along the boundaries.

8.3.5 Cooks Hole comprises large areas of open bare ground (former quarry) and large areas of open grassland. The most productive habitats are likely to be the brook/wet woodland corridor and again, the interface between the Site and Bedford Purlieus along the western boundary. There are two hedgerows, a gappy hedgerow running through the Site from Bedford Purlieus in the west to the A47 in the east and an adjoining complete hedgerow running south to Cooks Hole Farmhouse/the brook corridor. As per Table 4.1 in the BCT guidelines, Cooks Hole is assessed as generally having 'low' suitability for commuting and foraging habitats, elevated to 'medium' suitability along the internal hedgerows and 'high' suitability along the brook corridor.

Activity surveys – static detectors.

8.3.6 Eight bats were identified to species level (with the abbreviated name used in the results tables), namely:

- Common pipistrelle (P.pip).
- Soprano pipistrelle (P.pyg).
- Nathusius' pipistrelle (P.nath).
- Noctule bat (N.noct).
- Leisler's bat (N.leis).
- Brown long-eared bat (P.aur).
- Barbastelle bat (B.barb).

8.3.7 Bats of the *Myotis* genus were not identified to species due to call convergence but the majority of those recorded are likely to be either Daubenton's bat or whiskered/Brandts bat.

8.3.8 The habitats with the greatest levels of bat activity were the brook corridor and the interface with Bedford Purlieus. With a few notable exceptions, bat activity elsewhere was generally low. Whilst bat activity was recorded along the internal hedgerows to be lost and the southern and eastern boundaries to be retained, there was no significant difference between them other than for noctule bat.

8.3.9 It is likely that any roosts within the zone of influence are within Bedford Purlieus for predominantly tree roosting species (noctule, barbastelle and Leisler's bats) or nearby buildings for the remaining species that will roost in buildings as well as trees. It is highly likely there are multiple maternity roosts with 2km of the Site and the more productive habitats on Site will lie within each colony's Core Sustenance Zone.

8.3.10 The total number of passes per species per night at each sample point in June and July is given in Tables 13 and 14 respectively. The activity levels are described for each species below, with reference to any important habitats.

TABLE 13. Total number of bat passes per species per sample point over six consecutive nights in June 2023.

Detector No	Habitat type	P.pip	P.pyg	P.nath	N.noct	N.leis	P.aur	B.barb	Myo
AE1	Internal gappy hedgerow (to be lost)	155	54	2	514	20	4	2	36
AE2	Internal hedgerow (to be lost)	94	33	0	439	0	0	1	7
AE3	Brook corridor (to be retained)	98	37	1	93	3	2	0	15
AE5	Boundary hedgerow (to be retained)	104	162	5	36	4	2	1	9

Detector No	Habitat type	P.pip	P.pyg	P.nath	N.noct	N.leis	P.aur	B.barb	Myo
AE7	Boundary hedge (to be retained)	42	24	0	103	4	0	0	9

TABLE 14. Number of bat passes per species per sample point over six consecutive nights in July 2023.

Detector No	Habitat type	P.pip	P.pyg	P.nath	N.noct	N.leis	P.aur	B.barb	Myo
AE1	Internal gappy hedgerow (to be lost)	58	46	1	42	2	0	2	18
AE3	Brook corridor (to be retained)	88	56	1	79	5	0	4	27
AE4	Open grassland	25	13	0	41	0	4	1	9
AE6	Edge of Bedford Purlieus	444	316	0	150	4	2	13	68
AE7	Cooks Hole Farmhouse	668	50	0	44	3	0	0	37

8.3.11 Common pipistrelle activity around Cooks Hole Farmhouse was relatively high, although the timestamps of the calls were spread through the night and not weighted around the 30-minute sunset emergence or dawn re-entry period, which might indicate swarming behaviour by a significant number of bats, although the presence of a small roost is a possibility. Common pipistrelles are the commonest and most widespread bat species in the UK and are the most frequently encountered species so their presence in all sample points is expected.

8.3.12 Noctule bat calls were recorded in high numbers in June at points AE1 and AE2 (the two internal hedgerows). Noctules are typically a high-flying open-habitat species that is not reliant upon linear landscape features such as hedgerows for commuting and foraging. In addition, their high amplitude calls make them easy to record (and double count if detectors are close enough together, as they were here). The activity levels most likely represent short, intense bursts of foraging activity in proximity to the detectors but independent of the hedgerows. However, the timestamps of the calls suggest there is a roost nearby. As noctules are almost exclusively a tree roosting species, this is likely to be within Bedford Purlieus.

8.3.13 Soprano pipistrelle activity was surprisingly low for such a common edge-habitat species.

8.3.14 Nathusius' pipistrelle is a scarce but widespread species in the UK with an easterly bias and is a known long-distance intercontinental migrant. With only 1-5 passes recorded, the data indicate the Site is not important to this species.

8.3.15 Brown long-eared bats tend to be under-represented in acoustic surveys due to their low amplitude calls. However, as this species predominantly feeds on moths, it tends to be associated with woodland and edge habitats so foraging opportunities within the Site are limited to the interface with Bedford Purlieus and the wooded brook corridor, both of which are unaffected.

8.3.16 Leisler's bat is another edge habitat species often associated with woodland. The low activity levels suggest use of the Site by an individual bat.

8.3.17 Barbastelles are a scarce but widespread species in southern/central England and in Cambridgeshire, records are concentred in the centre of the county. Barbastelles feed on micro-moths so tend to favour woodland habitats but will travel large distances and cross open fields. As with Leisler's bat, the low activity levels suggest use of the Site by an individual bat.

8.3.18 *Myotis* bat activity can most likely be attributed to Daubenton's bat (a common and widespread species in the UK) or whiskered/Brandt's bats. Again, the low levels of activity indicate the Site is not important to this species.

8.4 ASSESSMENT OF BIODIVERSITY IMPORTANCE

8.4.1 All bat species are afforded strict legal protection under the Conservation of Habitats and Species Regulations 2017 and the Wildlife and Countryside Act 1981 (as amended). Barbastelle, noctule, soprano pipistrelle and brown long-eared bat are also S41 species. Bats are highly mobile animals and most species recorded using the Site were doing so at relatively low levels. The most important habitats will be unaffected, whilst those to be lost will be replaced and in far higher proportions. As such, bats are likely resilient to the effects of the scheme. However, due to their conservation status, the assemblage is considered of Local importance.

9 OTHER NOTABLE/PRIORITY SPECIES

Water voles and otters.

9.1 There are no nearby records in the desk study for either species; there are no records from previous surveys and there are no habitats on the Site suitable for use by either species. Water voles and otters can be safely scoped out of the assessment.

White-clawed crayfish.

9.2 There are no nearby records in the desk study as this species is not known to be present in the local area. In addition, there are no habitats on Site suitable for use by this species so it can be safely scoped out of the assessment.

Hazel dormice.

9.3 Hazel dormice were reintroduced to Bedford Purlieus in 2001. The data search provided frequent records from monitoring of this reintroduction up to 2014, demonstrating its longer-term success. A hazel dormouse reintroduction site report (People's Trust for Endangered Species, 2019) reported 'good numbers in recent years', primarily in the 13ha deer-fenced receptor area, though they have been recorded around 100m beyond this. The report also

notes that the most appropriate dispersal corridors from the woodland would be to the southeast and to the west.

9.4 A dormouse survey of the Site was undertaken by ESL in 2009. This comprised setting out and checking eleven dormouse tubes that were installed along the central hedgerow between Thornhaugh and Cooks Hole Quarry on four occasions, as was considered best practice at the time (Bright *et al*., 2006). No evidence of dormice was recorded.

9.5 No further survey work has been undertaken to inform subsequent planning applications and as this hedgerow is now thin and very gappy, with poor habitat connectivity, no further surveys are currently necessary and dormice can be scoped out of the assessment.

Deer.

9.6 Fallow, roe and muntjac deer have all been recorded within Cooks Hole and are likely common in the local area. All three species are highly mobile and are likely resilient to any effects; they can be scoped out of the assessment.

Brown hares.

9.7 Only one post-2000 record was provided in the desk study. There are no historic records of brown hare ever being present within the Site and none was recorded during the 2023 surveys. If present, this mobile species is likely resilient to any effects and can be scoped out of the assessment.

Hedgehogs.

9.8 There are no records of hedgehogs ever being present within the Site and whilst suitable habitats are preset, there are no standard survey methods for this species. If present, this species will benefit from protective measures implemented for other species and hedgehogs can be scoped out of the assessment.

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KEY

- Site boundary - Thornhaugh Landfill Site
- 10 - Scattered scrub
- r1f - Other standing waters: 191 - Ditch, 500 - Dry
- h2a6 - Other native hedgerow
- 112 - Earthbank
- g4 - Modified grassland
- g3c - Other neutral grassland
- h3h - Mixed scrub
- r1f - Other standing waters: 40 - Ponds (priority habitat)
- u1f - Sparsely vegetated urban land: 81 - Ruderal or ephemeral, 510 - Bare ground, 831 - Landfill
- 80 - Open mosaic habitas on previously developed land
- f2d - Aquatic marginal vegetation
- w1g - Other woodland; broadleaved
- w1h - Other woodland; mixed

SITE NAME:
Cooks Hole Quarry and Thornhaugh Landfill Site, Peterborough.

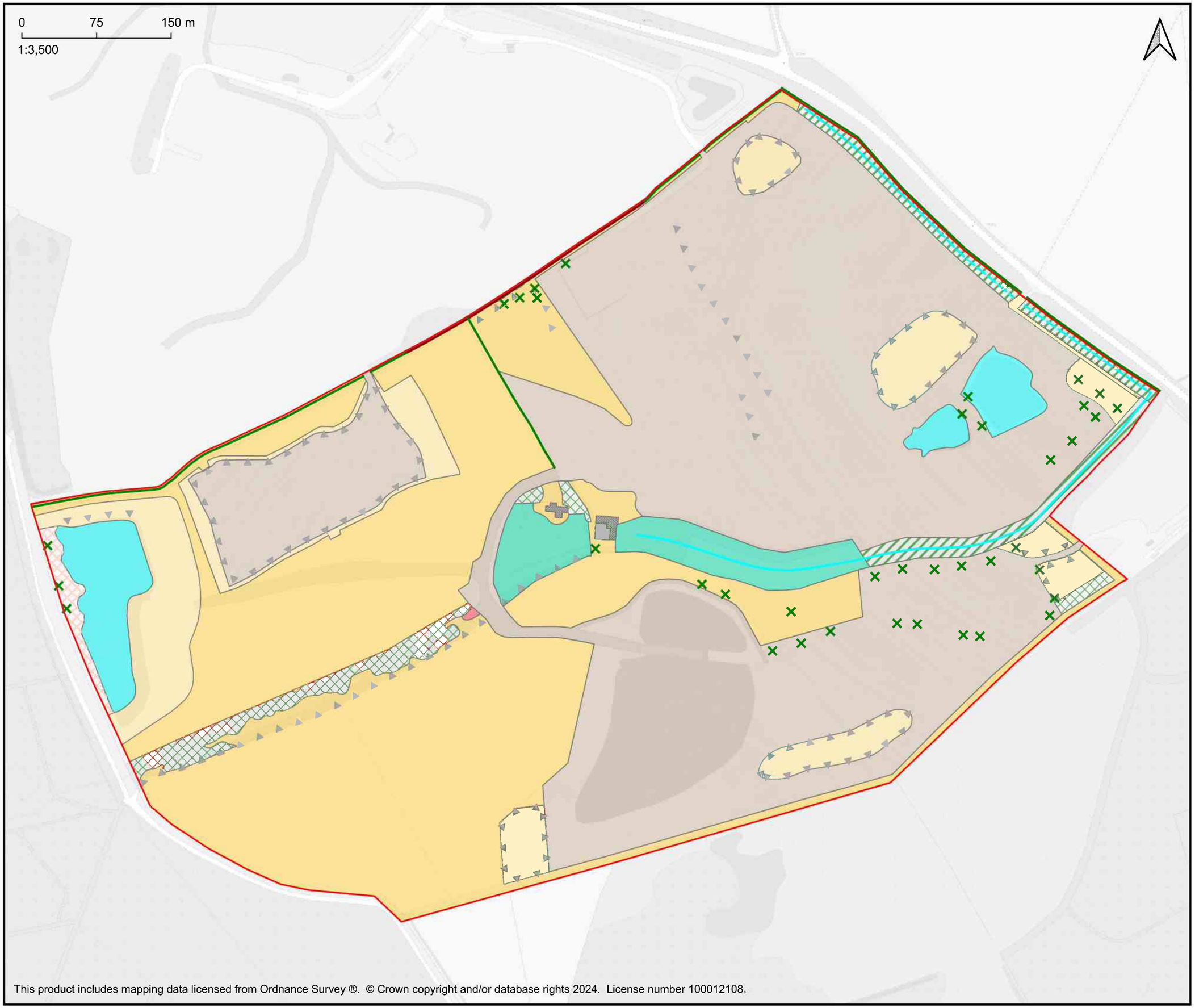
DRAWING TITLE:
Habitat map (Thornhaugh Landfill Site).

Figure 1
Dwg no.: MJCA125-L032-007 Date: Jan 2024

(Ecological Services) Limited

KEY

- Site boundary - Cooks Hole Quarry
- 10 - Scattered scrub
- r1f - Other standing waters: 191 - Ditch
- r1f - Other standing waters: 191 - Ditch, 500 - Dry
- h2a6 - Other native hedgerow
- 114 - Dry stone wall
- 112 - Earthbank
- g4 - Modified grassland
- g3c - Other neutral grassland
- h3h - Mixed scrub
- r1f - Other standing waters: 40 - Ponds (priority habitat)
- s1d - Other inland rock and scree
- u1f - Sparsely vegetated urban land: 81 - Ruderal or ephemeral, 510 - Bare ground, 831 - Landfill
- u1b5 - Buildings
- u1b6 - Other developed land
- f2d - Aquatic marginal vegetation
- w1g - Other woodland; broadleaved
- w1d - Wet woodland



SITE NAME:
Cooks Hole Quarry and Thornhaugh Landfill Site, Peterborough.

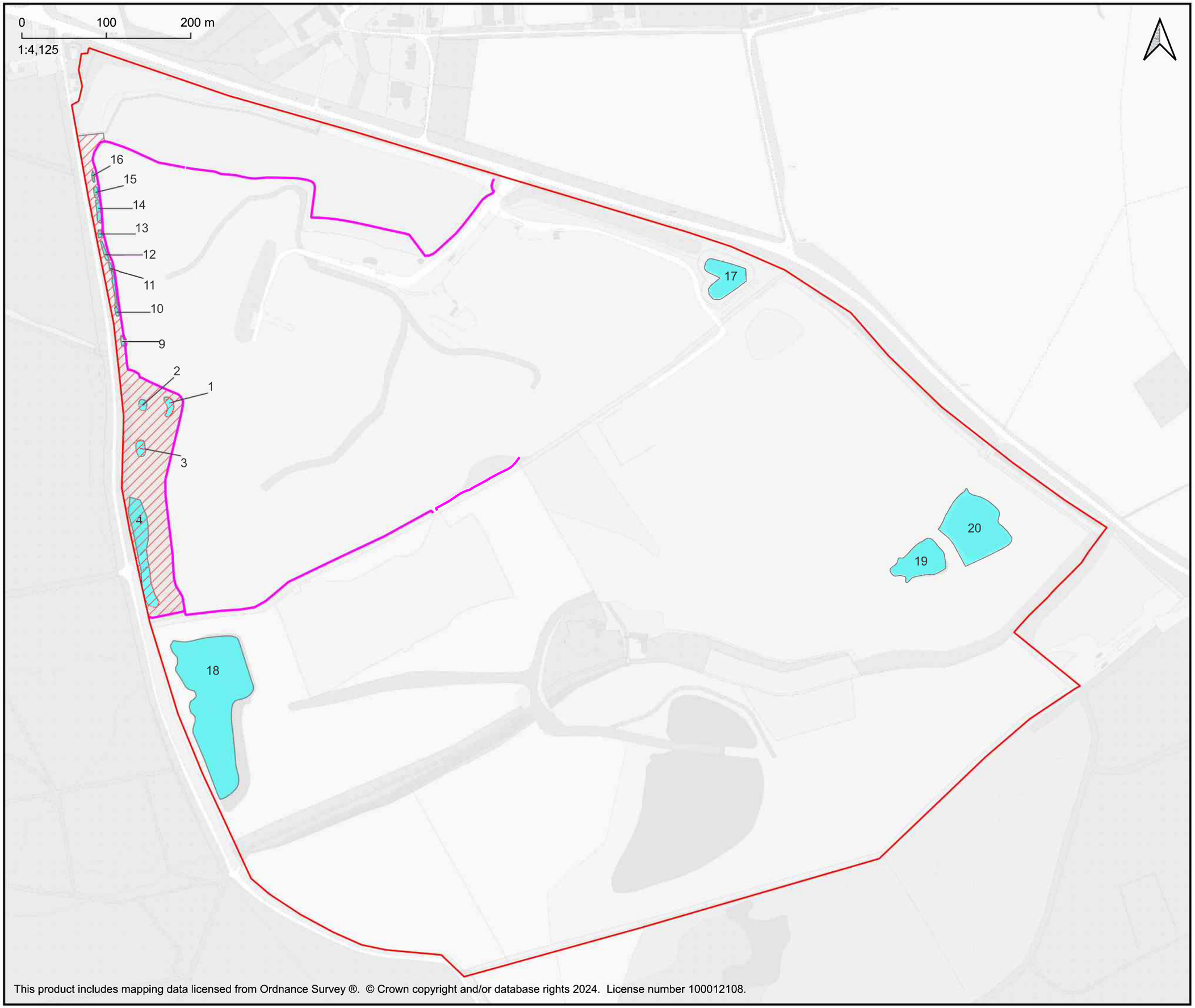
DRAWING TITLE:
Habitat map (Cooks Hole Quarry).

Figure 2
Dwg no.: MJCA125-L032-008 Date: Jan 2024

ESL (Ecological Services) Limited

KEY

- Site boundary
- Temporary amphibian fence (TAF)
- Ponds
- Thornhaugh Quarry CWS



SITE NAME:
Cooks Hole Quarry and Thornhaugh Landfill Site, Peterborough.

DRAWING TITLE:
Pond location map.

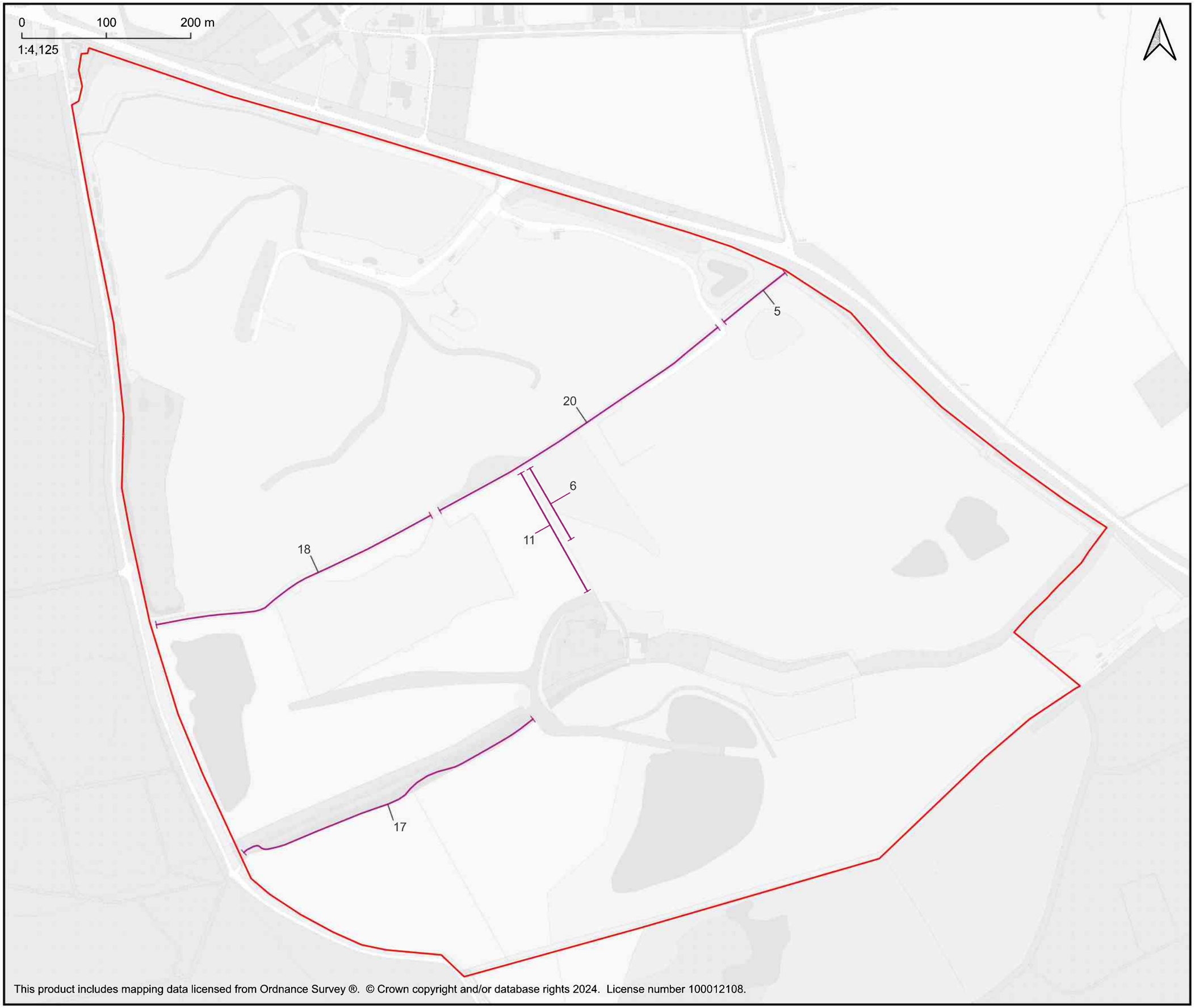
Figure 3
Dwg no.: MJCA125-L032-009 Date: Jan 2024

ESL (Ecological Services) Limited

KEY

Site boundary

Artificial reptile refugia



SITE NAME:
Cooks Hole Quarry and Thornhaugh Landfill Site, Peterborough.

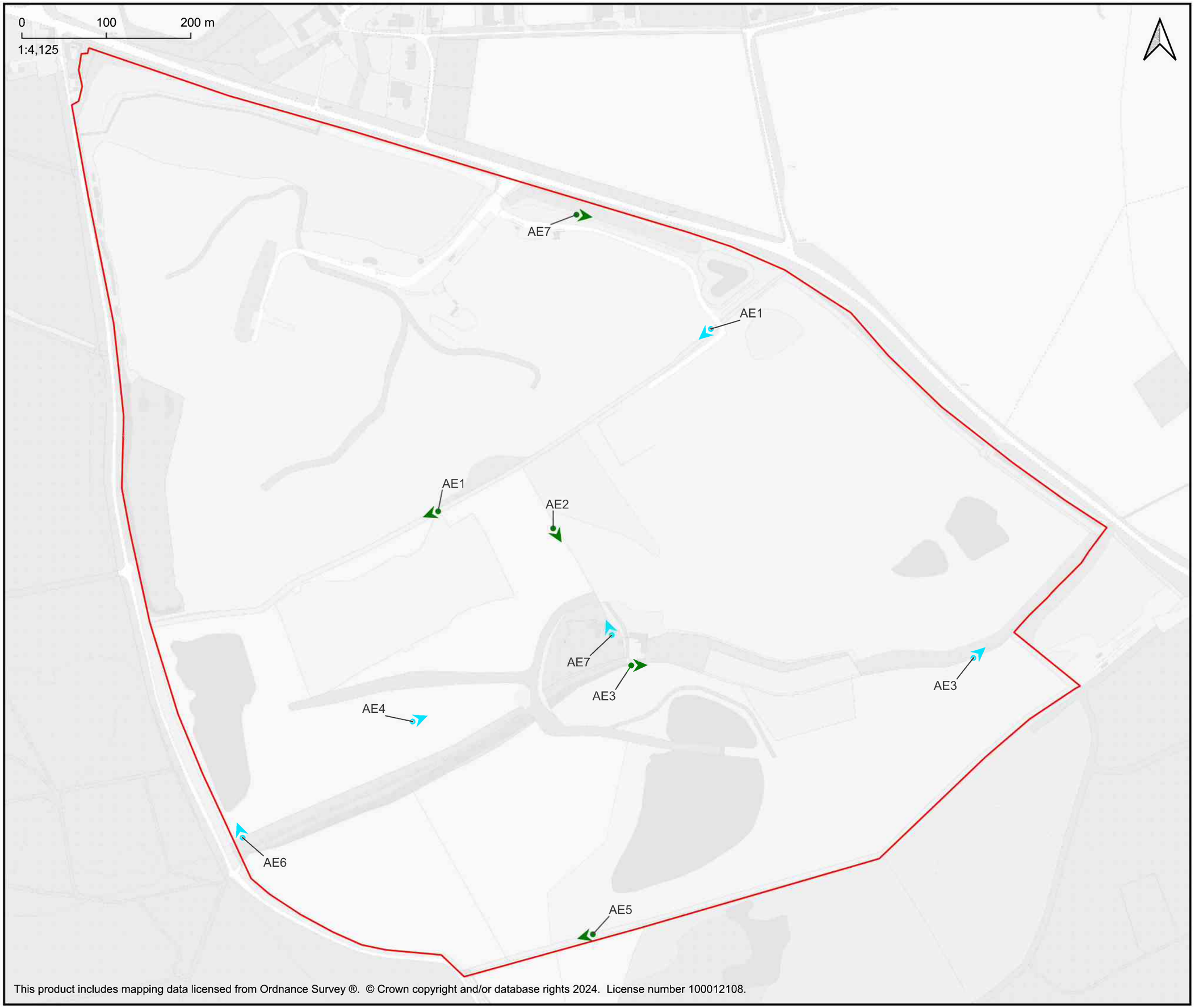
DRAWING TITLE:
Reptile artificial refugia map.

Figure 4
Dwg no.: MJCA125-L032-010 Date: Jan 2024

ESL (Ecological Services) Limited

KEY

- Site boundary
- Static detector sample point (June)
- Static detector sample point (July)



SITE NAME:
Cooks Hole Quarry and Thornhaugh Landfill Site, Peterborough.

DRAWING TITLE:
Bat static detector location map.

Figure 5
Dwg no.: MJCA125-L032-011 Date: Jan 2024

ESL (Ecological Services) Limited

APPENDIX 1

SPECIES LISTS

English name	Scientific name	DAFOR
Plants		
Annual meadow-grass	*Poa annua*	F
Ash	*Fraxinus excelsior*	F
Barren strawberry	*Potentilla sterilis*	O
Beaked hawk's-beard	*Crepis vesicaria*	O
Blackthorn	*Prunus spinosa*	F
Black horehound	*Ballota nigra*	O
Black medic	*Medicago lupulina*	F
Bladder campion	*Silene vulgaris*	O
Blue fleabane	*Erigeron acer*	O
Blue water-speedwell	*Veronica anagallis-aquatica*	O
Bramble	*Rubus fruticosus* agg.	F
Bristly oxtongue	*Helminthotheca echioides*	F
Bittersweet	*Solanum dulcamara*	O
Broad-leaved dock	*Rumex obtusifolius*	F
Broad-leaved plantain	*Plantago major*	O
Broad-leaved pondweed	*Potamogeton natans*	F
Brookweed	*Samolus valerandi*	O
Bulbous buttercup	*Ranunculus bulbosus*	O
Butterfly-bush	*Buddleia davidii*	A
Caper spurge	*Euphorbia lathyris*	O
Carline thistle	*Carlina vulgaris*	O
Celery-leaved buttercup	*Ranunculus sceleratus*	O
Changing forget-me-not	*Myosotis discolor*	F
Cleavers	*Gallium aparine*	O
Cock's-foot	*Dactylis glomerata*	A
Colt's-foot	*Tussilago farfara*	A
Common agrimony	*Agrimonia eupatoria*	R
Common bent	*Agrostis capillaris*	F
Common bird's-foot trefoil	*Lotus corniculatus*	A
Common centaury	*Centaurium erythraea*	O
Common chickweed	*Stellaria media*	F
Common comfrey	*Symphytum officinale*	O
Common duckweed	*Lemna minor*	O

English name	Scientific name	DAFOR
Common eyebright	*Euphrasia nemorosa*	O
Common field-speedwell	*Veronica persica*	O
Common fleabane	*Pulicaria dysenterica*	O
Common fumitory	*Fumaria officinalis*	O
Common ivy	*Hedera helix*	O
Common knapweed	*Centaurea nigra*	O
Common knotgrass	*Polygonum aviculare*	F
Common mouse ear	*Cerastium fontanum*	O
Common nettle	*Urtica dioica*	F
Common polypody	*Polypodium vulgare*	R
Common poppy	*Papaver rhoeas*	O
Common ragwort	*Senecio jacobaea*	F
Common reed	*Phragmites australis*	O
Common spike-rush	*Eleocharis palustris*	F
Common stork's-bill	*Erodium cicutarium*	O
Common valerian	*Valeriana officinalis*	O
Common water plantain	*Alisma plantago-aquatica*	O
Compact rush	*Juncus conglomeratus*	O
Cotton thistle	*Onopordum acanthium*	R
Crab apple	*Malus sylvestris*	O
Crack willow	*Salix fragilis*	F
Creeping bent	*Agrostis stolonifera*	F
Creeping buttercup	*Ranunculus repens*	F
Creeping cinquefoil	*Potentilla reptans*	A
Creeping jenny	*Lysimachia nummularia*	O
Creeping soft-grass	*Holcus mollis*	O
Creeping thistle	*Cirsium arvense*	F
Curled dock	*Rumex crispus*	F
Cut-leaved crane's-bill	*Geranium dissectum*	O
Daisy	*Bellis perennis*	O
Dandelion	*Taraxacum officinale* agg.	O
Deadly nightshade	*Atropa belladonna*	R
Dewberry	*Rubus caesius*	R
Dog's mercury	*Mercurialis perennis*	O

English name	Scientific name	DAFOR
Domestic pear	*Pyrus communis*	R
Dove's-foot crane's-bill	*Geranium molle*	O
Dwarf mallow	*Malva neglecta*	O
Elder	*Sambucus nigra*	F
Enchanter's nightshade	*Circaea lutetiana*	O
Fairy flax	*Linum catharticum*	R
False-brome	*Brachypodium sylvaticum*	O
False oat-grass	*Arrhenatherum elatius*	A
Field bindweed	*Convolvulus arvensis*	O
Field forget-me-not	*Myosotis arvensis*	O
Field horsetail	*Equisetum arvense*	O
Field madder	*Sherardia arvensis*	O
Field rose	*Rosa arvensis*	O
Field scabious	*Knautia arvensis*	R
Floating sweet-grass	*Glyceria fluitans*	O
Fool's water-cress	*Helosciadium nodiflorum*	O
Garlic mustard	*Alliaria petiolata*	O
Germander speedwell	*Veronica chamaedrys*	O
Goat's-beard	*Tragopogon pratensis*	O
Goat's-rue	*Galega officinalis*	F
Greater burdock	*Arctium lappa*	O
Great willowherb	*Epilobium hirsutum*	F
Grey willow	*Salix cinerea*	F
Ground-ivy	*Glechoma hederacea*	F
Groundsel	*Senecio vulgaris*	O
Gypsywort	*Lycopus europaeus*	O
Hairy brome	*Bromopsis ramosa*	O
Hairy sedge	*Carex hirta*	O
Hard rush	*Juncus inflexus*	F
Hawthorn	*Crataegus monogyna*	A
Hazel	*Corylus avellana*	O
Hedge bedstraw	*Gallium mollugo*	O
Hedge mustard	*Sisymbrium officinale*	O
Hedge woundwort	*Stachys sylvatica*	O

English name	Scientific name	DAFOR
Hemlock	*Conium maculatum*	O
Herb robert	*Geranium robertianum*	O
Hoary ragwort	*Jacobaea erucifolia*	O
Hogweed	*Heracleum sphondylium*	O
Hop trefoil	*Trifolium campestre*	O
Hornwort	*Ceratophyllum demersum*	O
Horse chestnut	*Aesculus hippocastanum*	O
Hound's-tongue	*Cynoglossum officinale*	O
Lady's bedstraw	*Gallium verum*	O
Lesser burdock	*Arctium minus*	O
Lesser pond-sedge	*Carex acutiformis*	O
Lesser trefoil	*Trifolium dubium*	O
Lords-and-ladies	*Arum maculatum*	O
Male fern	*Dryopteris felix-mas*	R
Marsh bedstraw	*Galium palustre*	O
Marsh foxtail	*Alopecurus geniculatus*	O
Marsh horsetail	*Equisetum palustre*	O
Marsh marigold	*Caltha palustris*	O
Meadowsweet	*Filipendula ulmaria*	O
Mouse-ear hawkweed	*Pilosella officinarum*	O
Mugwort	*Artemisia vulgaris*	O
Mullein	*Verbascum* sp.	O
Musk mallow	*Malva moschata*	O
Narrow-leaved ragwort	*Senecio inaequidens*	O
Nodding thistle	*Carduus nutans*	O
Opium poppy	*Papaver somniferum*	O
Oxeye daisy	*Leucanthemum vulgare*	O
Pedunculate oak	*Quercus robur*	O
Pendulous sedge	*Carex pendula*	F
Perennial ryegrass	*Lolium perenne*	F
Perforate St John's-wort	*Hypericum perforatum*	O
Plum	*Prunus domestica*	R
Prickly sow-thistle	*Sonchus asper*	O
Purple loosestrife	*Lythrum salicaria*	O

English name	Scientific name	DAFOR
Purple toadflax	*Linaria purpurea*	O
Pyramidal orchid	*Anacamptis pyramidalis*	R
Red bartsia	*Odontites vernus*	O
Red clover	*Trifolium pratense*	O
Red dead-nettle	*Lamium purpureum*	O
Redcurrant	*Ribes rubrum*	R
Red fescue	*Festuca rubra*	F
Redshank	*Persicaria maculosa*	F
Remote sedge	*Carex remota*	O
Ribwort plantain	*Plantago lanceolata*	F
Rosebay willowherb	*Chamaenerion angustifolium*	O
Rough chervil	*Chaerophyllum temulum*	O
Rough meadow-grass	*Poa trivialis*	F
Salad burnet	*Sanguisorba minor*	F
Scarlet pimpernel	*Anagallis arvensis*	O
Scentless mayweed	*Tripleurospermum inodorum*	F
Scots pine	*Pinus sylvestris*	O
Sea club-rush	*Bolboschoenus maritimus*	O
Self-heal	*Prunella vulgaris*	O
Sharp-flowered rush	*Juncus acutiflorus*	O
Silver birch	*Betula pendula*	O
Silverweed	*Potentilla anserina*	O
Small cat's-tail	*Phleum bertolonii*	O
Small-flowered crane's-bill	*Geranium pusillum*	O
Smooth tare	*Vicia tetrasperma*	O
Soft brome	*Bromus hordeaceus*	O
Soft rush	*Juncus effusus*	O
Spear-leaved orache	*Atriplex prostrata*	F
Spear thistle	*Cirsium vulgare*	F
Spiked sedge	*Carex spicata*	O
Square-stalked St John's-wort	*Hypericum tetrapterum*	R
Stinking hellebore	*Helleborus foetidus*	R
Sycamore	*Acer pseudoplatanus*	O
Teasel	*Dipsacus fullonum*	F

English name	Scientific name	DAFOR
Timothy	*Phleum pratense*	F
Traveller's joy	*Clematis vitalba*	O
Tufted hair-grass	*Deschampsia cespitosa*	O
Tufted vetch	*Vicia cracca*	O
Upright hedge-parsley	*Torilis japonica*	O
Wall barley	*Hordeum murinum*	O
Water figwort	*Scrophularia auriculata*	O
Water mint	*Mentha aquatica*	F
Wayfaring tree	*Viburnum lantana*	O
Weld	*Reseda luteola*	F
Welted thistle	*Carduus crispus*	O
White bryony	*Bryonica dioica*	O
White campion	*Silene latifolia*	O
White clover	*Trifolium repens*	F
White dead-nettle	*Lamium album*	O
White willow	*Salix alba*	O
Wild basil	*Clinopodium vulgare*	R
Wild carrot	*Daucus carota*	O
Wild lettuce	*Lactuca virosa*	O
Wild liquorice	*Astragalus glycyphyllos*	R
Wild mignonette	*Reseda lutea*	O
Wild parsnip	*Pastinaca sativa*	O
Wild privet	*Ligustrum vulgare*	O
Wild service tree	*Sorbus torminalis*	O
Willowherb	*Epilobium* sp.	F
Wood avens	*Geum urbanum*	O
Wood dock	*Rumex sanguineus*	O
Wood forget-me-not	*Myosotis sylvatica*	O
Wood small-reed	*Calamagrostis epigejos*	O
Yarrow	*Achillea millefolium*	O
Yellow iris	*Iris pseudacorus*	O
Yellow rattle	*Rhinanthus minor*	O
Yellow toadflax	*Linaria vulgaris*	R
Yellow-wort	*Blackstonia perfoliata*	O

English name	Scientific name	DAFOR
Yorkshire fog	*Holcus lanatus*	A

KEY TO DAFOR (An estimate of plant relative abundance at a site)

D **Dominant**

A **Abundant**

F **Frequent**

O **Occasional**

R **Rare**

English name	Scientific name
Birds	
Blackbird	*Turdus merula*
Blue tit	*Cyanistes caeruleus*
Buzzard	*Buteo buteo*
Canada goose	*Branta canadensis*
Carrion crow	*Corvus corone*
Coal tit	*Periparus ater*
Coot	*Fulica atra*
Dunnock	*Prunella modularis*
Goldfinch	*Carduelis art*
Green woodpecker	*Picus viridis*
Long-tailed tit	*Aegithalos caudatus*
Magpie	*Pica caudates*
Mallard	*Anas platyrhynchos*
Pheasant	*Phasianus colchicus*
Pied wagtail	*Motacilla alba*
Red kite	*Milvus milvus*
Red-legged partridge	*Alectoris rufa*
Sand martin	*Riparia riparia*
Skylark	*Alauda arvensis*
Song thrush	*Turdus philomelos*
Swallow	*Hirundo rustica*
Wren	*Troglodytes troglodytes*
Yellowhammer	*Emberiza citrinella*

English name	Scientific name
Amphibian	
Common toad	*Bufo bufo*
Great crested newt	*Triturus cristatus*
Palmate newt	*Lissotriton helveticus*
Smooth newt	*Lissotriton vulgaris*

English name	Scientific name
Reptiles	
Common lizard	*Zootoca vivipara*
Grass snake	*Natrix helvetica*

English name	Scientific name
Invertebrates	
Azure damselfly	*Coenagrion puella*
Beewolf	*Philanthus triangulum*
Black-tailed skimmer	*Orthetrum cancellatum*
Blue-tailed damselfly	*Ischnura elegans*
Brimstone	*Gonepteryx rhamni*
Brown argus	*Aricia agestis*
Bumblebee hoverfly	*Volucella bombylans*
Buff-tailed bumblebee	*Bombus terrestris*
Cinnabar	*Tyria jacobaeae*
Comma	*Polygonia c-album*
Common blue	*Polyommatus icarus*
Common carder bee	*Bombus pascuorum*
Common darter	*Sympetrum striolatum*
Common field grasshopper	*Chorthippus brunneus*
Dark Green Fritillary	*Speyeria aglaja*
Emerald damselfly	*Lestes sponsa*
Gatekeeper	*Pyronia tithonus*
Glow-worm	*Lampyris noctiluca*
Green Leaf-hopper	*Cicadella viridis*
Green-veined white	*Pieris napi*
Honeybee	*Apis mellifera*

English name	Scientific name
Hornet hoverfly	*Volucella zonaria*
Marbled white	*Melanargia galathea*
Meadow brown	*Maniola jurtina*
Meadow grasshopper	*Chorthippus parallelus*
Painted lady	*Vanessa cardui*
Peacock	*Aglais io*
Red admiral	*Vanessa atalanta*
Red-tailed bumblebee	*Bombus lapidarius*
Ringlet	*Aphantopus hyperantus*
Roesel's bush-cricket	*Metrioptera roeselii*
Ruddy darter	*Sympetrum sanguineum*
Seven-spot ladybird	*Coccinella septempunctata*
Silver-Y	*Autographa gamma*
Six-spot burnet moth	*Zygaena filipendulae*
Small skipper	*Thymelicus sylvestris*
Small white	*Pieris rapae*
Southern hawker	*Aeshna cyanea*
Southern wood ant	*Formica rufa*
Speckled wood	*Pararge aegeria*
Tree bumblebee	*Bombus hypnorum*
Vestral cuckoo bumblebee	*Bombus vestalis*
White-legged damselfly	*Platycnemis pennipes*

English name	Scientific name
Mammals	
Badger	*Meles meles*
Common shrew	*Sorex araneus*
Field vole	*Microtus agrestis*
Fox	*Vulpes vulpes*
Grey squirrel	*Sciurus carolinensis*
Mole	*Talpa europaea*
Muntjac	*Muntiacus reevesi*
Rabbit	*Oryctolagus cuniculus*
Roe deer	*Capreolus capreolus*

APPENDIX 2

LEGAL PROTECTION

1 LEGAL STATEMENTS FOR REPORTS INCLUDING S41 STATUS.

1.1 GREAT CRESTED NEWTS

1.1.1 In England, Scotland and Wales, GCNs are fully protected under the Wildlife and Countryside Act 1981 (as amended), including by the Countryside and Rights of Way Act 2000. They are also protected under European legislation, being included on Schedule-2 of the Conservation of Habitats and Species Regulations 2017. Taken together, this legislation makes it illegal, *inter alia*, to:

- Intentionally or recklessly kill, injure or capture a GCN.
- Damage or destroy habitat that a GCN uses for shelter or protection.
- Deliberately disturb a GCN when it is occupying a place it uses for shelter and protection.

1.1.2 These provisions apply to all life-stages of protected animals and in the case of amphibians, to both their terrestrial and aquatic habitats.

1.1.3 GCNs have been adopted as a species of principal importance in England under Section 41 of NERC.

1.2 REPTILES

1.2.1 All four of the more widespread species of native reptiles, that is common lizard, grass snake, slow worm and adder are given partial protection under the Wildlife and Countryside Act 1981 (as amended), which prohibits, *inter alia*, the intentional killing, injuring or taking of any of these species. The habitats of common reptile species are not protected under this Act and the animals are also not protected from disturbance whilst occupying their habitat.

1.2.2 There is no provision in the Act for licensing works that could give rise to an offence but it does provide a defence where it can be shown that the otherwise unlawful act was the incidental result of a lawful operation and that it could not reasonably have been avoided. Permitted development or a development which has received planning permission is clearly a lawful activity but the law thus requires that a reasonable effort be made to avoid killing or injuring protected animals in the course of implementing this permission.

1.2.3 Releasing reptiles into unsuitable habitat could constitute an offence under the Animal Welfare Act 2006.

1.3 BIRDS

1.3.1 The Wildlife and Countryside Act 1981 (as amended) protects all wild birds, their nests and eggs. Under this Act it is an offence to:

- Kill, injure or take any wild bird.

- Take, damage or destroy the nest of any wild bird while it is in use or being built.
- Take or destroy the egg of any wild bird.

1.3.2 Bird nesting sites are not themselves protected when not in use and the common species are not protected from disturbance whilst occupying their nest-sites. However, certain rare breeding birds, listed on Schedule-1 of the Act (e.g., barn owls *Tyto alba*) are also protected against disturbance whilst building a nest or on or near a nest containing eggs or young.

1.3.3 The 49 species that are listed as species of principal importance in England in accordance with Section 41 of NERC must be protected from adverse effects of any development.

1.4 BATS

1.4.1 In England, Scotland and Wales, all species of bats are fully protected under the Wildlife and Countryside Act 1981 (as amended), including by the Countryside and Rights of Way Act 2000. They are also protected under European legislation, being included on Schedule-2 of The Conservation of Habitats and Species Regulations 2017. Taken together, this legislation makes it illegal, *inter alia*, to:

- Intentionally or recklessly kill, injure or capture a bat.
- Deliberately disturb a bat when it is occupying a roost.
- Damage, destroy or obstruct access to a bat roost.

1.4.2 A bat roost is defined as being any structure or place that is used for shelter or protection and since it may be in use only occasionally or at specific times of year, a roost retains such designation whether the bats are present or not.

1.4.3 Seven species of bat (barbastelle, Bechstein's, noctule, soprano pipistrelle, brown long-eared bat, greater horseshoe bat and lesser horseshoe bat) have been adopted as species of principal importance in England under Section 41 of NERC.

1.5 BADGERS

1.5.1 Badgers are fully protected by the Protection of Badgers Act 1992, which subsumed all previous legislation covering this species. This Act makes it an offence, *inter alia*, to:

- Wilfully kill, injure or take or attempt to kill, injure or take, a badger.
- Interfere with a badger sett by doing any of the following things, intending to do any of these things or being reckless as to whether one's actions would have any of these consequences:
    - Damaging a badger sett or any part of it.
    - Destroying a badger sett.
    - Obstructing access to, or any entrance of, a badger sett.
    - Disturbing a badger when it is occupying a badger sett.

1.5.2 A badger sett is defined in the Act as any structure or place that displays signs of '*current use*' by a badger. The term '*current use*' is not clearly defined and needs to be interpreted carefully based on evidence. Although a sett may be empty at a certain time, it may be used as part of a regular cycle throughout the year and may therefore become active again at any time. Under certain conditions, activities which could otherwise give rise to an offence may be licensed by Natural England.

1.5.3 If a disturbance-only licence is issued, it is now common for the badgers to be left in-situ and not excluded from the sett (by gating). A sett which can be shown by an experienced ecologist to be disused would fall outside the Act and no licence or special precautions are then required

1.5.4 Badgers have been adopted as species of principal importance in England under Section 41 NERC.

APPENDIX 3

DESK STUDY

Northamptonshire Biodiversity Records Centre

[redacted]
ESL (Ecological Services) Ltd
1 Otago House
Allenby Business Village
Crofton Road
Lincoln
LN3 4NL

Northamptonshire Biodiversity Records Centre
C/O The Wildlife Trust
Lings House
Billing Lings
Northamptonshire
NN3 8BE
Tel: 01604 400448
Fax: 01604 784835
nbrc@northantsbrc.org.uk

Our Reference: 23-331

Monday 23rd October 2023

Dear Luke,

Re: Ecological data search, Thornhaugh and Cooks Hole (Ref: MJCA125)

Thank you for approaching the NBRC with this enquiry. All the information that you have requested is contained within this report. This includes a map of the search area, statutory and non-statutory site details and a list of protected and notable species records from your specified search area. For definitions of these sites please refer to the document at the end of this report.

Statutory sites

The following statutory sites are located within your specified search area. These sites have been labelled on the accompanying map.

Bedford Purlieus	Site of Special Scientific Interest/National Nature Reserve
Bonemills Hollow	Site of Special Scientific Interest
Collyweston Great Wood and Easton Hornstocks	Site of Special Scientific Interest/National Nature Reserve
Old Sulehay Forest	Site of Special Scientific Interest
Wansford Pasture	Site of Special Scientific Interest
West Abbot's and Lound Woods	Site of Special Scientific Interest

Further details, such as SSSI status and citations, can be accessed through the Natural England website using the following links;

https://designatedsites.naturalengland.org.uk/

Non-statutory sites

Following the Natural Environment White Paper (2011), twelve Nature Improvement Areas (NIA's) were designated and granted government funding in February 2012. They should aim to achieve significant and demonstrable enhancements of the ecological network over large areas by undertaking the actions prioritised in the review.

Further information regarding the Nene Valley Nature Improvement Area can be found on the Natural England website using the following link: https://www.wildlifebcn.org/sites/default/files/2019-01/Nene-Valley-A4-16PP-MAR-2015-web.pdf

The following non-statutory sites are located within your specified search area. These sites have been labelled on the accompanying map.

Site Name	Site Status
Fair Oak Sale	Local Wildlife Site
Fair Oak Sale Quarry	Local Wildlife Site
Great Byards Sale	Local Wildlife Site
Old Sulehay	Wildlife Trust Reserve/Local Wildlife Site/SSSI
Ring Haw Green Lane	Local Wildlife Site
Ring Haw Quarry Grassland	Local Wildlife Site/Wildlife Trust Reserve/Local Geological Site
Ring Haw Quarry Gullet	Local Wildlife Site/Local Geological Site
Ring Haw Woodland	Local Wildlife Site/Wildlife Trust Reserve
Spires Wood to Ring Haw	Local Geological Site/Local Wildlife Site
Standen's Pasture	Local Wildlife Site/Wildlife Trust Reserve
Stone Pit Quarry	Local Wildlife Site/Wildlife Trust Reserve
Wansford and Standen's Pastures	Wildlife Trust Reserve/Local Wildlife Site
Whiteland's Farm	Local Wildlife Site
Whiteland's Farm North	Potential Wildlife Site
Yarwell Dingle and Pond	Wildlife Trust Reserve
Yarwell Quarry	Local Wildlife Site

Descriptions for most of these non-statutory sites are attached to this report.

We do not currently hold any information for the following non-statutory sites located within your specified search area.

Site Number	Site Status
Great Byards Sale Quarry	Potential Wildlife Site category 1
749	Potential Wildlife Site category 1
750	Potential Wildlife Site category 1
751	Potential Wildlife Site category 1
753	Potential Wildlife Site category 1
754	Potential Wildlife Site category 1/Wildlife Trust Reserve

755	Potential Wildlife Site category 1
757	Potential Wildlife Site category 1
758	Potential Wildlife Site category 1
759	Potential Wildlife Site category 1
769	Potential Wildlife Site category 1

Potential Wildlife Site Category 1 definition is; sites never fully surveyed and assessed against LWS criteria.

For full definitions of Northamptonshire non-statutory sites please refer to the section "Sites of wildlife and geological importance in Northamptonshire" below.

Species records

Please note that we do not provide data for bats. This information can be obtained directly from the Northants Bat Group/County Recorder for Mammals using the contact details already provided.

7150 protected and notable species records fall within your specified search boundaries. A list of these species records is attached to this report.

This report contains sensitive information about the location of protected species and has been provided in confidence to assist you in your work. Because of this OS Grid References must be withheld from documents destined for public consumption.

I would remind you that these data are limited spatially and temporally and I would strongly recommend that follow-up surveys be carried out to support the baseline provided. I would also like to draw your attention to our terms and conditions once again.

Northamptonshire Biodiversity Records Centre
Terms and conditions

1. All rights to the data are reserved and ownership is not transferred with it. Data held by the Northamptonshire Biodiversity Record Centre (NBRC) remains the intellectual property, and in the ownership and copyright, of the originator(s).

2. Whilst every effort is made to ensure the accuracy of all the data provided, the NBRC can accept no responsibility for any costs, damages or liabilities whatsoever arising from the use of the data or for any omissions or inaccuracies within it.

3. The data held by the NBRC may not be comprehensive and the absence of data, in response to a data search, does not imply that a species, important habitat or designation does not exist within that search area. Recorded presence does not imply current presence and the date for all records will be provided.

4. Data is provided solely for the use of the enquirer (and their client) and only for the purpose(s) specified by the enquirer at the time of its request. Data must not be reused or stored beyond the life of the project for which they were acquired.

5. Data may be used as required in support of the planning process but OS grid references must be removed from documents destined for public consumption due to sensitive data concerning protected species.

6. The NBRC will provide access to data subject to any conditions imposed on its use by the General Data Protection Regulation 2018, Data Protection Act, Environmental Information Regulations 2004, Copyright and Intellectual Property Right Law or the data owner. Restrictions on the release of information may therefore apply.

7. The NBRC will only release un-interpreted data and will not usually comment upon its significance.

8. The NBRC will release as soon as possible, and within twenty working days of receipt, the request unless an extension of time is necessary. In this event the enquirer will be informed within ten working days.

9. All charges made by the NBRC relate to the provision of administration, data handling and search services.

10. Personal details submitted will be kept securely for the time needed to process your request and for up to 7 years, as required for HMRC. Following this time, these records will be responsibly destroyed. If you would like to know more about how we manage your data please view our privacy policy.

As agreed, the total charge for the time taken to extract this information and put together the report is £145 plus VAT (£174 including VAT). An invoice will be sent under different cover from our Cambridgeshire office.

Should you have any enquiries please feel free to contact me at the above address.

Yours sincerely,

[redacted]

Nathalie Hueber
Biodiversity Data Officer

Sites of wildlife and geological importance in Northamptonshire

Statutory Sites:

Special Protected Area (SPA)
SPAs are strictly protected sites classified in accordance with Article 4 of the EC Directive on the conservation of wild birds (79/409/EEC), the Birds Directive.

Site of Special Scientific Interest (SSSI)
The SSSI series provide statutory protection for the best examples of the natural environment. SSSI were originally notified under the National Park and Access to the Countryside Act 1949 and they were renotified under the Wildlife and Countryside Act 1981. Improved provisions for their protection and management were introduced in the Countryside and Rights of Way Act 2000.

National Nature Reserve (NNR)
NNRs are declared by the statutory country conservation agency (English Nature) under the National Park and Access to the Countryside Act 1949. NNR contain the most important examples of natural and semi-natural ecosystems within Great Britain. NNR conserve the habitats within them and offer opportunities for research.

Local Nature Reserve (LNR)
LNRs are declared under the National Park and Access to the Countryside Act 1949 by local authorities. LNR are declared and managed for nature conservation, education and research or opportunities for public access to nature.

Non-statutory sites:

Nature Improvement Area (NIA)
Following the Natural Environment White Paper (2011), twelve NIAs were designated and granted government funding in February 2012. They should aim to achieve significant and demonstrable enhancements of the ecological network over large areas by undertaking the actions prioritised in the review:

- Improving the management of existing wildlife sites
- Increasing the size of existing wildlife sites
- Increasing the number of wildlife sites
- Improving connectivity between sites
- Creating wildlife corridors

Local Wildlife Site (LWS)
Local Wildlife Sites are areas of land which are rich in wildlife and are the equivalent to Sites of Importance for Nature Conservation. Criteria for selection take in threats and declines in certain species, national priorities and local distinctiveness. The LWS system is managed, in partnership, by The Wildlife Trust, local authorities, statutory nature conservation agencies, local naturalists and landowners. Local Wildlife Sites were previously known as County Wildlife Site (CWS) in the past.

Protected Wildflower Verge (PWV)
Protected Wildflower Verges are roadside verges rich in wildlife and are crucial to the success of the local Biodiversity Action Plan. Criteria for selection take in threats and declines in certain species, national priorities and local distinctiveness. The PWV system is managed, in partnership, by The Wildlife Trust, local authorities, statutory nature conservation agencies, local naturalists and landowners.

Pocket Park
The Pocket Park vision is to develop easy public access to the countryside, bringing the countryside to the people and providing opportunities for enjoyment and understanding of 'Countryside on the Doorstep'. Over the past 18 years, the county council has worked in partnership with many organisations and other local authorities to help create 80 Pocket Parks. For more information on this scheme please refer to the website at www.pocketparks.com.

Local Geological Site (LGS)
Local Geological Sites (LGS) are the most important places for geology and geomorphology outside the statutory SSSI. The sites are designated using locally developed criteria and are assessed by the local geological group.

Potential Local Geological Site (PLGS)
Potential Local Geological Sites (PLGS) are sites that were identified and considered to be important geological exposures. These sites have not yet been formally notified as Local Geological Sites by the local geological group. Currently these sites can only be located by a grid reference, as they do not have a formal site boundary and there is no descriptive survey information.

Potential Wildlife Site (PWS)
Potential Wildlife Sites (PWS) are sites that are either known or thought to be of higher biodiversity value than the average countryside but have not been confirmed to be of Local Wildlife Site (LWS) standard.

PWS can belong to one of three categories: 1. Sites never fully surveyed and assessed against LWS criteria. 2. Sites surveyed and assessed against the LWS criteria but not currently reaching the standard. 3. Sites previously recognised as LWS but not currently meeting the latest LWS criteria.

PWS were originally outlined using a combination of local knowledge and looking at aerial photographs for evidence of biodiverse habitats. All PWS are likely to be important for the County's biodiversity, either in their own right, or through buffering and linking current LWS and contributing to Green Infrastructure. Many of these sites could potentially be of LWS standard once surveyed.

Important Invertebrate Areas (IIAs)

IAAs are nationally or internationally significant places for the conservation of invertebrates and the habitats upon which they rely. IIAs have been selected where they support a nationally significant assemblage of species or support a single globally endangered, European endangered or national Critically Endangered species

NBRC
Northamptonshire Biodiversity Records Centre

Area around Thornhaugh and Cooks Hole (2km search area)

Bonemills Hollow SSSI
Bedford Purlieus NNR/SSSI
Collyweston Great Wood and Easton Hornstocks NNR/SSSI
West Abbot's and Lound Woods SSSI
Wansford and Standen's Pastures
Wansford Pasture SSSI
Standen's Pasture
757
759
753
Yarwell Quarry
Spires Wood to Ring Haw LGS
Stone Pit Quarry
754
Yarwell Dingle and Pond
749
Ring Haw Woodland
Old Sulehay Forest SSSI
Great Byards Sale Quarry
750
755
758
Whiteland's Farm North
751
Whiteland's Farm
Great Byards Sale
Ring Haw Quarry Gullet
Fair Oak Sale
769
Old Sulehay Reserve
Fair Oak Sale Quarry
Ring Haw Quarry Grassland
Ring Haw Green Lane

- Local Geological Site
- County Boundary
- Site of Special Scientific Interest
- National Nature Reserve
- Nature Improvement Area
- Local Wildlife Site
- Potential Wildlife Site
- Wildlife Trust Reserve

N

500m

Site Name: **Fair Oak Sale Quarry**

Site Code: E1399

Status: LWS

Other Designations:

Grid Reference: TL041974

Area (ha): 11.2

District: East Northamptonshire

Site History:
21/09/2010 LWS

Habitats present
Broad Habitat: Grassland, Wetland, Woodland
BAP Habitat: Lowland Calcareous Grassland, Open Mosaic Habitats on Previously Developped Land

Reason for Designation:
An area of old quarry workings that have developed an open mosaic habitat with a large extent of early successional species rich calcareous grassland that is developing well on thin soils. The site qualifies as a LWS under the open mosiac and calcareous grassland criteria with 23 Calcareous indicators recorded of which 14 were strong.

Site Description:

22/07/2010
The 2 former LWS were surveyed seperately and the results have been combined to create this new LWS.

Quarry 1 (former LWS E156 - TL041974)

This was a rather shallow quarry and the largest area here was occupied by dry, developing calcareous grassland on thin soil, which was suffering from the drought of early summer 2010.

The lake in the quarry bottom was longer than that shown on the base-map and appeared to have become deeper quite recently, as witnessed by small willows with a "drowned" appearance with lots of green leaves below water level.

At the south-western end of the site there was a small area of scrub and woodland on undulating ground with a reasonable selection of woodland plants.

The dry grassland of this site held plants such as Picris echioides Bristly Ox-tongue and Dipsacus fullonum Wild Teasel growing alongside Blackstonia perfoliata Yellow-wort, Carlina vulgaris Carline Thistle, Euphrasia nemorosa Eyebright and many more.

There was a small amount of emergent swamp vegetation in the lake, mainly Schoenoplectus lacustris Common Club-rush, and a selection of wetland species at the edge, including Juncus articulatus Jointed Rush, J. subnodulosus Blunt-flowered Rush and Lysimachia nummularia Creeping Jenny.

In the small area of scrub and woodland beyond the southern end of the lake, the ground flora included Ajuga reptans Bugle, Circaea lutetiana Enchanter's Nightshade and occasional Primula vulgaris Primrose.

Stock doves were using the large nestbox here.

North-West of Quarry 1 (TL041976)

A larger hollow to the north-east, on the other side of the track along the north-eastern boundary of Quarry 1, held some bare ground and a good selection of plants from calcareous grassland. Plants present here included Carlina vulgaris carline thistle, Euphrasia nemorosa eyebright and Blackstonia perfoliata yellow-wort.

The large hollow to the north-east of this site held similar vegetation to that on the more level ground of Quarry 1 and Quarry 2. The slopes here were in the early stages of colonisation with abundant bare ground and a mixture of pioneer species such as Picris echioides bristly oxtounge and Tussilago farfara colt's foot, and plants from calcareous grassland such as Brachypodium pinnatum tor grass, Carlina vulgaris carline thistle, Carex flacca glaucous sedge, Euphrasia nemorosa eyebright and Hypericum perforatum perforate st. John's-wort,

There was no water in this hollow but a shallow ditch on higher ground held additional species such as Schoenoplectus lacustris bulrush, Eleocharis palustris common spike-rush and Cirsium palustris marsh thistle.

Area between Quarry 1 and 2 (TL041973)

Furthermore, the area lying between Quarry 1 and Quarry 2, much of which was occupied by a plantation of small trees that had not done well, was just as species-rich as the drier parts of both Quarry 1 and Quarry 2 and the two sites could easily be combined as one unit.

Quarry 2 (former LWS E248 - TL041973)

This site lies between former E156 Quarry 1, and E116 Little Morton Sale Quarry and is almost continuous with them. It is also close to some large areas of established woodland.

Some of this site consisted of more or less level ground, perhaps landscaped, in a shallow quarry that was open to adjacent ground in the north-west. There was a low bank in the south, on the north-western side, a higher bank on the south-eastern side.

Some of the ground held wet grassland of variable height in the south-east, with other areas of short turf with a mixture of pioneer and calcareous grassland plants on a thin soil, and which were heavily grazed by rabbits. Areas of taller Calamagrostis epigejos Wood Small-reed broke up the short turf in places.

Much of the site though, consisted of a much deeper gully, being deepest in the south-west, where it was permanently flooded, and becoming progressively shallower to the north-east.

Most of the woodland of the site was found on the slopes of this deeper gully.

Classified as the primary habitat for its collection of calcareous grassland species, the short vegetation here held a mixture of pioneer species such as Picris echioides Bristly Ox-tongue and calcareous plants including Carlina vulgaris Carline Thistle, Euphrasia nemorosa Eyebright, Pastinaca sativa Wild Parsnip and Viola hirta Hairy Violet. This was largely very short vegetation on parched ground, but was occasionally broken up by stands of taller Wood Small-reed. Bare ground was frequent and there were patches of Cladonia Sp. Cladonia lichens and dog lichens.

Neutral wet grassland in the south held a sward of varying height. Wood Small-reed also occurred here, but was now mixed in with species such as Cirsium palustre Marsh Thistle, Dactylorhiza fuchsii Common Spotted-orchid, Deschampsia cespitosa Tufted Hair-grass, Lotus pedunculatus Greater Bird's-foot-trefoil, Potentilla anserina Silverweed and Lysimachia nummularia Creeping Jenny.

Fraxinus excelsior Ash and Acer pseudoplatanus Sycamore were abundant in the drier woodland along with less frequent Quercus robur Pedunculate Oak, Fagus sylvatica Beech and others. Perhaps because of the large woodlands nearby, there was a good selection of shade plants on the woodland floor, including Mercurialis perennis Dog's mercury, Hypericum hirsutum Hairy St. John's-wort and Primula vulgaris Primrose. Much rarer was Atropa Belladonna Deadly Nightshade.

A small amount of wet woodland was present in the quarry bottom as an area of Salix cinerea woodland near the northern end, but there was little vegetation associated with it. Accumulations of debris in the gully suggest that water can sometimes sweep down the gully in force. There was also a selection of willow trees and shrubs on the edges of the lake.

Near the north-east corner of the site there was an area dominated by Pteridium aquilinum Bracken.

Lots of standing/dead wood was to be found in the gully along with rock outcrops in the deeper part of the gully.

Boundary Changes
14/09/2010 This site was created following the merging of the Wildlife Sites Quarry1 (E156) and Quarry 2 (E248) and includes the area between the two quarries.

Related Site Information

Fair Oak Sale - Quarry 1, Historical
Fair Oak Sale - Quarry 2, Historical

Fair Oak Sale - Quarry 1 (TL041974)
24/07/1991
This is a smallish quarry adjacent to the north part of Fair Oak Sale. It is quite recently abandoned. The sandy sides have a sparse vegetation of colonizing species typical of the area, eg. Blackstonia perfoliata, Centaurium erythraeum, Tussilago farfara, Picris echioides, Calamagrostis epigejos. The pond is quite well-vegetated with Schoenoplectus lacustris and Potamogeton natans. Juncus articulatus is frequent around the edges. To the south the pool dries up (seems especially dry this year). NB. the regraded area just to the east of this pit appears to have been planted with Cotoneaster spp. and Lotus uliginosus ? Juncus conglomeratus, Deschampsia caespitosa and various arable weeds are also taking it over. A good site because of its proximity to several others making a mosaic of habitats. This pit is likely to improve in interest if left undisturbed.

16/07/2002
Variance in habitat from secondary woodland forming around the edge from Fair Oak Sale to calcareous grassland and a long pool in the quarry with tall emergent vegetation surrounding it. The interest is less than that of a neighbouring quarry on site, but as a sub-site to Fair Oak Sale complex.

Fair Oak Sale - Quarry 2 (TL041973)
07/08/1991
This has well-scrubbed edges containing Salix alba, S. capraea, S. cinerea, Alnus spp., Crataegus spp. The lake has black, stagnant water and has not vegetated in the way that nearby lakes and ponds have. The vegetation has oddities such as white specimens of both Centaurium erythraeum and Prunella vulgaris. There is also a big rabbit colony with a high proportion of black rabbits. Colonized areas contain vegetation as in surrounding pits, but better-established than in Quarry 1, with grassy areas, one of which contained bee orchids. Overall the number of spp. present is quite high (counting the land by the track) - 70 spp. On either side of the track between Fair Oak Sale and this quarry is flat, rocky ground with a sparse, low vegetation. This contains Centaurium pulchellum, Atropa belladonna, Filago vulgaris (all rarities in Northants), Blackstonia perfoliata, Dipsacus fullonum and Centaurium erythraeum. This ground is therefore included in the Prime Site because of its unusual flora. The main interest of the site is in the rather unusual and ephemeral flora of the bare ground around the pit and the grassland/ scrub on the slopes. Some of the interest will change or go as this ground gets colonized. The water quality is a mystery as other pools nearby have good vegetation and aquatic invertebrate activity. Otherwise this is a valuable site and the habitat for primary colonizers would be good to preserve.

16/07/2002
The soil depth is very shallow in the quarry and this provides an opportunity for a wider variety of species to occur. A track runs alongside the site which should no longer be the boundary as the

diversity continues north of this track. There are some silver birch and areas of scrub along the track and in the gulley. The gulley also contains taller scrub and willows around a deep but botanically poor lake with some wildfowl. The gulley also supports small hills with other species including Pilosella officinarum. The site is recommended for extension

Map:

Site Name: **Fair Oak Sale**

Site Code: E59

Status: LWS

Other Designations: Ancient semi-natural woodland

Grid Reference: TL039973

Area (ha): 3.4

District: East Northamptonshire

Site History:
19/07/1991 LWS
08/05/2002 LWS

Habitats present
Broad Habitat: Woodland
BAP Habitat: Lowland Mixed Deciduous Woodland

Reason for Designation:
An area of Ancient Semi-Natural Woodland containing over 25% broad-leaved cover and is a good example of NVC W8. This site qualifes as a Wildlife Site as its Ancient Woodland with 48 woodland plants recorded of which 14 are Ancient Woodland Indicator species.

Site Description:

08/05/2002
Rich woodland site with interesting species including Hairy Wood-Rush in the southern section and many Early Purple-Orchids carpeting the central parts.

19/07/1991
A patch of ancient woodland now replanted and much diminished in area due to quarrying activities. The Sale is now restricted to two roughly triangular strips of woodland, similar in composition to Great Byards Sale. There is one small quarry pit adjacent to the northern strip of wood, and another, longer quarry running parallel to the whole length of the Sale (see subsites Quarry 1 and Quarry 2). The woodland used to be about twice its present area.

The semi-natural regrowth of trees and shrubs has now formed a uniform, youngish stand with a sparse shrub layer and groundflora dominated by Mercurialis. The trees are a mixture including Qercus robur, Fraxinus excelsior, frequent Acer pseudoplatanus, A. campestre, Malus sylvestris, Tilia platyphyllos (by track). Shrubs include Cornus sanguinea, Prunus spinosa, Ligustrum vulgare, Euonymus europaea. The groundflora is mostly Mercurialis perennis with occasional Scilla non-scripta, Anemone nemorosa, Urtica dioica, Galium mollugo (edge of wood) and Hedera helix. (NB Euphorbia amygdaloides recorded 1980, not seen on this survey). In general the floor of the wood seems drier and more light than eg. in Great Morton Sale, where mosses and ferns are more common. There is a pheasant pen in part of the wood, which has very rank vegetation atypical of the wood as a whole.

The woodland has quite a good variety of woody species and some ancient woodland associates. It benefits from proximity to Gt. Byards and Gr. Morton Sales, which may reduce some of the drawbacks of it being a small area with a lot of exposed edges. The quarries have not yet reached the most diverse flora achieved by nearby quarries, but there is no reason to suspect that a greater diversity will not develop quite rapidly. The flat, stoney ground between the wood and the quarries already contains three county-rare species, the larger quarry has at least one. It would probably benefit wildlife most if this small mosaic of sites was left to develop the full potential of limestone flora found in the area, not just in the quarries but also on either side of the track. Only the woodland ideally

needs some management - possibly minor thinning work (and/or coppicing as there is some suggestion that the Sale was once coppiced for field maple).

Boundary Changes
05/10/2015 Grid reference changed from TL040975 to TL039973 as this was at the edge of the woodland and not in the centre

Map:

Site Name: **Great Byards Sale**

Site Code: E78

Status: LWS

Other Designations: Ancient semi-natural woodland

Grid Reference: TL037977

Area (ha): 18.4

District: East Northamptonshire

Site History:
19/07/1991 LWS
02/05/2002 LWS
14/11/2018 LWS

Habitats present
Broad Habitat: Woodland
BAP Habitat: Lowland Mixed Deciduous Woodland

Reason for Designation:
An area of ancient woodland on the edge of the Rockingham Forest with a well developed oak-ash canopy, decent shrub layer with derelict coppice in places and a well developed herb layer in places. The woodland qualifies as a Wildlife Site as an area of extant ancient woodland with 15 ancient woodland indicator species recorded.

Site Description:

09/07/2018
Ancient semi-natural (deciduous) woodland and its associated rides forms the main habitat. There are also notable shallow wetland and seasonal pond habitats towards the eastern edge of the wood. Relatively species-rich grassland lies to the south of the wood (outside site boundary) and to the south of this lies Morton's Sale, another area of what I assume is semi-natural woodland. The northernmost tip of the latter and southernmost tip of Great Byards are fairly close. Apart from this, connections to other woodlands in the Rockingham forest area are rather tenuous.

The woodland covers over 17ha with few intrusions, a relatively large uninterrupted habitat by county standards. A well-developed canopy layer is dominated by ash (Fraxinus excelsior) with frequent oak (Quercus robur). The shrub layer is also well developed with hazel (Corylus avellana), common & midland hawthorn (Crataegus monogyna & Crataegus laevigata), blackthorn (Prunus spinosa) and field maple (Acer campestre) the main components. There are plenty of old coppice stools some of which have grown up into mature trees and some old standards too. Dead wood of all sizes is abundant. The herb layer is well developed in parts, sparse in others, with several ancient woodland indicators including early purple orchid (Orchis mascula), wood speedwell (Veronica montana) and wood spurge (Euphorbia amygdaloides). Three-veined sandwort (Moehringia trinervia) was present in greater abundance than I have seen in any other wood. Whether this is particular to 2018 or a regular occurrence, I do not know. Of interest are the shallow wetland and seasonal pond areas towards the eastern side of the wood. These were often dominated by remote sedge (Carex remota) and tufted hair-grass (Deschampsia cespitosa cespitosa). I have never seen a woodland with such abundant remote sedge (Carex remota), again whether this is a regular occurrence or particular to this year, I do not know. One tussocky ride dominated by bush grass (Calamagrostis epigejos) also had species of interest such as spiked sedge (Carex spicata) and lesser stitchwort (Stellaria graminea).

On the northern border, the presence of bracken (Pteridium aquilinum) indicates patches of acid soil whereas more calcareous patches are represented by plants such as hedge bedstraw (Gallium mollugo).

The area in the south which was planted with wild cherry (Prunus avium) and sycamore (Acer pseudoplatanus) does now have primrose (Primula vulgaris), dog's mercury (Mercurialis perennis) and hairy St. John's wort (Hypericum hirsutum); there was speculation this might happen in the original site description i.e. that vegetation might re-establish in the planted area.

Hornets (Vespa crabro) were seen on two occasions as was a swarm of crane flies. A few butterflies were seen but overall the almost continuous shade cast by the canopy does not favour most lepidoptera. For birds, see accompanying site visit notes. There was a relatively small amount of bird song and not that many sightings on the day of the survey.
This may have been due to the weather or to the fact that in 2018 many summer visitors were arriving late.

General notes on flora from a route along the east, north and south edges of the wood. A well-developed canopy layer was present, dominated by ash (Fraxinus excelsior) but also with frequent oak (Quercus robur). Equally there was a reasonably well developed shrub layer formed by hazel (Corylus avellana), common and midland hawthorn (Crataegus monogyna & Crataegus laevigata), blackthorn (Prunus spinosa) and field maple (Acer campestre). The presence of old coppice was very much a feature of the wood, both in the shrub layer and in the canopy where old coppice stools had been allowed to grow up. There were some very fine old coppiced stools especially of ash (Fraxinus excelsior) and field maple (Acer campestre). One or two of the old stools contained small pools of water. Despite the relatively well-developed shrub and canopy layers, much of the wood along routes 1 & 2 had a moderately open feel to it. Though there were few signs of browsing by deer, tree seedlings and saplings were few and far between. On the north side of the wood there was a track obviously well used by deer. The herb layer was mixed with several ancient woodland indicators, patches of lesser celandine (Ranunculus ficaria) and nettle (Urtica dioica) (not a lot of the latter). The fungus known as King Alfred's cakes (Daldinia concentrica) was also noted. A valuable ecological feature of the wood was the amount of dead wood of all sizes.

Fauna: the following birds were seen or heard: jackdaw (Corvus monedula), robin (Erithacus rubecula), blackbird (Turdus merula), great tit (Parus major), blue tit (Cyanistes caeruleus), chaffinch (Fringilla coelebs), blackcap (Sylvia atricapilla), wood pigeon (Columba palumbus). Songs were heard of robin (Erithacus rubecula), blackbird (Turdus merula), chaffinch (Fringilla coelebs), blackcap (Sylvia atricapilla) and wood pigeon (Columba palumbus). Given the time of year this was a disappointing list. However, this has been a late spring with several migrants late to arrive. It was also rather cool and blustery earlier in the day, though conditions did improve through the morning. A hornet (Vespa crabro) was seen as was a green veined-white butterfly (Pieris napi).

To the south the following species were seen, the first one possibly just outside the LWS boundary: wild parsnip (Pastinaca sativa) (r), Norway maple (Acer platanoides) (r), wood spurge (Euphorbia amygdaloides) (r). There was a tussocky damp ride dominated by bush grass (ld). Also present here were: lesser stitchwort (Stellaria graminea) (r), false fox sedge (Carex otrubae) (r), wood sedge (Carex sylvatica) (r), silverweed (Potentilla anserina) (r), creeping jenny (Lysimachia nummularia) (r) and spiked sedge (Carex spicata) (r).

Within the western half of the wood were a hybrid twixt common and midland hawthorn (Crataegus monogyna & Crataegus laevigata) (o), viola species (either V. riviniana or V. reichenbachiana), (r) and germander speedwell (Veronica chamaedrys) (r). Whilst moving east the following were seen: groundsel (Senecio vulgaris) (r), barren strawberry (Potentilla sterilis) (r), one or two hawthorn seedlings (r), early dog-violet (Viola reichenbachiana) (r), early purple orchid (Orchis mascula) (r; two plants seen), a violet with characteristics intermediate between V. riviniana & V. reichenbachiana was also seen (r). Much dense, derelict coppice was noted along route 5. Fauna: a speckled wood butterfly (Pararge aegeria) was seen.

To the east of the wood was a pheasant (Phasianus colchicus) pen not far from the house at Jack's green. Plant wise, ragwort (Senecio jacobaea), spear thistle (Cirsium vulgare) and brooklime (Veronica beccabunga) were seen here. Badger dung pits (Meles meles) were also present and a swarm of crane flies were seen whilst the song of a dunnock (Prunella modularis) was heard.

In the southwest corner were several wild cherries (Prunus avium) and sycamore (Acer pseudoplatanus) trees. These appeared to have been planted. The herb layer contained dog's

mercury (Mercurialis perennis), primrose (Primula vulgaris) and hairy St. John's-wort (Hypericum hirsutum). Here there was a substantial pile of rubble at the edge of the wood which should be a good habitat for reptiles. A red kite (Milvus milvus) flew over the wood and a buzzard (Buteo buteo) and green woodpecker (Picus viridis) were seen just outside the wood.

02/05/2002
The majority of the woodland is still as the previous surveyor described, with the exception of a small (approx. 2 ha) section on the southern tip, which has been felled and replanted with an Oak/Ash/ Cherry/Sycamore mix. It is probable that this section will gain back the same botanical diversity as the rest of the woodland with time.

19/07/1991
An ancient woodland site, probably cleared and replanted in some areas, with derelict hazel and maple coppice. The bulk of the wood is dominated by oak, ash and field maple. Some standard oaks appear to be very old, others - 50 years old? The scrub layer is very varied, quite dense in parts, with blackthorn, hawthorn, abundant privet, spindle (rare), elder, midland hawthorn, spurge laurel (rare) and young sycamore; hazel and field maple ex-coppice and saplings are frequent. Cherry is occasional. Ground flora is variable, dominated by Mercurialis perennis, with Agrostis stolonifera, Rumex conglomeratus and Primula vulgaris. The main ride runs from N-S along the west side of the wood, separating it from a strip of conifer plantation (now mixed with a few broadleaved species). It contains damp lush vegetation dominated by clumps of Carex otrubae and Juncus inflexus, with Mentha aquatica, Epilobium hirsutum, Juncus articulatus, Poa trivialis, Cirsium arvens, C.palustre and Juncus conglomeratus. The east and north margins of the wood have sparse limestone flora including a broad strip of Galium verum and Malva moschata along the south-east edge.

Other species include Pimpinella saxifraga, Pastinaca sativa, Odontites verna, Ophrys apifera (rare) on the north edge, and damp 'ride' vegetation with Lysimachia nummularia, Mentha spp. and Juncus effusus along the east edge by the main track to the KSR works. This woodland is of value due to its comparitively large area and its high diversity of tree (8) and shrub (12) species. The ground flora could be improved by appropriate management, which currently is lacking. In other respects the wood provides excellent bird, insect and mammal habitat.

Boundary Changes
23/11/2018 Boundary redrawn to more accurately reflect situation on the ground following the 2018 survey.

Map:

Site Name: **Ring Haw Green Lane**

Site Code: E157

Status: LWS

Other Designations: Ancient semi-natural woodland

Grid Reference: TL053973

Area (ha): 2.7

District: East Northamptonshire

Site History:
07/08/1991 LWS

Habitats present
Broad Habitat: Grassland, Hedgerows
BAP Habitat: Hedgerows

Reason for Designation:
An ancient byway with a thick and varied hedge containing a varirty of ancient woodland species. As it stands though the Lane seems to be well-used by birds and invertebrates.

Site Description:

07/08/1991
This appears to be an ancient byway, and has a thick and varied hedge (where not surrounded by actual woodland) for most of its length. The very southernmost point of the byway runs through a yard and so is of little interest, but from then on the hedges have been given some management (although usually minimal), and provide excellent thick cover - particularly in connection with the surrounding habitats. From the south to north of the lane, the vegetation is as follows: dense hedge of hawthorn, blackthorn, privet, buckthorn, crab apple etc. with tall ash standards. The verges of the bare track seem rank and of limited botanical interest. After the track crosses the disused Nassington railway line the verges become of more interest, the hedges more recently trimmed. Grassland species include Agrostis stolonifera, Arrhenatherum elatius, Phleum pratense, Dactylis glomerata with Silene alba, Mentha arvensis, Viola hirta, Arctium spp., Plantago lanceolata, Centaurea nigra, Cirsium palustre, Potentilla reptans. The hedges contain frequent spindle with field maple, hazel, crab apple, elder, hawthorn, blackthorn, ash standards and abundant Clematis vitalba. A minor crossroads is formed by a field track to the west and quarry entrance to the east (quarry long since disused). The hedges have slightly less diversity after this, but contain Ulmus glabra in addition. After the quarry the environs are all arable fields, which seems to have led to a reduction in diversity. The verges have abundant Urtica dioica and Conium maculatum here. When the lane passes through the Ring Haw woodland, the structure of the hedges disappears on the west edge and the verges broaden to contain the woodland margin. After 100 or so metres both track edges are similar, with Mercurialis perennis, Carex sylvatica, C. hirta, Mentha aquatica, Prunella vulgaris, Aegopodium podagraria, Urtica dioica, Vicia sylvatica, Poa nemoralis. Damper areas contain Juncus effusus, J. inflexus, Epilobium hirsutum and abundant Juncus bufonius along the track edge. The northernmost end of the Green Lane broadens slightly and the verges have tangled rank vegetation including Rubus fruticosus, Heracleum sphondylium, Urtica dioica. All of the track is used by vehicles (hence the bare and rutted central track), walkers and horses. Note the rare greater dodder, Cuscuta europaea, was recorded on the lane verges in 1971 and has been reported since. It was not recorded on this survey but is likely to reappear, infrequently. A very important wildlife corridor for the area which would well repay some more management. The verges and track itself are not as diverse as they could be and the tree line is not therefore fulfilling its full habitat potential either. Even as it stands though the Lane seems to be well-used by birds and invertebrates.

Boundary Changes

25/01/2013 Grid ref. changed to TL053973 to use central grid ref. of site instead of the start and end points. Start and end points of the site are TL054980/TL050967 at this time.

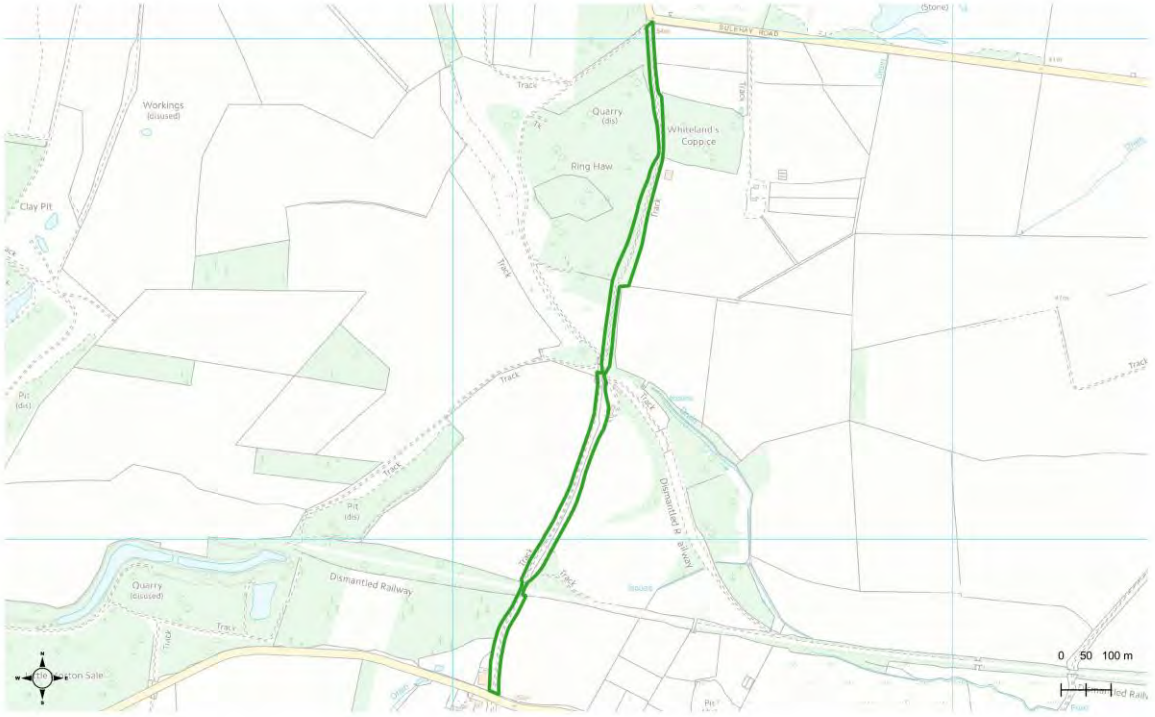
Related Site Information

Ring Haw, Historical

Ring Haw (TL053973)
07/08/1991
An area of ancient woodland, part of which has been quarried. The quarry grassland had SSSI status until levelled. Now the levelled area has regained some of its interest. The woodland has had little management recently, and one ride and a small clearing are very low in floristic interest due to pheasant husbandry. Overall the wood is of good habitat value, the structure being quite good. The quarry gullet to the southwest of the grassland has small, rather rank areas of standing water and dense scrub, plus interesting flora on the sandy cliffs. The ancient Green Lane is used as a public byway, and has some floristic interest.

Ring Haw represents a mosaic of undisturbed ancient and seminatural habitats of very high wildlife value, not least on botanical grounds alone. The area of ancient woodland does not have its full potential for plants due to minimal management, but is still an excellent bird and mammal habitat; signs of fallow, muntjac and - more unusually - roe deer were found, two species of woodpecker and one of owl were actually sighted during the survey and previous lists cite common lizard, badger, treecreeper, blackcap and 14 butterfly spp. on the site as a whole. The quarry grassland, and sandy 'cliffs' in particular, represent unusual plant habitats within the county, on which 6 county rare plant species are currently flourishing and abundant. Two other rarities have been recorded in the past on the Green Lane and wood. These former habitats do not currently seem to need management; only the lane and wood are in need of urgent attention for improval of their habitat value. It is worth noting that the Green Lane contains 15 woody species plus two woody climbers, making it noteworthy on grounds of hedgerow diversity before the grassy verges are considered. Overall the Ring Haw area benefits as much from its collection of habitats than from species contained within them, with regard to its wildlife value. If any individual habitat were to be lost the value of the overall site would in all likelihood decrease out of proportion to the size of the one habitat lost.

Map:



Site Name: **Ring Haw Quarry Grassland**

Site Code: E158

Status: LWS

Other Designations: Ancient semi-natural woodland, Wildlife Trust Reserve, Local Geological Site

Grid Reference: TL052976

Area (ha): 5.2

District: East Northamptonshire

Site History:
19/07/1991 LWS

Habitats present
Broad Habitat: Grassland, Woodland
BAP Habitat: Lowland Calcareous Grassland, Lowland Mixed Deciduous Woodland

Reason for Designation:
Areas of species rich calcareous grassland amongst scrub and woodland.

Site Description:

19/07/1991
A small area of previously established limestone grassland remains to the southwest of the wood, with a slightly larger, newer community to the south, The newer community is a varied mixture of low-growing herb spp. and taller herbs and scrub. Salix cinerea and Rubus fruticosus are dotted about a predominantly bare area on which the primary colonizers (now fairly well established) are growing. Rarities here iclude Helleborus foetidus, Filago vulgaris, Centurium pulchellum, Atropa belladonna, Acinos arvensis (all county rarities). Other common spp. present include Centaurium erythraeum, Blackstonia perfoliata, Euphrasia agg., Hypericum perforatum, Pastinaca sativa, Linum catharticum and Malva moschata. The area is much used by deer and rabbits. The grassland to the south-west of the wood has less recently been disturbed and has a very short rabbit-grazed turf of Agrostis capillaris, Festuca rubra, and Arrhenatherum elatius, with Deschampsia cespitosa on more spp-poor areas. Herbs include abundant Lotus corniculatus and Origanum vulgare with Clinopodium vulgare, Galium verum, Hieracium pilosella, Leontodon autumalis and Malva moschata. A very good insect habitat surrounding the Ring Haw woodland that shows an interesting contrast between two types of grassland. Without management the more disturbed area will change but the short turf seems quite stable at the moment, probably because the grazing is so heavy.

Boundary Changes
25/01/2013 Grid ref. changed to TL052976 to use central grid ref. of site instead of the start and end points. Start and end points of the site are TL051978/TL053973 at this time.

Related Site Information

Ring Haw, Historical

Ring Haw (TL053973)
07/08/1991
An area of ancient woodland, part of which has been quarried. The quarry grassland had SSSI status until levelled. Now the levelled area has regained some of its interest. The woodland has had little management recently, and one ride and a small clearing are very low in floristic interest due to pheasant husbandry. Overall the wood is of good habitat value, the structure being quite good. The quarry gullet to the southwest of the grassland has small, rather rank areas of standing water and

dense scrub, plus interesting flora on the sandy cliffs. The ancient Green Lane is used as a public byway, and has some floristic interest.

Ring Haw represents a mosaic of undisturbed ancient and seminatural habitats of very high wildlife value, not least on botanical grounds alone. The area of ancient woodland does not have its full potential for plants due to minimal management, but is still an excellent bird and mammal habitat; signs of fallow, muntjac and - more unusually - roe deer were found, two species of woodpecker and one of owl were actually sighted during the survey and previous lists cite common lizard, badger, treecreeper, blackcap and 14 butterfly spp. on the site as a whole. The quarry grassland, and sandy 'cliffs' in particular, represent unusual plant habitats within the county, on which 6 county rare plant species are currently flourishing and abundant. Two other rarities have been recorded in the past on the Green Lane and wood. These former habitats do not currently seem to need management; only the lane and wood are in need of urgent attention for improval of their habitat value. It is worth noting that the Green Lane contains 15 woody species plus two woody climbers, making it noteworthy on grounds of hedgerow diversity before the grassy verges are considered. Overall the Ring Haw area benefits as much from its collection of habitats than from species contained within them, with regard to its wildlife value. If any individual habitat were to be lost the value of the overall site would in all likelihood decrease out of proportion to the size of the one habitat lost.

Map:

Site Name: **Ring Haw Quarry Gullet**

Site Code: E159

Status: LWS

Other Designations: Local Geological Site

Grid Reference: TL051975

Area (ha): 2.4

District: East Northamptonshire

Site History:
19/07/1991 LWS

Habitats present
Broad Habitat:
BAP Habitat: Open Mosaic Habitats on Previously Developped Land

Reason for Designation:
An old sand and ironstone gullet that has retained areas of bare ground and developed areas of speices rich grassland. Alongside the pools and scrub this provides a valuable habitat mosiac for wildlife in particular invertebrates.

Site Description:

19/07/1991
This sand and ironstone gullet is around 300m in length and reaches about 10m in depth at the northern end. The northeastern edge consists mostly of sand cliff with sparse flora. At the far northwest edge the sides become more rocky, with a scree/rock cliff below the Ring Haw grassland. The south of the quarry is shallow, with a dried-up pond - now marshy. There is some standing water further up the quarry, although there is little associated vegetation, the water being heavily shaded, dystrophic and apparently low in oxygen. The dried pond at the south end contains abundant Juncus inflexus and Typha latifolia, Epilobium hirsutum, Ranunculus ficaria, Veronica beccabunga, Nasturtium officinale and Juncus articulatus. North of the damper areas is a stand of Calamagrostis epigejos. The sides of the gullet get gradually deeper and steeper with dense Salix scrub on both sides. The scrub contains Salix capraea, S. cinerea, S. viminalis, Fraxinus excelsior, Sambucus nigra, Crataegus spp. and Betula pendula. Groundflora is limited and sparse, mainly Fragaria vesca, Brachypodium sylvaticum and Ranunculus repens. The north edge cliff contains around 98% bare sand with some interesting species on it including Catapodium rigidum, Sagina apetala, S. procumbens, Cerastium semidecandrum, Blackstonia perfoliata and Veronica officinalis. The small pools of black water contain Typha latifolia, Potamogeton natans, Glyceria maxima, abundant algae and locally abundant Equisetum fluviatile and Hippuris. Most of the southern edge of the gullet is bounded by overgrazed sheep pasture and arable. The side nearest Ring Haw woodland however runs alongside the levelled quarry grassland, so that the sandy, rocky top edge of the quarry has some interesting flora. The edge of the quarry grassland alongside the sand cliff is grazed very short by rabbits, and contains abundant Centaurium Pulchellum, Filago vulgaris (both very rare in Northants), Blackstonia perfoliata, Hypericum perforatum, Sagina procumbens, Malva moschata, M. neglecta, Lotus corniculatus, Anagallis arvensis. The rocky northeast edge of the gullet contains Atropa belladonna, Cotoneaster horizontalis (?a naturalized escape), Erigeron acer and one Helleborus foetidus plant (frequent in the quarry grassland above). Grasses are sparse and mainly Brachypodium pinnatum, Festuca ovina and F. rubra. The quarry cliffs and their top edge contain four county rarites and provide habitat for grass snakes; it is possible that other reptiles might use the area, but none were seen during this survey. A very interesting site, mostly because of the unusual sandy cliff habitats. The site is likely to scrub over more with time and lack of management although the heavy grazing on the top ledge should preserve some of the shorter vegetation for some time. The pools would benefit from clearing out.

Boundary Changes
10/06/2015 Site centroid changed from TL051977 to TL051975

Related Site Information

Ring Haw, Historical

Ring Haw (TL053973)
07/08/1991
An area of ancient woodland, part of which has been quarried. The quarry grassland had SSSI status until levelled. Now the levelled area has regained some of its interest. The woodland has had little management recently, and one ride and a small clearing are very low in floristic interest due to pheasant husbandry. Overall the wood is of good habitat value, the structure being quite good. The quarry gullet to the southwest of the grassland has small, rather rank areas of standing water and dense scrub, plus interesting flora on the sandy cliffs. The ancient Green Lane is used as a public byway, and has some floristic interest.

Ring Haw represents a mosaic of undisturbed ancient and seminatural habitats of very high wildlife value, not least on botanical grounds alone. The area of ancient woodland does not have its full potential for plants due to minimal management, but is still an excellent bird and mammal habitat; signs of fallow, muntjac and - more unusually - roe deer were found, two species of woodpecker and one of owl were actually sighted during the survey and previous lists cite common lizard, badger, treecreeper, blackcap and 14 butterfly spp. on the site as a whole. The quarry grassland, and sandy 'cliffs' in particular, represent unusual plant habitats within the county, on which 6 county rare plant species are currently flourishing and abundant. Two other rarities have been recorded in the past on the Green Lane and wood. These former habitats do not currently seem to need management; only the lane and wood are in need of urgent attention for improval of their habitat value. It is worth noting that the Green Lane contains 15 woody species plus two woody climbers, making it noteworthy on grounds of hedgerow diversity before the grassy verges are considered. Overall the Ring Haw area benefits as much from its collection of habitats than from species contained within them, with regard to its wildlife value. If any individual habitat were to be lost the value of the overall site would in all likelihood decrease out of proportion to the size of the one habitat lost.

Map:

Site Name: **Ring Haw Woodland**

Site Code: E160

Status: LWS

Other Designations: Ancient semi-natural woodland, Wildlife Trust Reserve

Grid Reference: TL053977

Area (ha): 7.2

District: East Northamptonshire

Site History:
19/07/1991 LWS

Habitats present
Broad Habitat: Woodland
BAP Habitat: Lowland Mixed Deciduous Woodland

Reason for Designation:
An ancient woodland of predominately ash/oak, with a good mixture of other trees and a number of ancient woodland species.

Site Description:

19/07/1991
This is a predominately ash/oak woodland with a good mixture of other trees. There is a well-defined and often dense scrub layer, and the ground flora is quite varied. Tree and shrub spp. present include birch, sycamore, field maple, hazel, spindle. In many areas the groundflora is dominated by Mercurialis, with few other species. Grassier areas/ glades are more varied, containing Carex sylvatica, Primula vulgaris, Trifolium repens. Fragaria vesca, Brachypodium sylvaticum, Astragalus glycyphyllos, Scrophularia nodosa, Hyacinthoides non-scripta, Centaurea nigra. Some areas have rank vegetation of poor diversity dominated by Urtica dioica (by the Lane) and Cirsium arvense (surrounding the pheasant areas). The county-rare Euphorbia lathyrus was recorded in 1970 and may still crop up. A valuable habitat but one which does not really have the diversity one might expect. This is mostly due to lack of management and very intensive pheasant husbandry within the small area of the central ride. The structure of the woodland itself is quite good, with a well-developed scrub layer and mostly varied groundflora.

Related Site Information

Ring Haw, Historical

Ring Haw (TL053973)
07/08/1991
An area of ancient woodland, part of which has been quarried. The quarry grassland had SSSI status until levelled. Now the levelled area has regained some of its interest. The woodland has had little management recently, and one ride and a small clearing are very low in floristic interest due to pheasant husbandry. Overall the wood is of good habitat value, the structure being quite good. The quarry gullet to the southwest of the grassland has small, rather rank areas of standing water and dense scrub, plus interesting flora on the sandy cliffs. The ancient Green Lane is used as a public byway, and has some floristic interest.

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Map:

Historical Background / Significance / Former use of site

Ironstone quarrying 1939 north of LMSR railway, to 1953 (area now infilled).
Further quarrying towards Roman Road to north, and Ring Haw 1968.
Quarry No3 south of the railway (disused 1968) worked 1968–70 for ironstone. (Spires Wood area)
Also overburden by KSR for siliceous clay from 1963.
These activities opened valuable geological sections (described in Sylvester-Bradley & Ford's Geology of the East Midlands 1968, & having been included in an important field meeting of the Geologists' Association in 1965)
Subsequently access has been granted by KSR International for geologists to visit the remaining faces, along the Spires Wood gullet and also north of the former railway (TL047970 and northeastwards)

Conservation and remedial work needed or desirable

Retention of rock faces where possible.

Summary of site significance

A valuable section through the succession of Middle Jurassic in this area

Scientific value * *
Educational value *
Historical value *
Aesthetic value *

Submitted ~~by~~ on behalf of RIGS Group by PROF. J.D. HUDSON & DR D.S. SUTHERLAND Date 21 July 2001

Considered by Rigs Group on 8.5.1993 and 24.7.1993

Approved / ~~Not Approved~~ as a RIGS Site

Signed on behalf of the RIGS Group by Allen J.G. Smith,
CONSERVATION OFFICER,
NORTHAMPTONSHIRE WILDLIFE TRUST.

Northamptonshire RIGS Group: Site Evaluation Form

e1a/e1b/e1c. ID 28/29/30

Site name	Grid Ref	Local Authority
SPIRES WOOD to RING HAW	TL 04 0969 – 047970 – 052979	East Northants District

Geographical Location

2 km NW of Nassington, north of Apethorpe road

Former site use	Present site use
Nassington Ironstone quarries / limestone site	disused

Ownership details and address

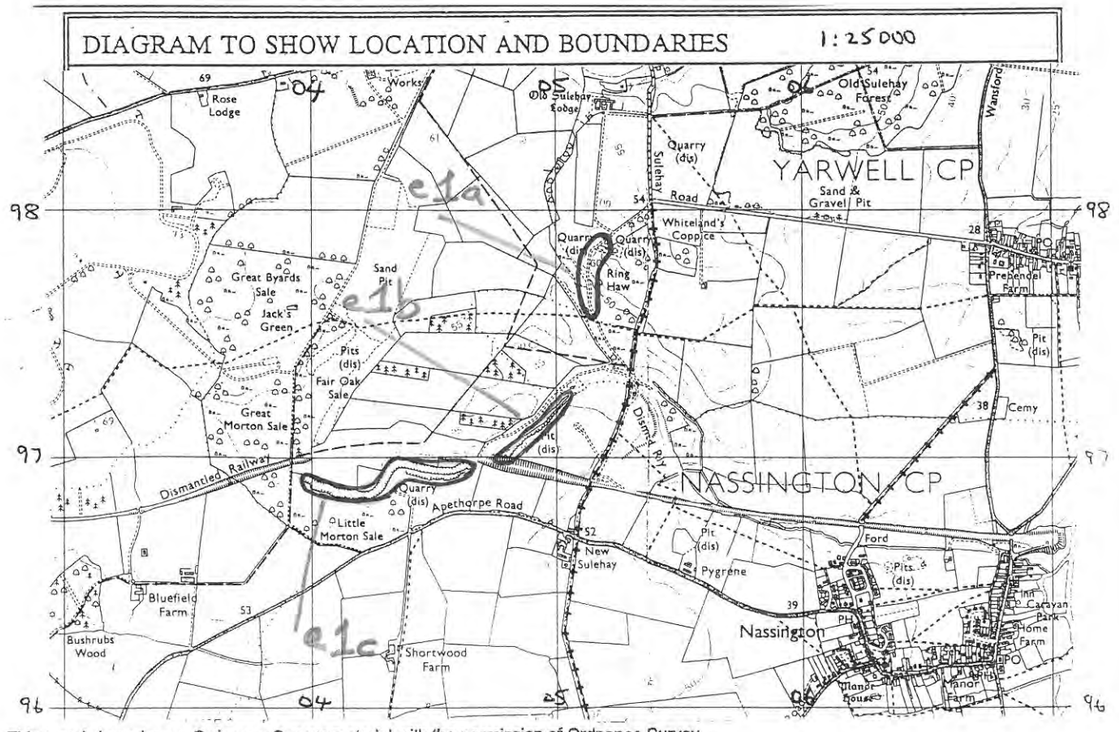
currently Mr Gilbert Hinckley, (Hinckley Estate)
Broomco Ltd.
Fax 01909774433

Photo? ☑ Location DSS

Stratigraphical position / Geological context (summary) Middle Jurassic:

Complete sections through: Northampton Sand Ironstone (upper part) – Grantham Formation – Lincolnshire Limestone Formation – Rutland Formation – Blisworth Limestone Formation – to Blisworth Clay

DIAGRAM TO SHOW LOCATION AND BOUNDARIES 1:25000



SCIENTIFIC DETAILS

Sketch / Section

See enclosures: Sylvester-Bradley, Merriam & Ashin 1965 Stop 3 (2 sheets) (unpublished)
Sylvester-Bradley & Ford 1968 (section by H.S. Torrens)
Martill's sketch section for Ring Haw

Geological Features and/or geomorphological / industrial economic features

1. Spires Wood (Little Morton Sale) gullet provides a well exposed section from the Northampton Sand Ironstone (Aalenian) through the Grantham Formation, to the Lower Lincolnshire Limestone (Bajocian) with Collyweston sands and concretions in the lower part of it. Total ~9m (TL040969–046969)
2. Second section north of disused railway line is cut through Bathonian rocks above the Lincolnshire limestone, exposing parts of Rutland Formation overlain by Blisworth Limestone and Blisworth Clay (TL049970)
3. Ring Haw quarry has afforded an informative section showing the complex relationships between the Grantham Formation (overlying the Northampton Sand Ironstone in the gullet) and the Lincolnshire Limestone. The latter includes sands equivalent to the Collyweston Slate horizon. A 'channel' of oolitic Lincolnshire limestone could be seen cutting down through the Grantham Formation almost to the ironstone below. This section was investigated by M. Ashton, O.M. Martill and J.D. Hudson 1978–81 and visited by the Geologists Association in 1978. (TL051977 – 052979)

Educational value

Good

Specialist ☑
Higher educational ☑
Secondary school ☐
Primary school ☐

Physical Means of Access

Access moderate; walking from footpath on Apethorpe road for Spires Wood (Little Morton Sale), then track to Ring Haw. Also access from north for Ring Haw.

Permission required ☑
Public access ☐
See footnote

Specimen collection potential

Yes

Hammering by permission ☑
Hammering forbidden ☐

Site facilities (e.g. parking, toilets?)

none

References, (published / unpublished) relating to the site

Geol. Map Stamford sheet 157 B.G.S.

Hollingworth, SE & Taylor JH, 1951 Memoir Geol. Surv. G.B. pp 119-120

Sylvester-Bradley PC, Merriam DF, & Ashin CJ, 1965 unpublished Geol. Assoc. Guide to Uppingham district, Univ. Leicester, Geology Dept.

Sylvester-Bradley PC & Ford TD (eds), 1968. The geology of the East Midlands. Leic. Univ. Press

Torrens, H.S. 1967 The Great Oolite Limestone of the Midlands. Trans. Leic. Lit & Phil Soc vol 61, 65-90

Jonks, E, 1992. The ironstone quarries of the Midlands Part VI Corby, p291-304 (map p294)

Regional context

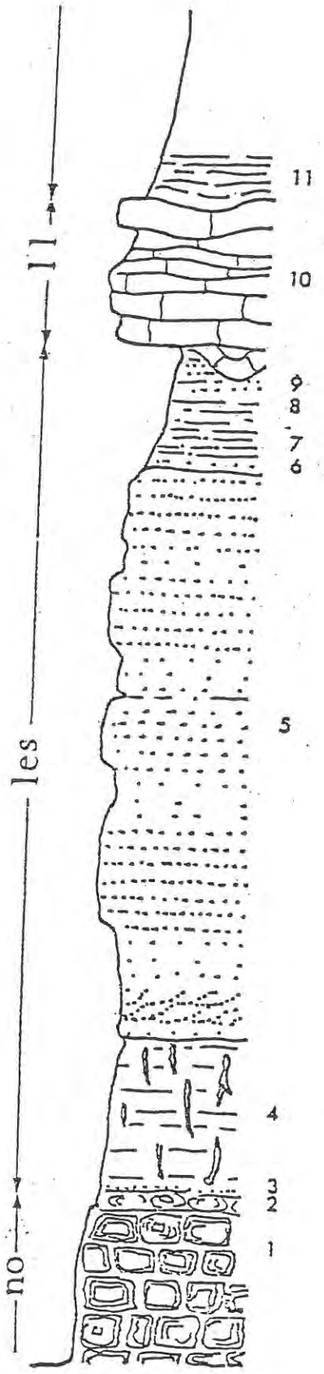
Unique ☐
Rare ☑

Unless on an official RIGS Group site visit, people visiting a site are responsible for their own Health and Safety. Unofficial visits are not covered by the Wildlife Trust's Liability Insurance.

STOP 3

[~TL042969] Spires Wood Section

Sylvester Bradley, Merriam & Aslin 1965



11. Sh., poorly exposed. 1 ft.
10. Ls., sometime cutting down to bed 5. False-bd., shelly, oolitic. 6 ft.
9. Sd., yel., scattered ooliths. 6 in. to 4 ft. [cowslip]
8. Sh., calc. 2 in. to 1 ft. 8 in.
7. Sd., yel. 0 to 4 ft. [primrose]
6. Sh. 3 in.
5. Sd., white at top, x-bd. at base 17 ft.
4. Sh., carb., laminated at top with rootlet markings. 5 ft.
3. Sd, wh. 1 in.
2. Sd, ferruginous. 6 in.
1. Ironstone, brn., "box-stone". 5+ ft.

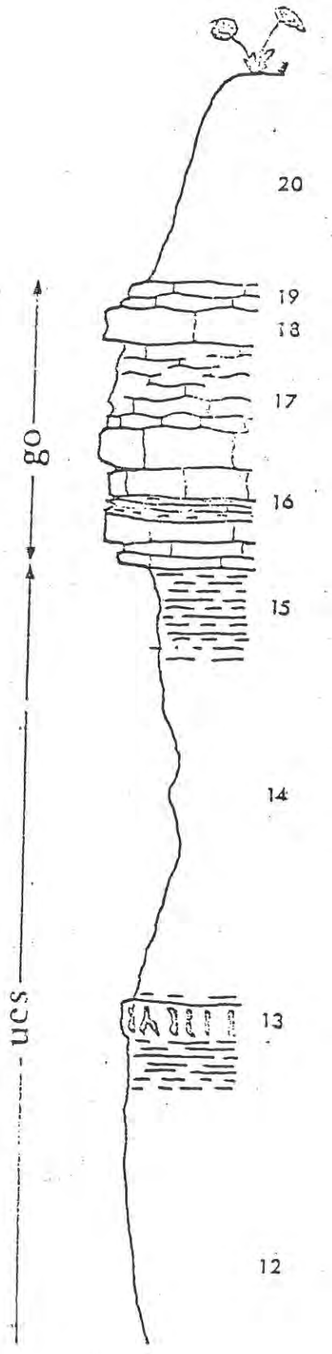
ll = Lincolnshire Limestone Formation

les = Grantham Formation (with Collyweston sands not divided)

no = Northampton Sand Ironstone

STOP 3
(continued)

[~TL 049970] [see also Sylvester-Bradley & Ford 1968 P262]



20. Clay, passing up into soil 6 ft.
19. Oyster bd., rubbly. 1 ft.
18. Ls., hd., oysters. 1 ft.
17. Oyster bd., rubbly. 3 ft.
16. Ls. and Sh. (from top downward): hd. oyster ls., 1 ft.; rubbly marl and sh., fossil., 1 ft.; hd. oyster ls., 6 in.; marly sh., 3 in.; rubbly brach bed, 1 ft. 3 in.; shelly marl, 4 to 6 in.; detrital ls. with fossil., 6 in. Total tk. 5 ft.
15. Sh. and Ls. (from top downward): shelly marl with oysters, 6 in.; shelly sh. with rootlets, 1 ft.; thin shelly ls., 1 in.; shelly sh. with rootlets, silty in bottom part, 4 ft.; ls, impersistent, ½ to 1½ in.; sh, silty, oysters, 6 in.; shelly sh., 2 ft.; ls., 1 in.; silty, shelly sh., 3 in.; shelly sh., 4+ ft. Total tk. 12 ft. 6 in.
14. Covered. 3 ft.
13. Rootlet bed exposed along cliff. 1 ft.
12. Covered. 15 ft.

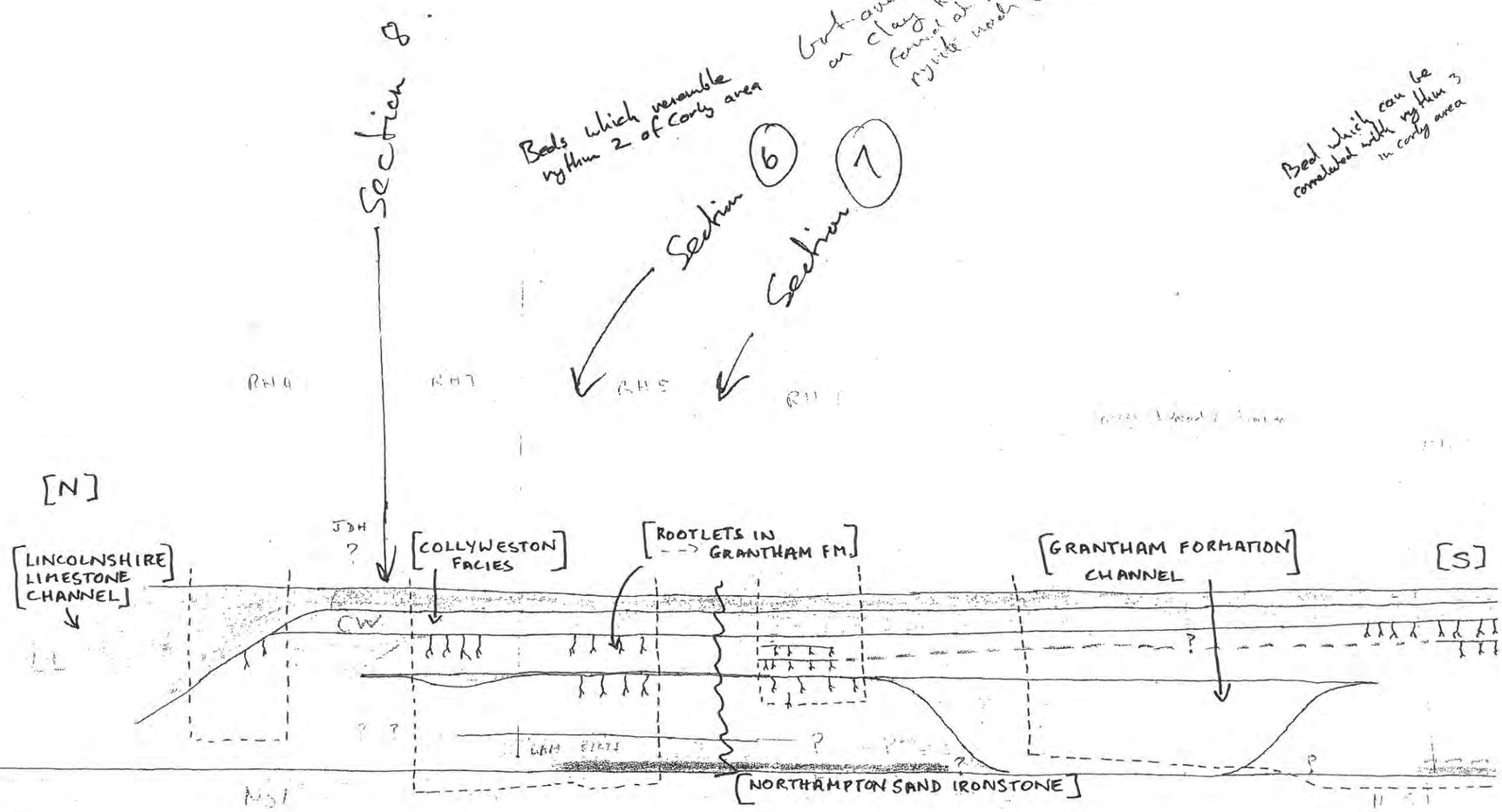
(above = Blisworth Clay)
go = Blisworth Limestone Formation
ues = Rutland Formation

Vertical Scale 1cm = 2m

--- = outline of exp

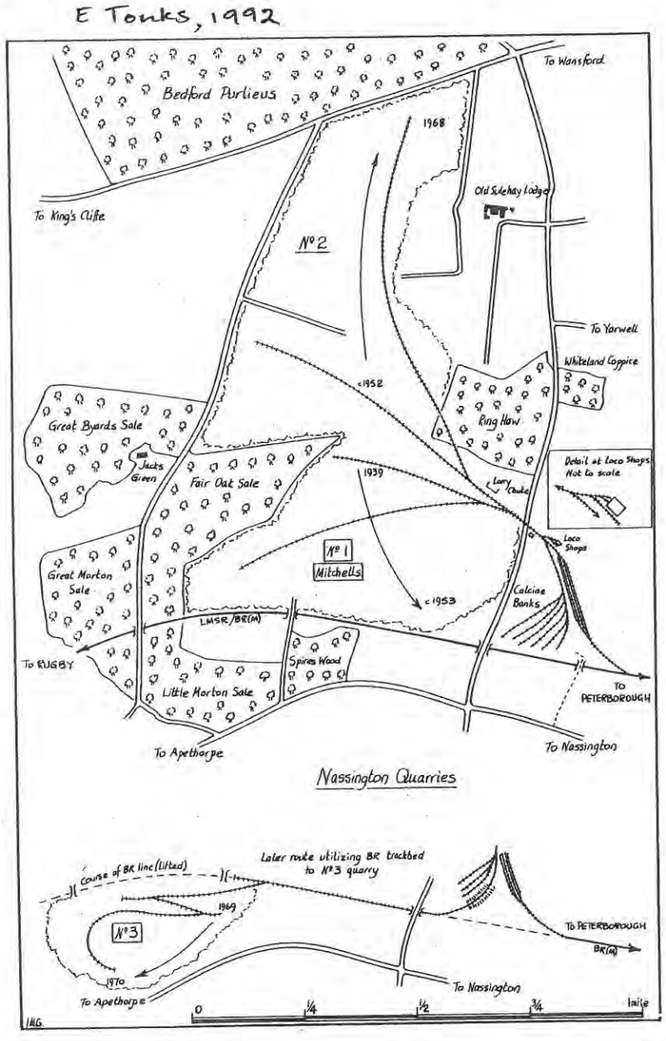
DAVE MARTILL

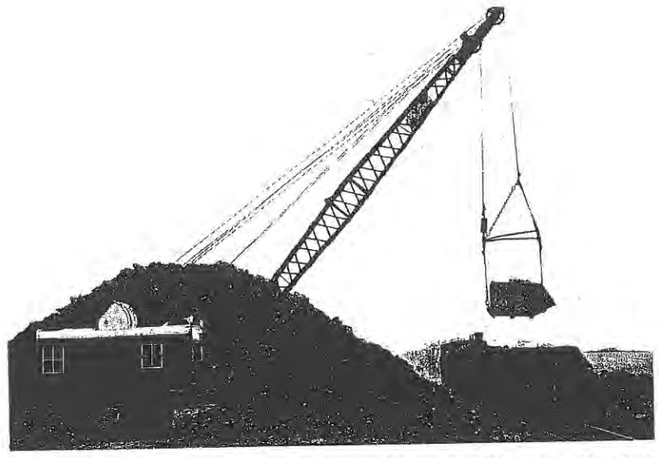
[RING HAW. copy of manuscript section by D.M.Martill, 1978-81]
[annotation added by D.S.S. in consultation with Prof J.D.Hudson who has original]



~~Gretton~~

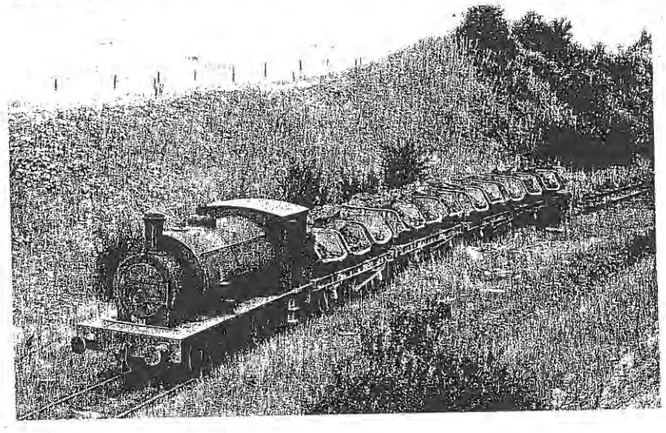
E Tonks, 1992





Nassington Quarries. Much of the ore was calcined; it was loaded into skips, three to a wagon, and taken to the clamps, where the skips were lifted off and the contents then emptied by using a special cradle. 15th August 1967. G. H. Starmer

Nassington Quarries. Bringing up wagons with skips loaded with ore for taking to the calcine bank. G. H. Starmer



Site Name: **Standen's Pasture**

Site Code: E809

Status: LWS

Other Designations: Wildlife Trust Reserve, Nene Valley NIA

Grid Reference: TL071993

Area (ha): 3.8

District: East Northamptonshire

Site History:
01/01/2005 PWS
15/04/2010 LWS
10/02/2021 LWS

Habitats present
Broad Habitat: Grassland

Reason for Designation:
One of two wildlife trust reserves set on limestone grassland either side of a valley. 20 neutral grassland (8 strong) indicators recorded alongside 14 calcareous grassland (7 strong), qualifying it as a LWS.

Site Description:

19/06/2020
Before Standen's Pasture was taken on by the trust it was intensively managed as pasture land, more sensitive management since has allowed species diversity to increase on site. Wet flushes are found towards the base of the hill, feeding into a small tributary of the River Nene which separates Standen's Pasture from Wansford Pasture. The site is bounded by hedges and mature trees on all sides with mature trees and some scrub alongside the watercourse.

The sward on site is varied from shorter areas with some bare ground and more herbs to longer grasses and sedges. Meadow fescue Festuca pratensis is the most abundant grass across the site with frequent Smaller Cat's-tail Phleum bertolonii, Yorkshire fog Holcus lanatus, Rough Meadow-grass Poa trivialis and Yellow Oat-grass Trisetum flavescens. Finer grasses such as Sweet Vernal-grass Anthoxanthum odoratum and Crested Dog's-tail Cynosurus cristatus were occasional, as was the coarser Tufted Hair-grass Deschampsia cespitosa, the latter being well spread but mostly towards the wetter areas of the site.

Amongst 14 calcareous grassland indicators that were recorded 7 were strong indicators. This included locally frequent Yellow Rattle Rhinanthus minor, Eyebright Euphrasia nemorosa, and Fairy Flax Linum catharticum, abundant Common Spotted-orchid Dactylorhiza fuchsii, frequent Glaucous Sedge Carex flacca, occasional Mouse-ear-hawkweed Pilosella officinarum and a single Pyramidal Orchid Anacamptis pyramidalis. Other Orchids present on site included a single Bee Orchid Ophrys apifera and an abundance of Southern Marsh-orchids Dactylorhiza praetermissa in the wetter areas at the base of the slope. Frequent elsewhere in the sward were Oxeye Daisy Leucanthemum vulgare, Lady's Bedstraw Galium verum, Adder's-tongue Ophioglossum vulgatum and Bird's-foot Trefoil Lotus corniculatus. Common Knapweed Centaurea nigra was occasional throughout with other plants of interest including Cowslip Primula veris, Meadow Foxtail Alopecurus pratensis and Wild Mignonette Reseda lutea much scarcer.

At the bottom of the slope on site the conditions were much wetter and the plant compositions changed significantly. The county rare Blunt-flowered Rush Juncus subnodulosus was locally frequent in this area amongst abundant Hard Rush Juncus inflexus, Meadowsweet Filipendula ulmaria, Wild

Angelica Angelica sylvestris, Water Mint Mentha aquatica and Brooklime Veronica beccabunga. Lesser Pond-sedge Carex acutiformis become locally dominant in some areas.

Bounding the site on all sides were trees and scrub primarily Hawthorn Crataegus monogyna with some Bramble Rubus fruticosus agg. patches. Some areas within the grassland had a small amount of Hawthorn saplings but not of any significant coverage.

27/07/2007
Previous surveyor's description still stands.

27/07/2004
The site lies to the south of Wansford Pasture Wildlife Trust NR/SSSI on the opposite side of the stream which forms it's southern boundary. The field was cultivated some 30 years ago with wheat grown. The site has Lower Lincolnshire Limestone underlying the southern half, with Lower Estuarine Series and Upper Lias Clay in the northern half down towards the stream which forms the site's northern boundary. The field slopes down at a shallow angle towards the stream on it's northern boundary giving the site generally a northerly aspect. At least a third of the field consists of dry neutral grassland dominated by False Oat Grass Arrhenatherum elatius this was in the main species poor with only a few herbs scattered in low numbers infrequently through the sward. A few herbs of interest were located in eastern corner of the field on a drier slope including Fairy Flax Linum catharticum, Yellow Rattle Rhinanthus minor and Bladder Campion Silene vulgaris. At the bottom of the bank where the ground was slightly wetter there was Meadow Cranesbill Geranium pratense, a solitary Common Spotted Orchid Dactylorhiza fuchsii, a small patch of Adders Tongue Fern Ophioglossum vulgatum and a 1m by 5m metre strip of Butterbur Petasites hybridus adjacent to the stream. Much of the grassland had areas where subsequent years of growth had been left un-grazed and a layer of thatch had built up.

Going south up the slope on the drier parts the False Oat Grass dominated grassland gives way to several fingers of short turf grassland dominated by Red Fescue Festuca rubra, Germander Speedwell Veronica chamaedrys, Yorkshire Fog Holcus lanatus, Small Cat's-tail Phleum bertolonii and Bent Grass Agrostis sp. with frequent Creeping Thistle Cirsium arvense and Common Ragwort Senecio jacobaea. This short turf is probably the result of the grazing patterns of current rabbit grazing and past horse grazing.

Adjacent to the stream where the field is underlain by Upper Lias Clay the False Oat Grass dominated grassland gives way to a number of locally damp areas. The largest of the wet areas is in the lowest lying area on site. This area is dominated by Hairy Sedge Carex hirta, Field Horsetail Equisetum arvense and large tussocks of Hard Rush Juncus inflexus with locally abundant patches of Common Fleabane Pulicaria dysenterica and locally dominant patches of Jointed Rush Juncus articulatus. Other herbs included Square Stalked St. Johns Wort Hypericum tetrapterum, Hoary Willowherb Epilobium parviflorum, Common Ragwort Senecio jacobaea, Water Forget-me-not Myosotis scorpioides and Water Figwort Scrophularia auriculata.

Other smaller damp patches along the stream have Meadow Foxtail Alopecurus pratensis, occasional Water Mint Mentha aquatica and Spiked Sedge Carex spicata.

Along the southern boundary of the field there is an area of tall herb vegetation dominated by Common Nettle Urtica dioica and Creeping Thistle Cirsium arvense. These significant patches are evidently spreading and seeding into the rest of the grassland.

Tall thick hedgerows dominated by Common Hawthorn Crataegus monogyna form the field boundaries to the east and west. On the southern boundary working from the west is a sparse line of scrub, a central section of red brick wall and near the gated entrance off the Wansford Road is a line of Horse Chestnut Aesculus hippocastanum trees. A stream runs along the northern boundary which is lined by mature Ash Fraxinus excelsior trees for much of its length. Several gardens back onto the field in the eastern half of the northern boundary some garden waste and plants abut right up on this boundary.

Boundary Changes

10/07/2013 Grid ref changed from TL070992 to TL071993 to match Recorder database grid reference.

22/03/2021 Corrected to reflect site boundary

Map:

Site Name: **Stone Pit Quarry**

Site Code: E145

Status: LWS

Other Designations: Wildlife Trust Reserve

Grid Reference: TL056982

Area (ha): 10.3

District: East Northamptonshire

Site History:
02/10/1991 LWS

Habitats present
Broad Habitat: Grassland, Woodland
BAP Habitat: Lowland Calcareous Grassland, Open Mosaic Habitats on Previously Developped Land

Reason for Designation:
An old quarry that has developed an open mosaic habitat that supports a fairly advanced calcareous scrub with colonizing vegetation on the bare, rocky ground in between, all interspersed with small paths and tracks. The abundance of flowers attracts many insects, providing an excellent hunting territory for dragonflies and damselflies breeding in the flooded areas of the east pit. A very important site, with particular significance for plants and invertebrates.

Site Description:

02/10/1991
This is the better-recorded of the two quarries southwest of Old Sulehay Forest. It was owned by KSR. It is subject to frequent public access by walkers and cyclists, and now supports a fairly advanced calcareous scrub with colonizing vegetation on the bare, rocky ground in between, all interspersed with small paths and tracks. The scrub consists of silver birch and young ash, with frequent elder, dogrose and sallow and more occasional hawthorn. Much of the scrub is covered with a tangle of Clematis vitalba - a sign of a calcareous substrate that rarely occurs in Northants. This, along with dogrose and bramble, is encroaching on the rabbit-grazed grassland that still forms large areas of short, herb-rich turf. Other scrub cover comes from the north edge of the site, which is bounded by the ancient hedgerow leading through Old Sulehay Forest SSSI. This hedgerow contains species such as Midland hawthorn, field maple, crab apple, spindle, privet and dogwood (not found amongst the young scrub in the pit). The grassy areas vary between taller vegetation dominated for the most part by Origanum vulgare, which seems to be out-competing everything else in places, and forms a sea of flowers visited by huge numbers of insects. Elsewhere, the taller grassland has Alopecurus pratensis, Arrhenatherum elatius, Bromus erectus, Brachypodium pinnatum, Festuca rubra, Acinos arvensis, Bellis perennis, Agrimonia eupatoria, Achillea millefolium, Knautia arvensis, Leucanthemum vulgare, Trifolium pratensis, T. repens, Sanguisorba minor and Ophrys apifera. The short turf has fewer grasses and more sparse cover, with many species unusual to the county or found only on ephemeral sites. These include Atropa belladonna, Aethusa cynapium, Carduus acanthoides, Epilobium montanum, Erigeron acer, Inula conyza, Carlina vulgaris, Cirsium eriophorum, Erodium cicutarium, Cynoglossum vulgaris, Clinopodium vulgaris, Blackstonia perfoliata and Verbascum thapsus, amongst others. The county botanist's list for 1988 also includes the rare Ornithopus persupillus, Lathyrus nissolia, Centaureum pulchellum and Filago vulgaris. The abundance of flowers attracts many insects, providing an excellent hunting territory for dragonflies and damselflies breeding in the flooded areas of the east pit. A very important site, with particular significance for plants and invertebrates.

11/08/1991
No site description

30/07/1991
No site description

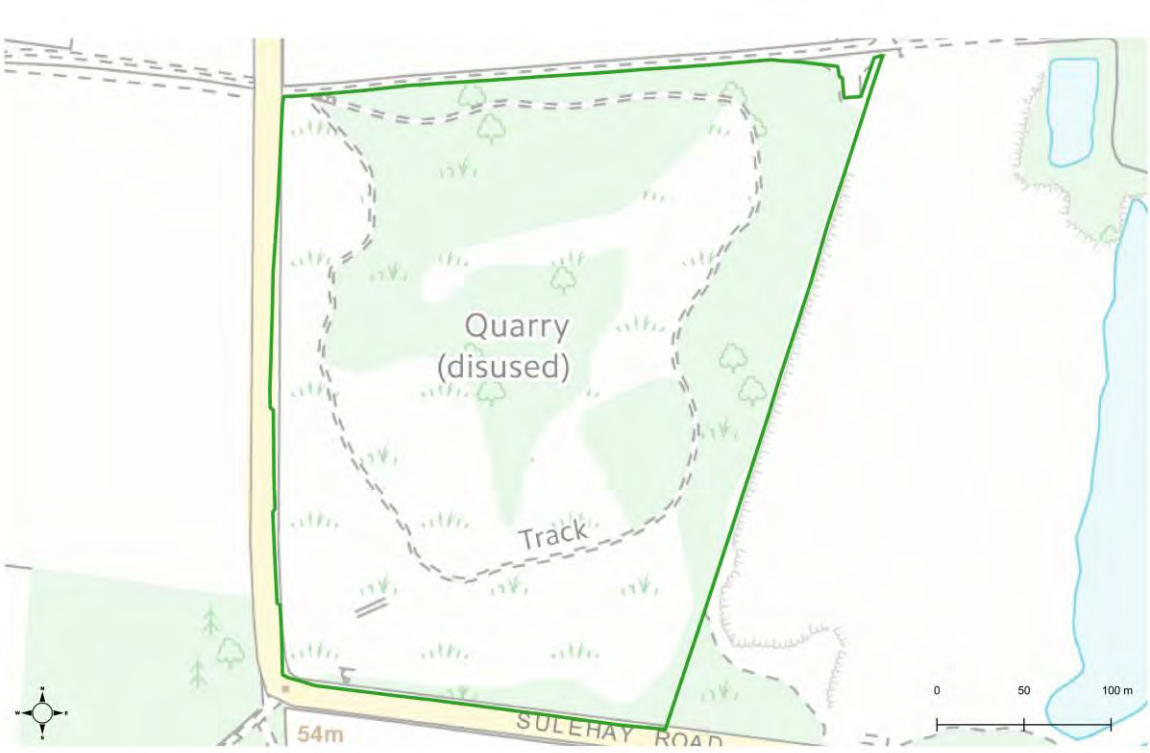
Related Site Information

Old Sulehay Sand Pits, Historical

Old Sulehay Sand Pits (TL058982)
02/10/1991
Glow-worms found 1992. A pair of disused quarries, with rockier ground in the western half and sand in the eastern quarry (known as Andrews Quarry). See subsite details for each half of this site. Two very important sites, quite different in nature, of particular significance for invertebrates (although in the west quarry flora is also very good). The site has been a pSSSI for some time.

Both these pits appear to have a diverse flora of a habitat type uncommon within this county.The proximity to Old Sulehay Forest SSSI may well have contributed to the diversity of woody species colonizing the pits (and certainly the hedge), and in any case the combination of rich habitats increaes their overall wildlife value. The pits also act as an excellent buffer to the SSSI. The lake in the east pit may be a particular feature. The west pit appears to contain a very exceptional diversity of flora, insetcs, mammal and the bird life is likely to be correspondly rich. Of all the surrounding group of ironstone quarries this appears to be one of the best examples from a wildlife point of view.

Map:



Site Name: **Whiteland's Farm North**

Site Code: E1579

Status: PWS

Other Designations:

Grid Reference: TL056978

Area (ha): 9.9

District: East Northamptonshire

Site History:
01/01/2005 PWS
10/02/2021 PWS

Habitats present
Broad Habitat: Grassland

Reason for Designation:
A grassland site adjacent to part of Old Sulehay Nature Reserve on the site of an ex-pig farm. The site has 3 fields which are variously scrubbed over and wet in places. 13 cacareous grassland (8 strong) indicators mean this site is LWS standard but these indicators were very restricted in spread. It was deemed appropriate to make these fields part of the PWS on part of the site already.

Site Description:

03/07/2020
The western compartment (field 2 - TL05499793) is split east to west by a fence with the southern section being wetter grassland with a seasonal pond and occasional scrub, and the northern section being drier and more scrubby grassland with abundant Silver Birch Betula pendula Hawthorn Crataegus monogyna and Bramble Rubus fruticosus agg.

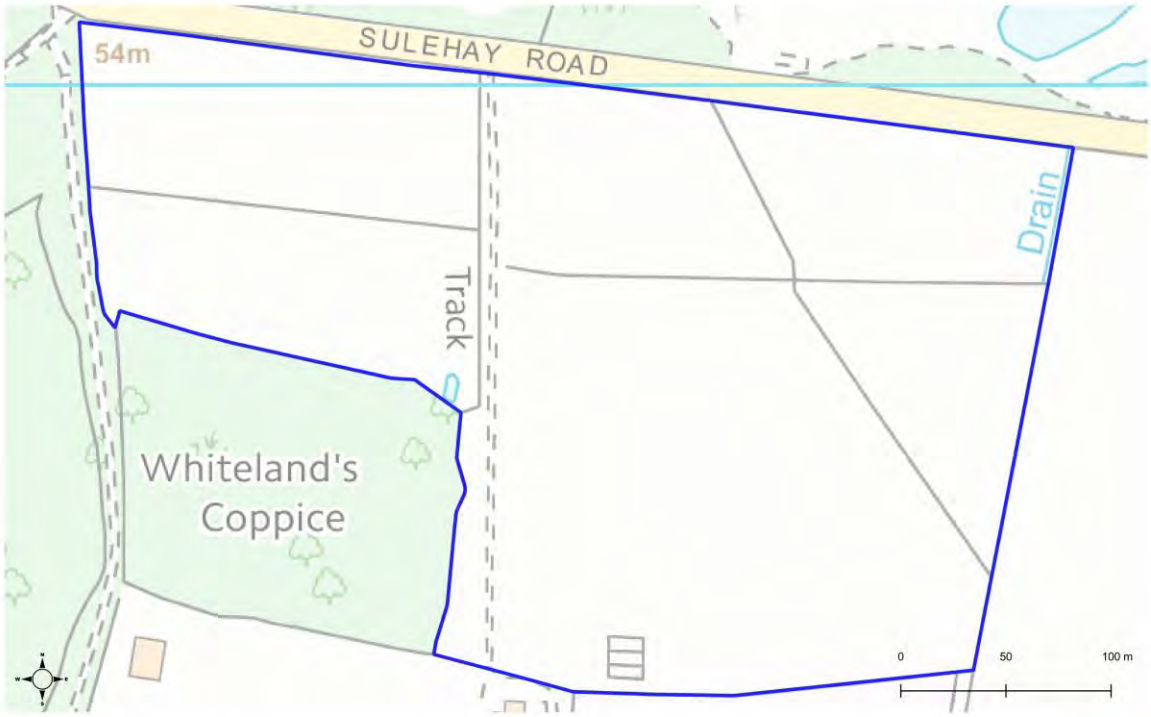
Field 3 (TL05729794) at the north eastern side is again split in two, with a fence running north south along the public footpath. The eastern side of field 3 is dense Hawthorn and Bramble scrub, with the west portion being more open but still with abundant Bramble interspersed with a few open areas. Field 4 (TL05719780) borders the eastern section of field 1 (TL05589757) and is a much large parcel but is mostly species poor with some occasional species of interest, again a portion of this field is fenced for the public footpath, with the fenced off area to the east being much more scrubbed over than the rest.

False-oat grass Arrhenatherum elatius is locally abundant across all of these compartments with Nettle Urtica dioica dominant in places, particularly in field 2. Pyramidal orchids Anacamptis pyramidalis were locally frequent across these fields with a single Southern Marsh-orchid Dactylorhiza praetermissa in field 2. Wood Small-reed Calamagrostis epigejos is again frequent across these fields with, frequent Yorkshire Fog Holcus lanatus, Spiked Sedge Carex spicata, Glaucous Sedge Carex flacca, Meadow Foxtail Alopecurus pratensis, Creeping Bent Agrostis stolonifera and Tufted Hair-grass Deschampsia cespitosa.

Wild strawberry Fragaria vesca is Locally frequent in barer areas of all of these fields, alongside Common Bird's-foot Trefoil Lotus corniculatus, Lesser Stichwort Stellaria graminea, Wild Basil Clinopodium vulgare, Wild Marjoram Origanum vulgare, Perforate St John's-wort Hypericum perforatum, Fairy Flax Linum catharticum, Common Centaury Centaurium erythraea and significant amounts of Travellers Joy Clematis vitalba. Field 3 to the south had the most diverse sward of these 3 fields with the only Lady's Bedstraw Galium verum on site, as well as Eyebright Euphrasia nemorosa, Yellow-wort Blackstonia perfoliata, Agrimony Agrimonia eupatoria and a single Wood Avens Geum urbanum.

Boundary Changes
08/04/2021 Boundary extended from original PWS to include 2 further fields

Map:



Site Name: **Whiteland's Farm**

Site Code: E1573

Status: LWS

Other Designations:

Grid Reference: TL055975

Area (ha): 10.4

District: East Northamptonshire

Site History:
01/03/2021 LWS

Habitats present
Broad Habitat: Grassland
BAP Habitat: Lowland Calcareous Grassland

Reason for Designation:
A grassland site adjacent to part of Old Sulehay Nature Reserve on the site of an ex-pig farm. The site has calcareous influences, 16 calcareous grassland (9 strong) and 12 neutral grassland (5 strong) were recorded, easily qualifying it as a LWS.

Site Description:

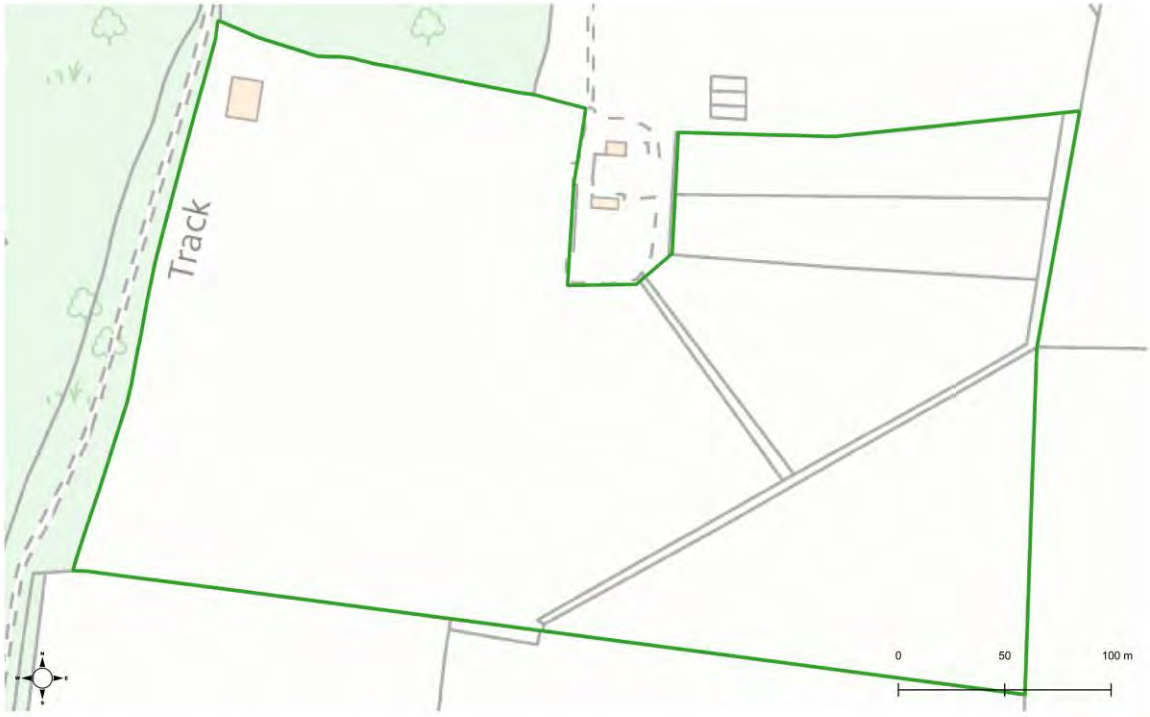
03/07/2020
A grassland site adjacent to part of Old Sulehay Nature Reserve on the site of of an ex-pig farm.

The site is split into 2 equal sized areas roughly north to south from the old farm house on site. The western area gently slopes away to the south and is bordered on the north and west sides by mature woodland with a hedgerow separating it from Old Sulehay reserve to the south. The eastern area is flatter and has hedgerows along 3 sides. The south eastern corner of the eastern compartment is fenced off where a public right of way crosses the site, this area was the coarsest part of field 1 with a significant amount of Hawthorn Crataegus monogyna scrub and False Oat-grass Arrhenatherum elatius. The western compartment had the most abundant botanical interest. Bramble Rubus fruticosus agg. is frequent in patches across field 1.

A wider range of interesting species were present within field one, frequent in the sward were Agrimony Agrimonia eupatoria, Pyramidal orchid Anacamptis pyramidalis, Common Centaury Centaurium erythraea, Woolly Thistle Cirsium eriophorum, Wild Basil Clinopodium vulgare, Eyebright Euphrasia nemorosa, Perforate St John's-wort Hypericum perforatum and Mouse-ear Hawkweed Pilosella officinarum. Wood Small-reed Calamagrostis epigejos is locally frequent in this area with some significant clumps in some areas. Frequent False Oat-grass, Red Fescue Festuca rubra, Common Bent Agrostis capillaris and Yellow Oat-grass Trisetum flavescens make up the majority of the grass cover over the rest of field one, alongside finer species including Yorkshire Fog Holcus lanatus, Sweet Vernal-grass Anthoxanthum odoratum, Meadow Brome Bromus commutatus, False Brome Brachypodium sylvaticum, Smaller Cat’s-tail Phleum bertolonii and Rough Meadow Grass Poa trivialis.

More occasional species of interest in this field included Yellow-wort Blackstonia perfoliata, Glaucous Sedge Carex flacca, Spiked Sedge Carex spicata, Wild Marjoram Origanum vulgare, Wild Parsnip Pastinaca sativa, Cowslip Primula veris and Common Bird’s-foot Trefoil Lotus corniculatus. A small but abundant patch of Kidney Vetch Anthyllis vulneraria was present on the southern western side. Hoary Plantain Plantago media was also locally frequent across the area.

Map:



Yarwell Dingle

Administrative areas:	Northamptonshire(E County (74-)) Yarwell(Civil Parish)
Status(es):	Wildlife Trust Reserve
Centroid:	TL075985 (Site Centroid)
Site type:	Site
File code:	E/TR
Site/Subsite hierarchy:	**Yarwell Dingle**
Description:	A small and virtually inaccessible area of scrub next to the River Nene opposite Stibbington House. A possible otter habitat. This reserve is actually in two parts see Yarwell Dingle Pond.
Total number of records:	0
Total number of species:	0

Yarwell Dingle Pond

Administrative areas:	Northamptonshire(E County (74-)) Yarwell(Civil Parish)
Status(es):	PWS Wildlife Trust Reserve
Centroid:	TL074981 (Site Centroid)
Site type:	Site
File code:	E/TR
Site/Subsite hierarchy:	**Yarwell Dingle Pond**
Description:	A small area of rough grassland with a recently created pond. Some meadow herb species are present in the grassy surround, along with a few tea roses, daffodils and other planted species. Botanically the most interesting part is probably the well-established drain which runs to the south of the site. Narrow ditches also border the west and east sides of the area. See also Yarwell Dingle, which is also managed as a reserve but on the other side of the River Nene to the pond.
Total number of records:	0
Total number of species:	0

Site Name: **Yarwell Quarry**

Site Code: E4

Status: LWS

Other Designations:

Grid Reference: TL059981

Area (ha): 17.7

District: East Northamptonshire

Site History:
02/10/1991 LWS
03/10/2018 LWS
01/10/2019 LWS

Habitats present
Broad Habitat:
BAP Habitat: Open Mosaic Habitats on Previously Developped Land

Reason for Designation:
An old quarry with large areas of bare sandy ground interspersed with species rich calcareous grassland, pools and areas of woodland and scrub. The site is an invaluable habitat for calcareous plants, a variety of insects and reptiles and qualifies as a Local Wildlife Site under the Open Mosiac Habitat Criteria, as well as with the areas of calcareous grassland (15 calcareous grassland indicators, including 11 strong).

Site Description:

26/06/2019
West Area

Around the car park are numerous species rich glades with frequent viper's-bugloss Echium vulgare, creeping cinquefoil Potentilla reptans, selfheal Prunella vulgaris, perforate st john's-wort Hypericum perforatum and eyebright Euphrasia nemorosa. This is surrounded by scrub - bramble Rubus fruticosus agg., Traveller's-joy Clematis vitalba and birch Betula sp. and provides excellent insect habitat. Beyond there the ground slopes steeply down to an area of young woodland with pedunculate oak Quercus robur, ash Fraxinus excelsior and birch with typical shade species below. This continues along the west boundary of the site.

This surrounds a very open, sandy expanse with abundant bare ground, occasional vegetation and scattered yarrow Achillea millefolium which is starting to re-vegetate. The edges have a species rich flora including dark mullein Verbascum nigrum, wild marjoram Origanum vulgare etc. Low exposed drifts are of interest on the west side.
The western section is separated by a birch dominated woodland on undulating ground which is criss-crossed by numerous tracks. Occasional small pools can also be found with wetland species along track edges with some areas dominated by sedges Carex spp. At the north end of this is an area of wet woodland willows and birch with great horsetail Equisetum telmateia and pendulous sedge Carex pendula below. Next to this is an area of well vegetated pond surrounded by willow scrub with a good mixture of reeds, rushes and open water.

Central Area

Beyond the woodland to the west is another expanse of bare ground with a shallow water body sitting across most of it. A steep cliff forms to the north end and there are a few birch dominated islands towards the centre. The open ground contains scattered plants on a sandy substrate including great willowherb Epilobium hirsutum, perforate St John's-wort with more calcareous species on the

woodland and island cliffs including yellow-wort Blackstonia perfoliata, common centaury Centaurium erythraea and common spotted-orchid Dactylorhiza fuchsii. An undulating, high sandy causeway then divides the site from the eastern section with buddleia Buddleja davidii dominating the causeway which has plenty of open ground. Wetter areas are dominated by the invasive New Zealand pygmyweed crassula helmsii. Jersey cudweed Helichrysum luteoalbum and variegated horsetail Equisetum variegatum were the first records of these species for Northamptonshire.

East Area

This section has a deep lake at the north end beyond which is a mosaic of open, grassy and scrubby ground on high undulating ground. The main section is a sparse sandy area with little vegetation and occasional patches of birch scrub.

The lake features little marginal vegetation, except for clumps of reed and bulrush Typha latifolia at both ends. There are two islands in the lake which are quite cut off and steep sand banks at the eastern end that could be good for Sand Martins Riparia riparia. Piles of log stores provide additional useful habitat for wildlife.

To the far east is a nice mosaic of bare ground, scrub and species rich grassland. Along the south boundary is a track in a slight cutting with glades of species rich grassland, pools and scrub.

Stoneworts are abundant on site with 7 species recorded.

28/04/2019
Species recorded for 2019 Bioblitz
See site description in the next survey

13/09/2018
The site is a large ex-sand quarry, with a fairly open landscape surrounded by steep slopes and young woodland. The most recent land use has been a 4x4 course, which has left numerous tracks across the undulating landscape. The predominant habitats are large areas of flat sandy ground with limited plant growth, large waterbodies, birch woodland, calcareous grassland and steep cliff faces of exposed rock.

The site can be split into 3 sections. The western third consists of a large expanse of bare level sandy ground which has been compacted by 4x4 usage. Surrounding this is undulating ground with scrub, calcareous grassland and young birch trees. There is a well established wet woodland and pond to the north. This section is divided from the rest of the site by a belt of birch woodland through which run numerous tracks. Species rich calcareous and wet grassland is found along the track margins.

The central section consists of large fluctuation waterbodies with limited vegetation, small islands of scrub and bare exposed sandy ground which becomes more vegetated on the higher ground away from the water bodies. Grassland of interest was found on the banks of the islands and there was a good rock exposure at the northern end. This is separated from the eastern section by a bund of remaining rock.

The eastern section is the largest and most varied part if the site. In the centre is a large permanent waterbody surrounded by exposed rock cliff faces on the north and eastern sides. South of the waterbody is a bare sandy substrate with spare vegetation but with less compaction and a much more varied topography than the other areas of bare ground. To the north and east are areas of undulating ground with numerous trackways forming a mosaic of scrub, bare ground and species rich grassland.

This site holds the only popultaion in the county for Jersey Cudweed Gnaphalium luteoalbum and is a new site for the locally scarce Marsh Pennywort Hydrocotyle vulgaris.

02/10/1991

This is the larger and, in parts, more recently-abandoned of the two Old Sulehay sand pits. Bare, sandy ground is still predominant in the north end of this quarry, but most of the south and centre have well-developed birch scrub with additional species such as sallow, ash, white willow and hawthorn. The floor of the quarry is mostly level and rather compacted, and there are occasional stands of Calamagrostis epigejos where the drainage is poor. The top stratum of soil in the site is almost pure sand, and supports some small patches of bracken; on the whole, though, the rocky surface is made up of broken oolitic limestone and has a calcareous flora. The flooded area in the northwest corner has not been colonized for long, and supports sparse new growth of Potamogeton natans, Typha latifolia and Scirpus lacustris. This pit is separated from the west pit by a high bund of remaining rock. This pit has been used for motor sports, and has bare ground where the tracks run between the scrub. This suggests that some interesting ephemeral species could be present. The invertebrate interest of the site is so important that it is a pSSSI. Amongst other things hairy dragonfly has been found. Nb. the flooded area may have some interesting stonewort species too.

Boundary Changes
02/04/2019 Site Name has been changed from Andrews Quarry (which was named by the previous owner) to Yarwell Quarry which it is known by locally.

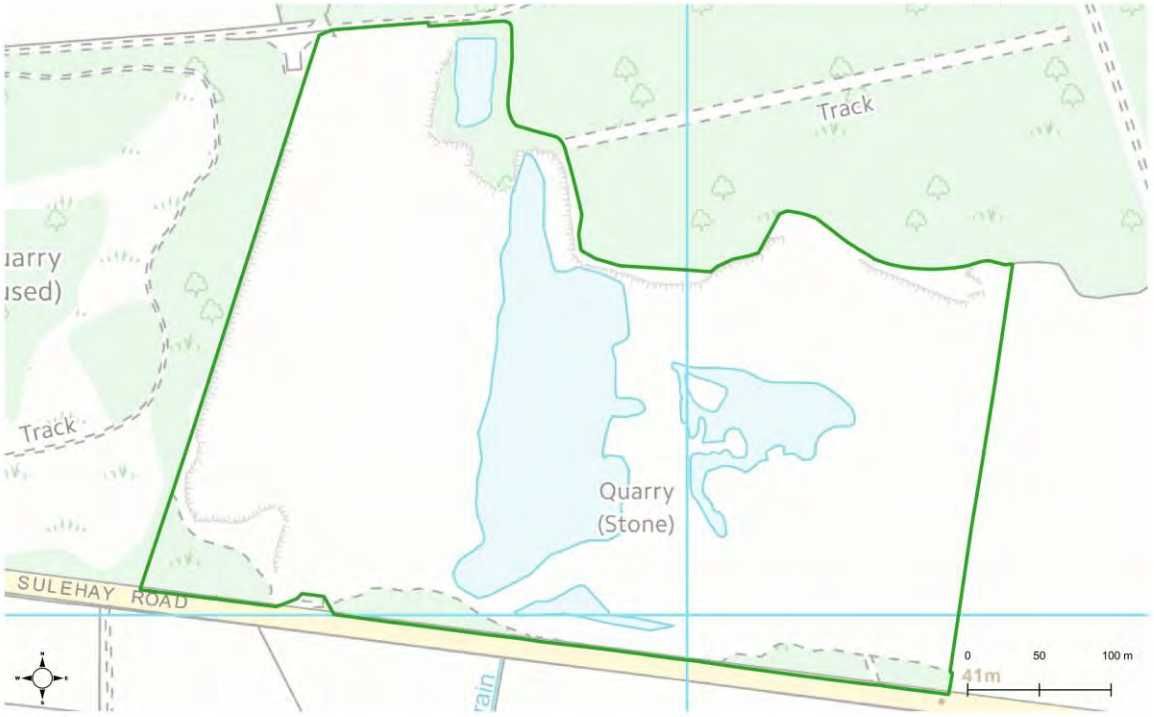
Related Site Information

Old Sulehay Sand Pits, Historical

Old Sulehay Sand Pits (TL058982)
02/10/1991
Glow-worms found 1992. A pair of disused quarries, with rockier ground in the western half and sand in the eastern quarry (known as Andrews Quarry). See subsite details for each half of this site. Two very important sites, quite different in nature, of particular significance for invertebrates (although in the west quarry flora is also very good). The site has been a pSSSI for some time.

Both these pits appear to have a diverse flora of a habitat type uncommon within this county.The proximity to Old Sulehay Forest SSSI may well have contributed to the diversity of woody species colonizing the pits (and certainly the hedge), and in any case the combination of rich habitats increaes their overall wildlife value. The pits also act as an excellent buffer to the SSSI. The lake in the east pit may be a particular feature. The west pit appears to contain a very exceptional diversity of flora, insetcs, mammal and the bird life is likely to be correspondly rich. Of all the surrounding group of ironstone quarries this appears to be one of the best examples from a wildlife point of view.

Map:



APPENDIX 4

INVERTEBRATE SCOPING REPORT

Cook's Hole Quarry, Peterborough

An Invertebrate Scoping Assessment

A report for:
ESL

05 May 2023

By:
Conops Entomology Ltd

Contract Reference: 23.29

ConopsEntomologyLtd
Invertebrate survey, research and conservation advice

Cook's Hole Quarry, Peterborough

An Invertebrate Scoping Assessment

Contract reference: 23.29

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Contents

1 Introduction..... 4
2 Habitats and features..... 5
3 Habitats and features potential..... 9
4 Summary and recommendations..... 10
5 Survey recommendations..... 11

1 Introduction

1.1 Conops Entomology Ltd was commissioned by ESL in April 2023 to undertake an invertebrate scoping assessment Cook's Hole Quarry, near Peterborough (referred to as 'the site' from this point forward) prior to developments and restoration to the site. The assessment was to appraise the key habitats and/or features of the site through on-site scoping and to assess their suitability and quality to support rich and varied invertebrate assemblages or species of principal importance.

1.2 The site is located at OS grid reference TL 05097 99910.

Methods and timings

1.3 All areas of the site were walked by a recognized invertebrate ecologist[1].

1.4 Any areas of the site that exhibited features of potential value to support key species [including NERC Act Section 41 (S41), Red Data Book, or Nationally Scarce and species of interest] or rich assemblages of invertebrates were photographed and used as evidence in the evaluation.

1.5 The site, and its various compartments and features, was appraised based on the quality, frequency, and footprint of the existing key features or juxtaposition of any features to one another (mosaics).

Survey timing

1.6 The site was visited on a single occasion:

05 May 2023: cloud, rain, and sun, 12–15°C.

[1] Andy Jukes is a Fellow of the Royal Entomological Society (FRES) and a Member of the Chartered Institute of Environmental and Ecology Managers (MCIEEM). He has over 20 years' involvement with invertebrates, including site assessments.

2 Habitats and features

Restoration area and surrounds resource

2.1 The restoration area (see Photograph 1) is located to the north of the weighbridge.

2.2 The area is a long, rounded bund comprising a mosaic of short sward flowery grassland, small areas of bare ground, and planted scrub.

2.3 The ground flora is varied but largely dominated by creeping cinquefoil (*Potentilla reptans*), hogweed (*Heracleum sphondylium*), cut-leaved crane's-bill (*Geranium dissectum*), ground ivy (*Gelchoma hederacea*), and vetches (*Vicia* spp.).

2.4 Between the restoration area and the new refuge area (see the following section) are areas of elevated complexity and habitat succession. These include a pond with mid-successional vegetation surrounding it that comprises *Buddleia*, coarser grasses, nettles (*Urtica dioica*) and disturbance species including colt's-foot (*Tussilago farfara*). Patches of bare ground are also evident in this area (see Photograph 2).

2.5 Immediately adjacent to this and leading towards the newt refuge area, is a capped area of landfill that has a range of low-growing flora including common bird's-foot trefoil (*Lotus corniculatus*) and creeping cinquefoil. Alongside these short perennials are taller species including fennel (*Foeniculum vulgare*) and teasel (*Dipsacus fullonum*). This specific area has large areas of bare ground but also areas of variation and interfaces with taller vegetation, and southerly aspect banks (see Photograph 3).

Photograph 1. Restoration area.

Photograph 2. Pond and mid-successional mosaic, adjacent to the restoration area.

New refuge area

2.6 The area is immediately adjacent to Bedford Purlieus National Nature Reserve. The area is in a depression with pools at the bottom. The tops of the banks are largely a short perennial mosaic with bare ground. The banks leading down to the pools are west-facing and partly vegetated with *Buddleia* and sycamore (*Acer pseudoplatanus*) amongst other tree and scrub species. The ground flora comprises common bird's-foot trefoil, creeping cinquefoil, bugle (*Ajuga reptans*), salad burnet (*Sanguisorba minor*), and wild strawberry (*Fragaria vesca*).

2.7 The ponds have varied margins with shallow drawdown zones and are well vegetated.

Silage grassland

2.8 The grassland includes a large pond that is largely devoid of vegetation and variation along its margins.

2.9 The northern side of the waterbody, however, has good-quality southerly aspect clifflets and associated early successional vegetation including St. John's-wort (*Hypericum* spp.) and weld (*Rerseda luteola*), along with species already noted such as common bird's-foot trefoil.

2.10 The grassland is dominated by coarse grasses but does include some botanical diversity including vetches, clovers (*Trifolium* spp.), speedwell species (*Veronica* spp.), bulbous buttercup (*Ranunculus bulbosus*), and thistles (*Cirsium* spp.).

Wet woodland

2.11 The wet woodland is a linear corridor of woodland of various tree cover and wetness. In dry areas, ash (*Fraxinus excelsior*) and oak (*Quercus* spp.) are dominant, with horse chestnut localized on the eastern end of the feature (*Aesculus hippocastanum*). As the linear features become wetter, crack willow (*Salix fragilis*) dominates.

2.12 The ground flora varies from dense nettle beds to stands of pendulous sedge (*Carex pendula*) and more typical wet woodland flora (see Photograph 3).

2.13 There is some waterflow through the wet woodland areas, though it is not constant along the length of the linear feature.

Photograph 3. Wet woodland.

Connective matrix

2.14 All of the above areas are connected by other quarry land. This land is largely disturbed with areas of open, recently worked ground and other areas succeeding to a mosaic of short swards and bare ground. Some areas are botanically rich, and others of lower diversity with ruderal vegetation.

3 Habitats and features potential

Restoration area and surrounds resource

3.1 The restoration area includes many flowering plants. There is little structural variation across the site, however, and this could be improved for invertebrates. The variation should include a created proportion of patchy bare ground and also taller swards. Evidence of heavy grazing and browsing from deer, however, may limit what can be achieved.

3.2 The restoration area has moderate potential for a range of open mosaic species to nest. Its predominate value, however, is a flowering resource for species utilizing the areas of the quarry. Without greater variation of swards, more optimal bare ground, and scrub that is allowed to grow and flower more than it currently does, its value to invertebrates is unlikely to increase over time.

3.3 The areas surrounding the restoration area are the supportive features that elevate the potential of the restoration area. It is these areas that provide the structural complexity and ample bare and patchy bare ground for nesting bees and wasps, and greater variation for surface-running beetles, butterflies, and other early succession species and assemblages.

3.4 Future restorations should seek to retain or create similar features alongside, or as part of, the current restoration area.

New refuge area potential

3.5 The newt refuge area includes open and patchy bare ground, ample low-growing perennials, structural complexity provided by scrub, and also an open water element.

3.6 There are therefore many opportunities for invertebrates in this area, including the bank tops, for a range of invertebrate groups from wetland flies to early successionally dependent butterflies such as the NERC Act Section 41 grizzled skipper (*Pyrus malvae*) and dingy skipper (*Erynnis tages*).

3.7 The area therefore has high potential to invertebrates including those that have nationally significant statuses.

Silage grassland potential

3.8 The silage grassland includes a large open waterbody and also some southerly aspect clifflets and patchy bare ground. Much of the area is devoid of significant floral diversity or variation and patchy bare ground. It is therefore unlikely that much of the areas would possess assemblages or species of high conservation value.

3.9 However, given the southerly aspect clifflets and associated flora and patchy bare ground, this specific location may hold potential for a range of species and groups including ground-nesting bees and wasps, and potentially dingy skipper butterflies.

Wet woodland resource potential

3.10 The wet woodland is small and narrow. There is a high degree of nitrogen input to the banks and into the wet woodland area that reduces its value to invertebrates, as the competition reduces floristic diversity, and also open muddy areas within the woodland. A lack of a high water table along its length also reduces the potential value, as again, exposed, muddy areas are reduced in frequency. It appears that the wet woodland has probably degraded since it was last appraised.

3.11 The wet woodland footprint is very small, and its value to typical wet woodland species also is likely to be small.

Connective matrix potential

3.12 Although the above key areas have been highlighted, there are many other areas around the site that hold potential to invertebrates. Specifically, these are areas of early succession. This early succession is similar in composition across the site. Some are along pathways, and others are bunds and capped areas of landfill. Some areas are small, and others large. They are all, however, part of a sitewide patchwork of early succession and bare ground.

4 Summary and recommendations

4.1 There are a number of locations around the site that hold potential to invertebrates. The newt area in particular is likely to hold strong assemblages of invertebrates. However, as noted in the Connective matrix potential section (section 3.12), it is the sitewide resource of early succession that is of overall importance. Essentially, wherever there is a matrix of bare ground, short sward vegetation, and complementary features such as variation, southerly aspect clifflets, or faces, they are likely to hold populations of species of conservation value, largely ground-nesting bees and wasps. Alongside these, wherever there are key plant species such as prostrate-growing Rosaceae (e.g. wild strawberry), there is potential for grizzled skipper, and where there are low-ground bird's-foot trefoils, there is potential for dingy skipper. It is therefore recommended that a suite of sampling events be undertaken to sample the sitewide resource of early successional invertebrates. Given that the whole site has a similar profile, sampling should be undertaken in a range of places, including the newt refuge area and the early successional areas adjacent to the silage grassland.

4.2 The wet woodland has a small footprint and is narrow, compounded by a negative impact of nitrogen run-off. It appears to have degraded and holds potentially little interest to the key invertebrate communities typically associated with such habitats. It is recommended that a baseline survey be undertaken, from which future monitoring of the invertebrate assemblages can be compared in order to appraise through analysis whether the feature is actually degrading and, if so, mitigation put in place to reverse its decline.

4.3 The wet woodland is noted for a few specific scarce species, but it is recommended that a more holistic assemblage-based approach be undertaken, as detecting the presence or absence of singular species does not provide an insight into the robustness or health of the overall wet woodland habitat.

5 Survey recommendations

5.1 It is recommended that for the baseline wet woodland survey, five visits should be undertaken between May and October.

5.2 The early successional site matrix survey should comprise five visits between May and August/September.

APPENDIX 5

INVERTEBRATE ASSESSMENT

Cook's Hole Quarry:
Site Restoration

An Invertebrate Assessment

Final Report

A report for:
ESL

16 October 2023

By:
Conops Entomology Ltd

Report Number: 23.29A

Cook's Hole Quarry:
Site Restoration

An Invertebrate Assessment

Final Report

Report Number: 23.29A

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Contents

1 Introduction 4
2 Results summary 6
3 Discussion 10
4 Recommendations 14
5 References 17
6 Appendix 18

1 Introduction

1.1 Conops Entomology Ltd was commissioned in May 2023 by ESL Ltd to undertake a survey of land at Cook's Hole Quarry, near Peterborough.

1.2 The scope of this survey is to undertake an invertebrate assessment of land in Cook's Hole Quarry, Peterborough (referred to hereafter as 'the site') prior to restoration works that may impact the habitats and/or features of value to invertebrates. The assessment appraised the key habitats and/or features of the site through the recording of invertebrates. The data are used to assess the value to invertebrates of those habitats or features in order to evaluate the site for its importance as an invertebrate resource.

- The site is located at OS grid reference TL 04915 99809.

Methods and timings

1.3 The methods used for the assessment are those recommended in the Natural England guidance document *Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation* (Drake *et al.*, 2007).

- **Sweep netting**

1.4 This method provides the main proportion of the survey element and is the most efficient method for cataloguing a site's invertebrate resource. Sweep netting involves the use of a long-handled sweep net being swept over vegetation such as stands of grasses or flowers, or along scrub fringes in order to gather invertebrate material.

- **Spot sampling**

1.5 Spot sampling is employed to collect large, conspicuous invertebrates such as bees and wasps from flowering plants, and to supplement the sweep samples. Spot sampling is often the most effective method for recording species from high-fidelity niches.

- **Vacuum sampling**

1.6 Suction sampling took place on areas of short and tall swards, and also patchy bare ground.

- **Pitfall trapping**

1.7 No pitfall traps were used owing to the presence of great crested-newts.

Target groups

1.8 The groups targeted for the survey are those that are key indicators of a range of habitats and features, as defined by Drake (2007). The principal groups are:

- heteropteran bugs (range of habitats including bare ground, short turf, and scrub fringes);
- various fly families including hoverflies and robberflies;
- beetles (including leaf beetles, ground beetles, and weevils); and
- aculeate hymenoptera (bare ground, structural complexity, flowering plants).

Survey timing

1.9 The site was visited on four occasions:

Visit dates

02 June 2023 – wind and sunny, 17–20°C;
05 July 2023 – sunny, 21–22°C;

15 August 2023 – sunny, 20–23°C; and
04 September 2023 – sunny, 22–27°C

Results analysis

1.10 Tables 1 and 2 provide a breakdown of the site's invertebrate resources and highlight any species of significance recorded during the surveys.

1.11 Tables 3–4 have been generated using the Pantheon software package. Pantheon is an analytical tool developed by Natural England and the Centre for Ecology & Hydrology to assist invertebrate nature conservation in England. Site data in the form of species lists can be imported into Pantheon, which then analyses the species within the lists, assigning them to habitats and resources. Pantheon also consigns the most up-to-date national status to the species where it is available.

1.12 Pantheon is also capable of other outputs such as Specific Assemblage Types (SATs) (see Table 4).

1.13 A SAT is characterized by stenotopic species (those that can withstand only a narrow range of environmental conditions). SATs are therefore more tightly defined than 'habitats' or 'resources' and sit within a parent habitat or Broad Assemblage Type (BAT). More than one SAT can sit within a parent BAT.

Example:

BAT: **F**2 – grassland and scrub matrix

SAT: **F**211 – herb-rich dense sward

F212 – dense scrub

1.14 The information obtained from Pantheon can then be used to assign quality to sites and their features, assist in management decisions, and facilitate requirement for further surveys, where required and appropriate.

1.15 Pantheon was first made publicly accessible in April 2018 and is the primary analytical tool used by entomologists in site evaluation. It is also the tool recognized and preferred by Natural England. For more information on this new resource, see http://www.brc.ac.uk/pantheon/.

1.16 Not all species of importance are expressed in the following tables, as they do not form part of the Pantheon analysis and/or their specific requirements are not yet fully understood.

2 Results summary

2.1 A total of 176 species from the sampled groups were recorded during the surveys.

2.2 A total of 21 species recorded have a national status, though it is recognized by many of the national recording schemes that a number of these no longer warrant their current status and that they may need revising. This total does not include research-only moths.

2.3 The full list of species is provided in Appendix II.

Table 1 Species breakdown

Site	Total no. of species recorded	Total no. of species of importance*	Species of importance (%)
Site	176	21	11.9

*Note: some species do not warrant nationally significant status.

Table 2 Species of importance

Scientific name	Vernacular name	National/local status	Habitat preferences and species notes
Andrena similis	A mining bee	Notable b	Nest in patchy bare ground. A calcareous-fidelity species. Forages from a range of plants.
Aphanus rolandi	A ground bug	Notable a	Open short swards and bare ground.
Aulacobaris picicornis	A weevil	Notable b	A strict calcareous-fidelity species. Found on mignonettes (*Reseda* spp.).
Cerceris quinquefasciata	A solitary wasp	Red Data Book 3*; NERC Act Section 41 species	Open sandy sites. Now much more common than its status suggests and should be downgraded.
Coenonympha pamphilus	Small heath butterfly	NERC Act Section 41	Requires fine-leaved grassland, ideally with areas of very short turf or bare ground for basking.
Dasypoda hirtipes	A mining bee	Notable b*	Nests in bare and patchy bare ground. Feeds from yellow composites. No longer warrants a nationally significant status.
Dorycera graminum	Phoenix fly	Provisionally Nationally Scarce; provisionally near Threatened*; NERC Act Section 41 species	Clear habitat preferences unknown, but it is much more common than its status suggests and no longer deserving of a nationally significant status.
Erynnis tages	Dingy skipper	NERC Act Section 41	Early succession with bird's-foot trefoil (*Lotus* spp.).
Evagetes dubius	A spider-	Notable b	Open short swards, friable soils.

Scientific name	Vernacular name	National/local status	Habitat preferences and species notes
	hunting wasp		
Hedychrum niemelai	A rubytail wasp	Red Data Book 3*	A parasite on *Cerceris quinquefasciata*. Expanded its range significantly and now requires a downward revision in its status.
Hylaeus signatus	A yellow-faced bee	Notable b*	Feeds on mignonettes (*Reseda* spp.). No longer warrants a nationally significant status.
Lasioglossum malachurum	A solitary bee	Notable b*	Nests in bare and patchy bare ground. Feeds from a range of flowers, especially yellow composites. No longer warrants a nationally significant status.
Lasioglossum puncticolle	A solitary bee	Notable b	Nests in bare and patchy bare ground. Feeds from a range of flowers, especially yellow composites.
Microdynerus exilis	A solitary wasp	Notable b	Nests in deadwood. Feeds on small beetles. No longer warrants a nationally significant status.
Nomada fucata	A nomad bee	Notable a*	Parasite on the mining bee *Andrena flavipes*. No longer warrants a nationally significant status.
Nysson dimidiatus	A solitary wasp	Notable b*	A parasite on the solitary wasp *Harpactus tumidus*. No longer warrants a nationally significant status.
Odynerus melanocephalus	Black-headed mason wasp	Notable a*; NERC Act Section 41	Has exacting requirements from a site including presence of water, clay, and grassland. May now be increasing in range and require status revision.
Ophonus azureus	A ground beetle	Nationally Scarce	Short turf and bare ground.
Philanthus triangulum	Bee wolf	Red Data Book 2*	A sandy-ground-nesting wasp. Feeds on honeybees. Requires a significant downward revision in its status.
Pyrgus malvae	Grizzled skipper	NERC Act Section 41	Early succession with prostrate-growing Rosaceae.
Sphecodes crassus	A cleptoparasitic bee	Notable b*	Brood parasite of *Lasioglossum* mining bees. Probably more common than its status suggests.

*Accepted as being more common than this status suggests; likely to be downgraded.

Table 3 Resource-usage table (taken from Webb *et al.*, 2017[1])

Broad biotope	Habitat	No. of species	No. of species with conservation status (excluding research-only moths)	Species with conservation status (excluding research-only moths)
open habitats	short sward & bare ground	81	17	*Ophonus azureus* (NS); *Aulcovaris picicornis* (Nb); *Aphanus rolandi* (NA); *Andrena similis* (Nb); *Nomada fucata* (Na*); *Hedychrum niemelai* (RDB3*); *Hylaeus signatus* (Nb*); *Cerceris quinquefasciata* (RDB3*; S41); *Philanthus triangulum* (RDB2*); *Lasioglossum malachurum* (Nb*); *Lasioglossum puncticolle* (Nb); *Specodes crassus* (Nb*: Nb); *Dasypoda hirtipes* (Nb*); *Evagetes dubius* (Nb); *Odynerus melanocphalus* (Na*: S41); *Pyrgus malvae* (VU: S41); *Coenonympha pamphilus* (NT: S41)
open habitats	tall sward & scrub	67	2	*Erynnis tages* (S41); *Dorycera graminum* (pNS: pNT: S41*)
tree-associated	decaying wood	9	1	*Microdynerus exilis* (Nb*)
wetland	marshland	4	–	–
tree-associated	arboreal	2	–	–
wetland	acid & sedge peats	1	–	–
tree-associated	shaded woodland floor	1	–	–
wetland	seepages	1	–	–

*Accepted as being more common than this status suggests; likely to be downgraded.

[1] Webb, J., Heaver, D., Lott, D., Dean, H.J., van Breda, J., Curson, J., Harvey, M.C., Gurney, M., Roy, D.B., van Breda, A., Drake, M., Alexander, K.N.A. and Foster, G. (2017). *Pantheon – Database Version 3.7.6* [online]. Available at: http://www.brc.ac.uk [Accessed 1 October 2023].

Table 4 Site SAT table (taken from Webb *et al.*, 2017)

Broad biotope	SAT	SAT code	No. of species	No. of species with conservation status (excluding research-only moths)	Conservation status	Reported condition
open habitats	rich flower resource	F002	29	6	*Andrena similis* (Nb); *Nomada fucata* Na*); *Hylaeus signatus* (Nb*); *Lasioglossum malachurum* (Nb*); *Lasioglossum puncticoll*e (Nb); *Dasypoda hirtipes* (Nb*)	Favourable (29 species, 15 required)
open habitats	bare sand & chalk	F111	20	5	*Ophonus azureus* (NS); *Aulacobaris picicornis* (Nb); *Cerceris quinquefasciata* (RDB3; S41); *Dasypoda hirtipes* (Nb*); *Evagetes dubius* (Nb)	Favourable (20 species, 19 required)
open habitats	scrub edge	F001	13	1	*Microdynerus exilis* (Nb*)	Favourable (13 species, 11 required)
tree-associated	bark & sapwood decay	A212	7	1	*Microdynerus exilis* (Nb*)	Unfavourable (7 species, 19 required)
open habitats	open short sward	F112	5	1	*Coenonympha pamphilus* (NT; S41)	Unfavourable (5 species, 13 required)
open habitats	scrub-heath & moorland	F003	2	–	–	Unfavourable (2 species, 9 required)

3 Discussion

Limitations

3.1 2023 experienced extremes in weather, from a dry and cold spring to a hot and dry June, followed by a wet July and August, off the back of 2022, which saw a protracted drought and a series of heatwaves. Little to no rain for many months over the two years coupled with extreme heat events has widely been reported as having had a significant impact on invertebrate numbers. This rapid decline of invertebrates has resulted in difficulty recording species diversity, as many species are now operating at very low densities and numbers.

3.2 Results therefore are on average slightly lower than expected, but the species still fairly reflect the site's primary feature of conservation value, the early successional mosaic. It is therefore still possible to reflect fairly the value of a site, though, through the analysis and discussion, and by using the experience of the invertebrate ecologist.

Habitats

3.3 The site is represented by a range of habitats broadly covering a single broad biotope, the 'open habitats', with the 'tree-associated' and 'wetland' also present on the site. The site's primary feature of conservation value is nestled within the open habitats biotope; however, the other biotopes do contribute to the overall complexity of the site and are therefore still deemed relevant and important to the discussion.

3.4 The open terrestrial biotope dominates the site in terms of species associations and physical extent of each habitat.

3.5 The habitat that is the most prominent across all areas of the site is the short sward and bare ground habitat, with 81 species of association. This is a very significant total of species and includes 17 species noted by Pantheon as having a nationally significant status.

3.6 The second most speciose habitat on the site is the tall sward and scrub habitat, with a total of 67 species of association recorded. The resource is moderately diverse, and thought to be reflective of the limited area of this habitat type on the site, which is largely restricted to a few defined areas and peripheral areas. It includes two species with a nationally significant status, though one of these (*Dorycera graminum*) is not considered to be scarce or threatened and will lose its status in an upcoming review.

3.7 There are a range of other habitats on the site, associated with either trees (decaying wood) or wetlands such as marshes and seepages. These are represented only by a few species from each habitat. Although not significant in terms of the numbers of species, they do contribute to the overall mosaic of the site, and particularly when considered water sources, their value is high

SATs

3.8 There are a number of SATs associated with the site, some of which are very strong and well developed.

3.9 The richest SAT that reaches favourable status is the rich flower resource (F002), with 29 species of association (where the threshold is 15). This is a significant total and includes a wide range of nectar and pollen-foraging species such as the mining bees and solitary wasps.

3.10 The bare and sand chalk SAT (F111) also reaches favourable status, with 20 species (threshold = 19 species of association). This is also a high total and is found widely across the site wherever there are areas of bare ground. This bare ground can be as horizontal planes or vertical exposures, and either as large areas of short turf and bare ground or as small discrete patches. As the feature is widespread, even these small patches are of value and hold an assemblage, since all the patchy bare ground features are inter-connected at the landscape (site) scale.

3.11 Open short sward SAT (F112) is the complementary assemblage to the above F111, together forming the 'open mosaics' habitat on the site. The F112 SAT, however, only holds five species of association; therefore, it is not in a favourable condition (where the threshold is 13) and is quite a low total for the site but is an assemblage that can be enhanced through conservation work on the site. It does, however, include the small heath butterfly (*Coenonymmpha pamphilus*), an S41 species associated with varied-structure fine-leaved swards.

3.12 Although scrub fringe SAT (F001) is reasonably limited on the site in terms of its extent and variation, it holds a significant resource of 13 species of association. This exceeds the favourable status threshold (11 species). It holds a strong list of solitary wasp species that nest in deadwood. The site's juxtaposition to Bedford Purlieus Nationally Nature Reserve may contribute to this feature's strength on the site.

3.13 This view is supported by the presence of a bark and sapwood decay assemblage (SAT code A212), and despite the site not possessing significant deadwood, it holds an assemblage of seven species.

3.14 The scrub-heath and moorland SAT (F003) is also highlighted, though this is only highlighted by species that are also highlighted in other SATs and not thought to be intrinsic to the site.

Species

3.15 The survey of the site recorded 176 species and 21 species identified by Pantheon as being of value; a number of species are more common now than their status suggests, so in time, this number would be revised downwards as further status reviews are completed.

3.16 Owing to the challenging weather conditions over much of the 2023 survey season, the lists of species are slightly shorter than expected, but they do still present a very strong cross-section of species that are reflective of the habitats on the site, in particular the bare ground and patchy swards. The important species on the lists are those that depend on this mosaic, notwithstanding the contributing value of other features such as scrub and open water.

3.17 There are a number of significant species on the lists, but there are a few that stand out as being of particular value to the site and the area.

3.18 The butterfly resource is significant. Both the dingy skipper (*Erynnis tages*) and grizzled skipper (*Pyrgus malvae*), which are NERC Act Section 41 species, are widespread across the site with the grizzled skipper seemingly most widespread and abundant. This species is listed by Butterfly Conservation as 'high priority', as it has declined by 49% since the 1970s[2]. The dingy skipper is also 'high priority', according to Butterfly Conservation, having declined by 61% since the 1970s[3].

3.19 The suites of ground-nesting bees and wasps are also diverse and robust. A total of 68 species are recorded, with 14 of these having a nationally significant status. However, a number of these are considered more common than their statuses suggest. It is suggested that should a focused survey on this group be undertaken, the site's totals would likely be much greater than the total recorded from this current survey.

3.20 The proximity of the site to Bedford Purlieus NNR presents opportunity to species that live along woodland edges. The red wood ant (*Formica rufa*) within the great crested-newt mitigation area is a notable species for the site. The wood ant, although not currently listed as scarce or threatened, is a species with a restricted distribution and is confined to areas of high tree cover. It lives along the edges of paths, rides, and woodland edges. Its presence on the site is a positive component to the overall value of the site for invertebrates, not only those indicative of early succession but those dependent upon woodland or scrub edges. As these broader suites of woodland edge or decaying wood species contribute to the site's diversity, they should be considered in any site enhancements and creation.

Site assessment summary

[2] Butterfly Conservation (2023). *Grizzled skipper species page* [online]. Available at: http://butterfly-conservation.org/50-1011/grizzled-skipper.html [Accessed 13 October 2023].

[3] Butterfly Conservation (2023). *Grizzled skipper species page* [online]. Available at: https://butterfly-conservation.org/butterflies/dingy-skipper [Accessed 13 October 2023].

3.21 The survey recorded 176 species from the target groups, including 21 species of importance. This constitutes 11.9% of the total species recorded, a strong scarce species representation.

3.22 The overall number of species recorded is slightly lower than expected for a site of this geographical location and type, but it still holds a strong list that includes a high number of scarce species associated with its key feature of conservation value, the early successional mosaic. This mosaic is complemented by scrub fringes, its proximity to Bedford Purlieus NNR, and the contributing open waterbodies.

3.23 The site holds robust populations of many of the species recorded. Of particular note are the early successional butterflies, the grizzled and dingy skipper. Unusually, it is the grizzled skipper that is most abundant and widely recorded. It can be found on almost all areas of suitable patchy bare ground habitat with prostrate-growing Rosaceae such as creeping cinquefoil (*Potentilla reptans*).

3.24 It is considered that the site is of value and has a significant potential for species associated with early successional mosaics and also to scrub fringes and woodland edgers. As such, a series of recommendations are put forward in the Recommendations section to offset any impacts on these habitats.

3.25 The key with any invertebrate compensation, restoration, or enhancements at the site will be to create mosaics that include strong juxtapositions of habitats and bare ground features.

3.26 As part of these mosaics, extensive, flower-abundant, and diverse swards are required along with open water sources.

Site evaluation

3.27 The site comprises, or is thought to comprise (see Limitations section), a moderately high invertebrate fauna that includes a low number of localized and specialized species; 15 of these currently have nationally significant statuses.

3.28 The valuation of the site takes into consideration the range of species recorded, including the scarce species, the overall assemblages, and the importance of the habitats to the species. It also considers the context of the year's weather, the site, and/or its species in relation to the local area and further afield.

3.29 From considering the above summary information and data collected from the surveys, it is suggested that any impact on the site's key features and species should be considered to be of **County importance**.

3.30 The site is considered to be of County importance, and not one of a lower status, owing to the site holding or supporting a potentially significant resource of early successional invertebrates including strong populations of early successional butterflies. The site also possesses good lists of species associated with scrub fringes and woodland edge. It is thought that this complex invertebrate resource is of high conservation value.

3.31 Through enhancements, the site could become even more diverse, and individual populations of species bolstered through appropriate measures. These measures are outlined in the Recommendations section.

4 Recommendations

Important note

4.1 All invertebrate-related mitigation should be undertaken on low-fertility soils.

4.2 As the site and its key species are associated with a range of features, there are a number of options possible to compensate for any losses to the site.

4.3 The success of any mitigation for loss of part or all of the site's key features will be dependent on incorporating key features in juxtaposition with one another and creating features that are **abundant**, **extensive**, and **optimal**.

4.4 Use of on-site material is encouraged but only **low-fertility subsoils**.

Short turf and bare ground

4.5 This is the key mosaic and should be replicated across all areas. It can be as a large mosaic or as small, discrete features.

4.6 To be successful, the mosaic of short turf and bare ground should be exposed to full sun for much of the day, including the key period between 10:00 and 16:00 h, and should be created on very nutrient-poor subsoils to promote a patchy sward dominated by flowering plants.

4.7 Bare ground should comprise a minimum of 20% of the habitat mosaic but no more than 50%.

4.8 A mosaic of fine-leaved grasses and a range of flowering plants are required to fulfil the requirements of the open mosaics. It is likely that a commercially sourced seed mixture may not be suitable, but a bespoke mix should be specified.

4.9 The bare ground element should be topographically varied to include horizontal planes and also vertical and/or near-vertical exposures. These exposures can be low (as little as 20 cm) to high cliffs over 1 m in height.

4.10 Ideally, on-site substrates should be used.

As a guide, the following plant species are/would be of greatest value to the site as part of the short turf sward:

- common bird's-foot trefoil (*Lotus corniculatus*);
- hawkbits (*Leontodon* spp.);
- other trefoils (Fabaceae);
- other vetches (*Vicia* spp.);
- other yellow Asteraceae;
- low-growing Rosaceae such as creeping cinquefoil (*Potentilla reptans*) and wild strawberry (*Fragaria vesca*);
- red clover (*Trifolium pratense*); and
- yarrow (*Achillea millefoilum*).

Flowery and varied height swards

4.11 To complement the bare ground and early succession, tall flowery swards are required. The swards should ideally include the following species and/or groups:

- common bird's-foot trefoil (*Lotus corniculatus*);
- common knapweed (*Centaurea nigra*);
- bush vetch (*Vicia cracca*);
- hawkbits (*Leontodon* spp.);
- hawkweeds (*Hieracium* spp.);
- labiates (Lamiaceae);
- red bartsia (*Odontites vernus*);
- wild carrot (*Daucus carota*);
- meadow vetchling (*Lathyrus pratensis*);
- other trefoils (Fabaceae);
- yarrow (*Achillea millefolium*);
- other vetches (*Vicia* spp.);
- ox-eye daisy (*Leucanthemum vulgare*);
- red clover (*Trifolium pratense*);
- viper's bugloss (*Echium vulgare*); and
- woundworts (*Stachys* spp.).

4.12 The flowering swards should have a high density of flowers. Most standard mixes do not have a high enough proportion of flowering plants that are suitable for invertebrate mitigation, so a bespoke mix or additional ordering of supplementary flower seed or plugs is advised.

Deadwood

4.13 There are a number of deadwood-nesting bees and wasps recorded from the site. Deadwood in sheltered sunny situations can be easily provided by repurposing felled trees and inserting them into the ground in sunny and sheltered situations.

4.14 Each piece of deadwood should ideally be a minimum of 20 cm in diameter and no less than 1.5 m in length. They can be planted into the ground to create 'standing deadwood' or laid as piles of timbers, just so as long as they are in full sun and not shaded by surrounding features or tall vegetation.

Scrub fringes

4.15 Retention of scrub is important. To complement it, further scrub should be plants. This can be in the form of fringes or as scattered scrub and part of the early successional and perennial swards mosaic.

4.16 Species to use should reflect the local conditions, and preferences should go to nectar and pollen species that provide a continuity of flowers from early spring to summer, such as:

- apples (*Malus domestica* agg.);
- blackthorn (*Prunus spinosa*);
- cherry plum (*Prunus cerasifera*);
- field maple (*Acer campestre*);
- hawthorn (*Crataegus monogyna*);
- plums (*Prunus domestica* agg.);
- rowan (*Sorbus aucuparia*); and
- willows (*Salix* spp.).

Pools

4.17 Retention or creation of open waterbodies is important to the site, and water should be available across all areas of invertebrate conservation. Creation of pools should offer a range of aspects including water depth, varied topography, and also the margins. Shallow margins benefit many wetland flies, beetles, and bugs.

4.18 Pools that dry up or nearly dry up (ephemeral) will also be important to a range of species that are dependent upon the seasonal changes in water levels. The shallower the margin, the greater the drawdown zone, which maximizes the potential for invertebrates.

4.19 Some areas of the pools should, however, be deep and steep-sided so that they retain water all year round and contain open water.

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6 Appendix

Appendix I: Red Data Book definitions
Appendix II: Survey results

Appendix I: Red Data Book definitions

Red Data Book category 1 (RDB 1) – Endangered
Species that are known or believed to occur as only a single population within one 10-km square of the National Grid.

Red Data Book category 2 (RDB 2) – Vulnerable
Species declining throughout their range or in vulnerable habitats.

Red Data Book category 3 (RDB 3) – Rare
Species that are estimated to exist in only 15 or fewer post-1970 10-km squares. This criterion may be relaxed where populations are likely to exist in over 15 10-km squares but occupy small areas of especially vulnerable habitat.

Nationally Notable (Scarce) category A (NS A) – Notable A
Taxa that do not fall within the RDB category but that are nonetheless uncommon in Great Britain and thought to occur in 30 or fewer 10-km squares of the National Grid or, for less well-recorded groups, between eight and 20 vice counties.

Nationally Notable (Scarce) category B (NS B) – Notable B
Taxa that do not fall within the RDB category but that are nonetheless uncommon in Great Britain and thought to occur in 31–100 10-km squares of the National Grid or, for less well-recorded groups, between eight and 20 vice counties.

Nationally Notable (Scarce) (N) – Notable
Species that are estimated to occur within the range of 16–100 10-km squares. The subdividing of this category into Notable A and Notable B has not been attempted for many species in this part of the review.

IUCN categories
EXTINCT (EX)
A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range, have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CRITICALLY ENDANGERED (CR)
A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.
ENDANGERED (EN)
A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.
VULNERABLE (VU)
A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
NEAR THREATENED (NT)
A taxon is Near Threatened when it has been evaluated against the criteria but does not

qualify for Critically Endangered, Endangered, or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LEAST CONCERN (LC)
A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable, or Near Threatened. Widespread and abundant taxa are included in this category.
DATA DEFICIENT
A taxon is Data Deficient (DD) when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. DD is therefore not a category of threat.

GB Rarity Status categories and criteria
Broadly speaking, the Nationally Rare category is equivalent to the Red Data Book, namely: Endangered (RDB1), Vulnerable (RDB2), Rare (RDB3), Insufficiently Known (RDBK), and Extinct, which will not be used in this report.
The Nationally Scarce category is directly equivalent to the combined Nationally Notable A (Na) and Nationally Notable B (Nb) categories used in the assessment of various taxonomic groups, e.g. by Hyman and Parsons (1992) in assessing the status of beetles, but never used in a published format to assess these three families.

Nationally Rare Native species recorded from 15 or fewer hectads of the Ordnance Survey National Grid in Great Britain since 31 December 1989 and where there is reasonable confidence that exhaustive recording would not find them in more than 15 hectads. This category includes species that are probably extinct.
Nationally Scarce Native species that are not regarded as Nationally Rare AND have not been recorded from more than 100 hectads of the Ordnance Survey National Grid in Great Britain since 31 December 1989 and where there is reasonable confidence that exhaustive recording would not find them in more than 100 hectads.

England NERC S.41 Biodiversity Lists – England England NERC S.41 Species ‘of principal importance for the purpose of conserving biodiversity’ covered under section 41 (England) of the NERC Act (2006) and therefore need to be taken into consideration by a public body when performing any of its functions with a view to conserving biodiversity. 2008 Natural Environment and Rural Communities Act 2006 – Species of Principal Importance in England (section 41) and Wales (section 42)

Appendix II: Survey results

Only species with a national status have been annotated. All others are common or local species.

Scientific name	Family	Order	National status
Adelphocoris lineolatus	Miridae	Hemiptera	
Adonia variegata	Coccinellidae	Coleoptera	
Aelia acuminata	Pentatomidae	Hemiptera	
Agapanthia villosoviridescens	Cerambycidae	Coleoptera	
Amara convexior	Carabidae	Coleoptera	
Ammophila sabulosa	Sphecidae	Hymenoptera	
Ancistrocerus gazella	Vespidae	Hymenoptera	
Ancistrocerus nigricornis	Vespidae	Hymenoptera	
Andrena bicolor	Andrenidae	Hymenoptera	
Andrena cineraria	Andrenidae	Hymenoptera	
Andrena dorsata	Andrenidae	Hymenoptera	
Andrena minutula	Andrenidae	Hymenoptera	
Andrena similis	Andrenidae	Hymenoptera	Notable a
Anoplius infuscatus	Pompilidae	Hymenoptera	
Anoplius nigerrimus	Pompilidae	Hymenoptera	
Anthocoris confusus	Anthocoridae	Hemiptera	
Aphantopus hyperantus	Nymphalidae	Lepidoptera	
Aphanus rolandri	Lygaeidae	Hemiptera	Notable a
Aricia agestis	Lycaenidae	Lepidoptera	
Astata boops	Crabronidae	Hymenoptera	
Aulacobaris picicornis	Curculionidae	Coleoptera	Notable b
Bembecia ichneumoniformis	Sesiidae	Lepidoptera	
Bombus pascuorum	Apidae	Hymenoptera	
Bombus terrestris	Apidae	Hymenoptera	
Calathus melanocephalus	Carabidae	Coleoptera	
Caliadurgus fasciatellus	Pompilidae	Hymenoptera	
Calliopum tuberculosum	Lauxaniidae	Diptera	
Cantharis lateralis	Cantharidae	Coleoptera	
Capsus ater	Miridae	Hemiptera	
Ceratapion gibbirostre	Apionidae	Coleoptera	
Cerceris quinquefasciata	Crabronidae	Hymenoptera	Red Data Book 3*; Section 41 Priority Species

Scientific name	Family	Order	National status
Cerceris rybyensis	Crabronidae	Hymenoptera	
Cheilosia pagana	Syrphidae	Diptera	
Chloromyia formosa	Stratiomyidae	Diptera	
Chorthippus brunneus	Acrididae	Orthoptera	
Chrysops relictus	Tabanidae	Diptera	
Cicindela campestris	Carabidae	Coleoptera	
Closterotomus trivialis	Miridae	Hemiptera	
Coenonympha pamphilus	Nymphalidae	Lepidoptera	Near Threatened; Section 41 Priority Species
Colletes hederae	Colletidae	Hymenoptera	
Colletes similis	Colletidae	Hymenoptera	
Conocephalus dorsalis	Conocephalidae	Orthoptera	
Corizus hyoscyami	Rhopalidae	Hemiptera	
Crossocerus capitosus	Crabronidae	Hymenoptera	
Crossocerus quadrimaculatus	Crabronidae	Hymenoptera	
Dasypoda hirtipes	Melittidae	Hymenoptera	Notable b*
Dichetophora obliterata	Sciomyzidae	Diptera	
Dioctria atricapilla	Asilidae	Diptera	
Dioctria rufipes	Asilidae	Diptera	
Diodontus minutus	Crabronidae	Hymenoptera	
Dorycera graminum	Ulidiidae	Diptera	Provisionally Nationally Scarce; provisionally Near Threatened; Section 41 Priority Species*
Dryudella pinguis	Crabronidae	Hymenoptera	
Elampus panzeri	Chrysididae	Hymenoptera	
Enallagma cyathigerum	Coenagrionidae	Odonata	
Entomognathus brevis	Crabronidae	Hymenoptera	
Epeolus variegatus	Apidae	Hymenoptera	
Episyron rufipes	Pompilidae	Hymenoptera	
Eriothrix rufomaculata	Tachinidae	Diptera	
Erynnis tages	Hesperiidae	Lepidoptera	Section 41 Priority Species; Vulnerable
Eupeodes corollae	Syrphidae	Diptera	
Eurydema (Eurydema) oleracea	Pentatomidae	Hemiptera	
Evagetes dubius	Pompilidae	Hymenoptera	Notabe b

Scientific name	Family	Order	National status
Formica fusca	Formicidae	Hymenoptera	
Formica rufa	Formicidae	Hymenoptera	
Gonepteryx rhamni	Pieridae	Lepidoptera	
Gymnomerus laevipes	Vespidae	Hymenoptera	
Halictus rubicundus	Halictidae	Hymenoptera	
Halictus tumulorum	Halictidae	Hymenoptera	
Harpalus affinis	Carabidae	Coleoptera	
Harpalus rufipes	Carabidae	Coleoptera	
Harpalus tardus	Carabidae	Coleoptera	
Hedychrum niemelai	Chrysididae	Hymenoptera	Red Data Book 3*
Hemicrepidius hirtus	Elateridae	Coleoptera	
Heterogaster urticae	Lygaeidae	Hemiptera	
Himacerus (Aptus) mirmicoides	Nabidae	Hemiptera	
Hylaeus communis	Colletidae	Hymenoptera	
Hylaeus confusus	Colletidae	Hymenoptera	
Hylaeus signatus	Colletidae	Hymenoptera	Notable b*
Ischnura elegans	Coenagrionidae	Odonata	
Lasioglossum albipes	Halictidae	Hymenoptera	
Lasioglossum leucopus	Halictidae	Hymenoptera	
Lasioglossum leucozonium	Halictidae	Hymenoptera	
Lasioglossum malachurum	Halictidae	Hymenoptera	Notable b*
Lasioglossum minutissimum	Halictidae	Hymenoptera	
Lasioglossum parvulum	Halictidae	Hymenoptera	
Lasioglossum puncticolle	Halictidae	Hymenoptera	Notable b
Lasioglossum villosulum	Halictidae	Hymenoptera	
Leptogaster cylindrica	Asilidae	Diptera	
Leptophyes punctatissima	Phaneropteridae	Orthoptera	
Leptopterna dolabrata	Miridae	Hemiptera	
Libellula quadrimaculata	Libellulidae	Odonata	
Lindenius albilabris	Crabronidae	Hymenoptera	
Lycaena phlaeas	Lycaenidae	Lepidoptera	
Machimus cingulatus	Asilidae	Diptera	
Malachius bipustulatus	Malachiidae	Coleoptera	
Maniola jurtina	Nymphalidae	Lepidoptera	

Scientific name	Family	Order	National status
Melanargia galathea	Nymphalidae	Lepidoptera	
Melanostoma mellinum	Syrphidae	Diptera	
Meligethes aeneus	Nitidulidae	Coleoptera	
Microdynerus exilis	Vespidae	Hymenoptera	Notable b*
Microlestes maurus	Carabidae	Coleoptera	
Mimesa equestris	Crabronidae	Hymenoptera	
Mordellistena pumila	Mordellidae	Coleoptera	
Myrmosa atra	Mutillidae	Hymenoptera	
Nomada flavoguttata	Apidae	Hymenoptera	
Nomada fucata	Apidae	Hymenoptera	Notable a*
Nomada goodeniana	Apidae	Hymenoptera	
Nomada panzeri sensu lato	Apidae	Hymenoptera	
Nysson dimidiatus	Crabronidae	Hymenoptera	Notable b*
Ochlodes sylvanus	Hesperiidae	Lepidoptera	
Odynerus melanocephalus	Vespidae	Hymenoptera	Notable a*; Section 41 Priority Species
Oedemera lurida	Oedemeridae	Coleoptera	
Oedemera nobilis	Oedemeridae	Coleoptera	
Onthophagus joannae	Scarabaeidae	Coleoptera	
Ophonus azureus	Carabidae	Coleoptera	Nationally Scarce
Opomyza germinationis	Opomyzidae	Diptera	
Orthocephalus coriaceus	Miridae	Hemiptera	
Osmia spinulosa	Megachilidae	Hymenoptera	
Oulema duftschmidi/melanopus agg.	Chrysomelidae	Coleoptera	
Oxybelus uniglumis	Crabronidae	Hymenoptera	
Oxycera nigricornis	Stratiomyidae	Diptera	
Paradromius linearis	Carabidae	Coleoptera	
Paragus haemorrhous	Syrphidae	Diptera	
Passaloecus singularis	Crabronidae	Hymenoptera	
Pemphredon inornata	Crabronidae	Hymenoptera	
Phania funesta	Tachinidae	Diptera	
Phasia pusilla	Tachinidae	Diptera	
Pherbellia cinerella	Sciomyzidae	Diptera	
Philanthus triangulum	Crabronidae	Hymenoptera	Red Data Book 2*

Scientific name	Family	Order	National status
Phyllobius maculicornis	Curculionidae	Coleoptera	
Phytocoris (Ktenocoris) varipes	Miridae	Hemiptera	
Pieris brassicae	Pieridae	Lepidoptera	
Pieris napi	Pieridae	Lepidoptera	
Pieris rapae	Pieridae	Lepidoptera	
Pipizella viduata	Syrphidae	Diptera	
Polygonia c-album	Nymphalidae	Lepidoptera	
Polyommatus icarus	Lycaenidae	Lepidoptera	
Priocnemis parvula	Pompilidae	Hymenoptera	
Pseudomalus auratus	Chrysididae	Hymenoptera	
Pyrgus malvae	Hesperiidae	Lepidoptera	Section 41 Priority Species; Vulnerable
Pyronia tithonus	Nymphalidae	Lepidoptera	
Rhopalus (Rhopalus) subrufus	Rhopalidae	Hemiptera	
Roeseliana roeselii	Tettigoniidae	Orthoptera	
Scaeva pyrastri	Syrphidae	Diptera	
Sicus ferrugineus	Conopidae	Diptera	
Sitona lineatus	Curculionidae	Coleoptera	
Sphaeroderma testaceum	Chrysomelidae	Coleoptera	
Sphaerophoria scripta	Syrphidae	Diptera	
Sphecodes crassus	Halictidae	Hymenoptera	Notable b*
Sphecodes geoffrellus	Halictidae	Hymenoptera	
Sphecodes gibbus	Halictidae	Hymenoptera	
Sphecodes monilicornis	Halictidae	Hymenoptera	
Sphecodes puncticeps	Halictidae	Hymenoptera	
Stenocorus meridianus	Cerambycidae	Coleoptera	
Stenotus binotatus	Miridae	Hemiptera	
Stictopleurus abutilon	Rhopalidae	Hemiptera	
Stictopleurus punctatonervosus	Rhopalidae	Hemiptera	
Subcoccinella vigintiquattuorpunctata	Coccinellidae	Coleoptera	
Sympetrum sanguineum	Libellulidae	Odonata	
Syntomus foveatus	Carabidae	Coleoptera	
Syritta pipiens	Syrphidae	Diptera	
Tachina fera	Tachinidae	Diptera	

Scientific name	Family	Order	National status
Tachysphex pompiliformis	Crabronidae	Hymenoptera	
Tephritis cometa	Tephritidae	Diptera	
Tetrix undulata	Tetrigidae	Orthoptera	
Thecophora atra	Conopidae	Diptera	
Thereva nobilitata	Therevidae	Diptera	
Thymelicus sylvestris	Hesperiidae	Lepidoptera	
Tyria jacobaeae	Erebidae	Lepidoptera	
Tytthaspis sedecimpunctata	Coccinellidae	Coleoptera	
Vanessa atalanta	Nymphalidae	Lepidoptera	
Vanessa cardui	Nymphalidae	Lepidoptera	
Volucella inanis	Syrphidae	Diptera	
Volucella zonaria	Syrphidae	Diptera	
Xanthogramma pedissequum sensu lato	Syrphidae	Diptera	
Zygaena filipendulae	Zygaenidae	Lepidoptera	

*Widely accepted as being much more common than this status suggests; likely to be downgraded.

APPENDIX 6

INVERTEBRATE WET WOODLAND BASELINE

Cook's Hole Quarry
Wet Woodland

Invertebrate Baseline

Final Report

A report for:
ESL

10 October 2023

By:
Conops Entomology Ltd

Report Number: 23.29B

ConopsEntomologyLtd
Invertebrate survey, research and conservation advice

Cook's Hole Quarry
Wet Woodland

Invertebrate baseline

Final Report

Report Number: 23.29B

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Contents

1 Introduction 4
2 Results summary 6
3 Discussion 9
4 Site assessment summary 10
5 References 12
6 Appendix 13

1 Introduction

1.1 Conops Entomology Ltd was commissioned in May 2023 by ESL to undertake a baseline survey of an area of wet woodland at Cook's Hole Quarry, near Peterborough.

1.2 The scope of this survey is to undertake an invertebrate baseline of a wet woodland as part of a wider restoration project and redevelopment of areas of land at Cook's Hole Quarry, Peterborough (referred to hereafter as 'the site'). The assessment appraised the wet woodland through the recording of invertebrates to set a baseline from which future monitoring results can be referred back to.

1.3 The site is located at OS grid reference TL 05156 99729.

Methods and timings

1.4 The methods used for the assessment are those recommended in the Natural England guidance document *Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation* (Drake *et al.*, 2007). In some instances, a bespoke method has been created for the wet woodland baseline but still retains the overall approach to assessing features and habitats for conservation assessment.

- **Sweep netting**

1.5 This method provides the main proportion of the survey element and is the most efficient method for cataloguing a site's invertebrate resource. Sweep netting involves the use of a long-handled sweep net being swept over vegetation such as stands of vegetation.

- **Spot sampling**

1.6 Spot sampling is employed to collect large, conspicuous invertebrates such as bees and wasps from flowering plants, and to supplement the sweep samples. Spot sampling is often the most effective method for recording species from high-fidelity niches.

Target groups

1.7 The groups targeted for the survey are those that are key indicators of wet woodlands, as defined by Drake (2007). The principal groups are as follows:

- heteropteran bugs (range of habitats including lush vegetation and trees);
- various fly families including hoverflies and craneflies; and
- beetles (including leaf beetles, ground beetles, and weevils);
- aculeate hymenoptera (owing to the historic presence of *Cleptes semiauratus*).

- **Timing**

1.8 So that the site can be monitored fairly over time, the sampling is standardized:

Sweep netting = 45 minutes;
Spot sampling = 30 minutes

Survey timing

1.9 The site was visited on four occasions:

Visit dates
02 June 2023 – wind and sunny, 17–20°C;

23 June 2023 – sunny, 22–26°C;
05 July 2023 – sunny, 21–22°C;
15 August 2023 – sunny, 20–23°C; and
04 September 2023 – sunny, 22–27°C

Results analysis

1.10 Tables 1 and 2 provide a breakdown of the site's invertebrate resources and highlight any species of significance recorded during the surveys.

1.11 Tables 3 and 4 have been generated using the Pantheon software package. Pantheon is an analytical tool developed by Natural England and the Centre for Ecology & Hydrology to assist invertebrate nature conservation in England. Site data in the form of species lists can be imported into Pantheon, which then analyses the species within the lists, assigning them to habitats and resources. Pantheon also consigns the most up-to-date national status to the species where it is available.

1.12 Pantheon is also capable of other outputs such as Specific Assemblage Types (SATs) (see Table 4).

1.13 A SAT is characterized by stenotopic species (those that can withstand only a narrow range of environmental conditions). SATs are therefore more tightly defined than 'habitats' or 'resources' and sit within a parent habitat or Broad Assemblage Type (BAT). More than one SAT can sit within a parent BAT.

Example:

BAT: **F**2 – grassland and scrub matrix

SAT: **F**211 – herb-rich dense sward

F212 – dense scrub

1.14 The information obtained from Pantheon can then be used to assign quality to sites and their features, assist in management decisions, and facilitate requirement for further surveys, where required and appropriate.

1.15 Pantheon was first made publicly accessible in April 2018 and is the primary analytical tool used by entomologists in site evaluation. It is also the tool recognized and preferred by Natural England. For more information on this new resource, see http://www.brc.ac.uk/pantheon/.

1.16 Not all species of importance are expressed in the following tables, as they do not form part of the Pantheon analysis and/or their specific requirements are not yet fully understood.

1.17 Table 5 provides a list of previously recorded scarce species from a survey undertaken in 2009[1].

[1] Walker, J., Southey, J. (2009) *Cook's Hole Quarry Ecological Management Plan.* Unpublished report for Augean Plc.

2 Results summary

2.1 A total of 105 species from the sampled groups were recorded during the surveys.

2.2 A single species recorded has a national status, though it is recognized by many of the national recording schemes that it no longer warrants its current status and that it will need revising.

2.3 The full list of species is provided in Appendix II.

Table 1 Species breakdown

Site	Total no. of species recorded	Total no. of species of importance*	Species of importance (%)
Site	105	1	0.9

*Note: some species do not warrant nationally significant status.

Table 2 Species of importance

Scientific name	Vernacular name	National/local status	Habitat preferences and species notes
Dorycera graminum	Phoenix fly	Provisionally Nationally Scarce; provisionally near Threatened*; NERC Act Section 41 species	Clear habitat preferences unknown, but it is much more common than its status suggests and no longer deserving of a nationally significant status.

*Accepted as being more common than this status suggests; likely to be downgraded.

Table 3 Resource-usage table (taken from Webb *et al.*, 2017[2])

Broad biotope	Habitat	No. of species	No. of species with conservation status (excluding research-only moths)	Species with conservation status (excluding research-only moths)
open habitats	tall sward & scrub	34	1	*Dorycera graminum* (pNS; NT; S41*)
tree-associated	shaded woodland floor	22	–	–
wetland	running water	10	–	–
wetland	marshland	10	–	–
wetland	acid & sedge peats	10	–	–
tree-associated	arboreal	9	–	–
tree-associated	wet woodland	9	–	–
tree-associated	decaying wood	9	–	–
wetland	wet woodland	9	–	–
open habitats	short sward & bare ground	3	–	–

*Accepted as being more common than this status suggests; likely to be downgraded.

[2] Webb, J., Heaver, D., Lott, D., Dean, H.J., van Breda, J., Curson, J., Harvey, M.C., Gurney, M., Roy, D.B., van Breda, A., Drake, M., Alexander, K.N.A. and Foster, G. (2017). *Pantheon – Database Version 3.7.6* [online]. Available at: http://www.brc.ac.uk [Accessed 1 October 2023].

Table 4 Site SAT table (taken from Webb *et al.*, 2017)

Broad biotope	SAT	SAT code	No. of species	No. of species with conservation status (excluding research-only moths)	Conservation status	Reported condition
tree-associated	bark & sapwood decay	A212	5	–	–	Unfavourable (5 species, 19 required)
open habitats	scrub edge	F001	4	–	–	Unfavourable (4 species, 11 required)
tree-associated	heartwood decay	A211	2	–	–	Unfavourable (2 species, 6 required)
open habitats	scrub-heath & moorland	F003	1	–	–	Unfavourable (1 species, 9 required)
wetland	Sphagnum bog	W312	1	–	–	Unfavourable (1 species, 8 required)

Table 5 List of 2009 scarce species with updated statuses

Species	Family	Order	Current national status	2009 national status	Feature of association
Apotomis lineana	Tortricidae	Lepidoptera	–	Nationally Scarce	On willows (*Salix* spp.)
Cleptes semiauratus	Chrysididae	Hymenoptera	Notable b	Nationally Scarce	Arboreal
Dicranomyia lucida	Limoniidae	Diptera	–	Nationally Scarce	Damp woodlands
Limonia trivittata	Limoniidae	Diptera	Notable	Nationally Scarce	Running water; shaded woodland floor; wet woodland
Magdalis carbonaria	Curculionidae	Coleoptera	Notable b	Nationally Scarce	Decaying wood
Stratiomys potamida	Stratiomyidae	Diptera	–	Nationally Scarce	Acid & sedge peats; base-rich seepage; marshland

3 Discussion

Limitations

3.1 2023 experienced extremes in weather, from a dry and cold spring to a hot and dry June, followed by a wet July and August, off the back of 2022, which saw a protracted drought and a series of heatwaves. Little to no rain for many months over the two years coupled with extreme heat events has widely been reported as having had a significant impact on invertebrate numbers. This rapid decline of invertebrates has resulted in difficulty recording species diversity, as many species are now operating at very low densities and numbers.

Monitoring Habitats

3.2 The analysis identifies a range of habitats recorded within the area of wet woodland. Table 4 lists the key habitats to be utilized in the monitoring. Tree-associated and wetland biotopes are the target biotope to compare with for positive changes.

3.3 Any open habitats recorded with significant numbers (caveating the usual vagrants from outside the key habitats) will indicate a decline to the wet woodland. In particular, the tall sward and scrub habitat can be used as a negative habitat indicator, as it highlights the influence of the edge effect on the small areas of wet woodland. The current value of 34 is considered to be quite high, especially when factoring in the tight constraints on the recording effort within the shaded woodland boundary. Any increase in this habitat (subject to analysis of the species recorded) is likely to indicate a degradation of the woodland as further open and woodland/scrub fringes species are recorded. Habitats nestled within the wetland biotope should be viewed as the most positive of changes to the wet woodland.

Monitoring SATs

3.4 The analysis identifies a number of Specific Assemblage Types (SATs) that represent the site and its key features of value. The key SATs that can be used to compare future monitoring with are listed in Table 6. Increases in any of these will be seen as a positive change in the woodland. Any specific increases in SAT value nestled within the ‘wetland’ biotope’ including the noted Sphagnum bog SAT (W312) should be recorded as significant improvement to the wet woodland. Open-habitat associated SATs that are noted in the analysis should be seen as negatives, as they suggest a degradation in close canopy wet woodland or lowering of the water table, resulting in drier-habitat assemblage species being able to colonize.

Table 6 Target SATs

Broad biotope	SAT	SAT code	No. of species
tree-associated	bark & sapwood decay	A212	5
tree-associated	heartwood decay	A211	2
wetland	Sphagnum bog	W312	1

Species

3.5 The survey of the site recorded 105 species, with a single species recorded as having significant status. This species, *Dorycera garminum*, is not a wet woodland species but is a species no longer warranting a nationally significant status.

3.6 Previously recorded scarce species were not re-recorded. Three of these no longer have a nationally significant status (see Table 5), and the remaining three were most likely not recorded, owing to habitat degradation brought about by external impacts including nitrogen runoff. The hot and dry 2020 and more recent 2022 may also have impacted these species, as wetland species are sensitive to hydrological changes, particularly a lowering of the water table.

3.7 The range of species recorded is typical of woodlands and shady places including suites of species of wet woodlands. The number of typical wetland species, however, is small, with only 26 species of association. Most of these are craneflies (Tipuloidea) and long-legged flies (Dolichopodidae). This is the key group to compare with for future monitoring.

4 Site assessment summary

4.1 The survey recorded 105 species within the confines of the wet woodland. This is a low total for a site, but considering the small area of wet woodland, the site is considered a rich area of habitat. It is, however, impacted significantly from external influences such as nitrogen runoff and the effects of a changing climate. Small areas of habitat are at greater risk of degradation, particularly wet habitats, as an increase in hot and dry periods of weather will impact these disproportionally. To increase the potential of the site and buffer it from climate-change impacts, it will need to be expanded, the hydrology improved, and the nitrogen runoff reduced.

4.2 The previously recorded scarce species were not recorded during this survey. It is likely that the site has degraded since the first survey (2009); however, the reasons for this are not clear, as the intervening period has seen an acceleration in hot summers and periods of low rainfall that would affect the wet woodland greater than other wetland areas, as it is small.

4.3 The site does still, however, possess a wetland and wet woodland resource of invertebrates. This group is the primary monitoring group to use for future surveys. As noted, any increases in this fauna will highlight a possible change to the wet woodland. Increases in open-habitat species such as the tall sward and scrub matrix will highlight a degradation to the site.

4.4 Table 7 confirms the baseline indicator numbers with which future monitoring should be compared.

Table 7 List of indicators to monitor changes against

Broad biotope	SAT/habitat	SAT code	No. of species (2023)	Number increase indicator
tree-associated	bark & sapwood decay	A212	5	Positive
tree-associated	heartwood decay	A211	2	Positive
wetland	sphagnum bog	W312	1	Positive
wetland	–	–	26	Positive
wetland	any wetland SAT code starting with (W…)	–	–	Positive
open habitats	tall sward and scrub	–	34	Negative

open habitats	any open habitat or SAT code starting with (F…)	–	–	Negative

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6 Appendix

Appendix I: Red Data Book definitions
Appendix II: Survey results

Appendix I: Red Data Book definitions

Red Data Book category 1 (RDB 1) – Endangered
Species that are known or believed to occur as only a single population within one 10-km square of the National Grid.

Red Data Book category 2 (RDB 2) – Vulnerable
Species declining throughout their range or in vulnerable habitats.

Red Data Book category 3 (RDB 3) – Rare
Species that are estimated to exist in only 15 or fewer post-1970 10-km squares. This criterion may be relaxed where populations are likely to exist in over 15 10-km squares but occupy small areas of especially vulnerable habitat.

Nationally Notable (Scarce) category A (NS A) – Notable A
Taxa that do not fall within the RDB category but that are nonetheless uncommon in Great Britain and thought to occur in 30 or fewer 10-km squares of the National Grid or, for less well-recorded groups, between eight and 20 vice counties.

Nationally Notable (Scarce) category B (NS B) – Notable B
Taxa that do not fall within the RDB category but that are nonetheless uncommon in Great Britain and thought to occur in 31–100 10-km squares of the National Grid or, for less well-recorded groups, between eight and 20 vice counties.

Nationally Notable (Scarce) (N) – Notable
Species that are estimated to occur within the range of 16–100 10-km squares. The subdividing of this category into Notable A and Notable B has not been attempted for many species in this part of the review.

IUCN categories
EXTINCT (EX)
A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range, have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CRITICALLY ENDANGERED (CR)
A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered, and it is therefore considered to be facing an extremely high risk of extinction in the wild.
ENDANGERED (EN)
A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered, and it is therefore considered to be facing a very high risk of extinction in the wild.
VULNERABLE (VU)
A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable, and it is therefore considered to be facing a high risk of extinction in the wild.
NEAR THREATENED (NT)
A taxon is Near Threatened when it has been evaluated against the criteria but does not

qualify for Critically Endangered, Endangered, or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LEAST CONCERN (LC)
A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable, or Near Threatened. Widespread and abundant taxa are included in this category.
DATA DEFICIENT
A taxon is Data Deficient (DD) when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. DD is therefore not a category of threat.

GB Rarity Status categories and criteria
Broadly speaking, the Nationally Rare category is equivalent to the Red Data Book, namely: Endangered (RDB1), Vulnerable (RDB2), Rare (RDB3), Insufficiently Known (RDBK), and Extinct, which will not be used in this report.
The Nationally Scarce category is directly equivalent to the combined Nationally Notable A (Na) and Nationally Notable B (Nb) categories used in the assessment of various taxonomic groups, e.g. by Hyman and Parsons (1992) in assessing the status of beetles, but never used in a published format to assess these three families.

Nationally Rare Native species recorded from 15 or fewer hectads of the Ordnance Survey National Grid in Great Britain since 31 December 1989 and where there is reasonable confidence that exhaustive recording would not find them in more than 15 hectads. This category includes species that are probably extinct.
Nationally Scarce Native species that are not regarded as Nationally Rare AND have not been recorded from more than 100 hectads of the Ordnance Survey National Grid in Great Britain since 31 December 1989 and where there is reasonable confidence that exhaustive recording would not find them in more than 100 hectads.

England NERC S.41 Biodiversity Lists – England England NERC S.41 Species ‘of principal importance for the purpose of conserving biodiversity’ covered under section 41 (England) of the NERC Act (2006) and therefore need to be taken into consideration by a public body when performing any of its functions with a view to conserving biodiversity. 2008 Natural Environment and Rural Communities Act 2006 – Species of Principal Importance in England (section 41) and Wales (section 42)

Appendix II: Survey results

Only species with a national status have been annotated. All others are common or local species.

Scientific name	Family	Order	National status
Adalia bipunctata	Coccinellidae	Coleoptera	
Agriotes obscurus	Elateridae	Coleoptera	
Anaspis maculata	Scraptiidae	Coleoptera	
Anthocoris nemorum	Anthocoridae	Hemiptera	
Apion frumentarium	Apionidae	Coleoptera	
Archarius salicivorus	Curculionidae	Coleoptera	
Argyra leucocephala	Dolichopodidae	Diptera	
Athous haemorrhoidalis	Elateridae	Coleoptera	
Baccha elongata	Syrphidae	Diptera	
Beris geniculata	Stratiomyidae	Diptera	
Calopteryx splendens	Calopterygidae	Odonata	
Calvia quattuordecimguttata	Coccinellidae	Coleoptera	
Campsicnemus loripes	Dolichopodidae	Diptera	
Cantharis cryptica	Cantharidae	Coleoptera	
Cantharis pallida	Cantharidae	Coleoptera	
Cantharis pellucida	Cantharidae	Coleoptera	
Cassida rubiginosa	Chrysomelidae	Coleoptera	
Chorisops tibialis	Stratiomyidae	Diptera	
Chrysogaster solstitialis	Syrphidae	Diptera	
Chrysopilus asiliformis	Rhagionidae	Diptera	
Chrysopilus cristatus	Rhagionidae	Diptera	
Chrysotus blepharosceles	Dolichopodidae	Diptera	
Chrysotus gramineus	Dolichopodidae	Diptera	
Closterotomus norwegicus	Miridae	Hemiptera	
Closterotomus trivialis	Miridae	Hemiptera	
Coenagrion puella	Coenagrionidae	Odonata	
Conocephalus fuscus	Conocephalidae	Orthoptera	
Contacyphon coarctatus	Scirtidae	Coleoptera	
Cordilura albipes	Scathophagidae	Diptera	
Crepidodera aurata	Chrysomelidae	Coleoptera	
Crepidodera plutus	Chrysomelidae	Coleoptera	

Scientific name	Family	Order	National status
Denticollis linearis	Elateridae	Coleoptera	
Dicranomyia modesta	Limoniidae	Diptera	
Dioctria baumhaueri	Asilidae	Diptera	
Dioctria rufipes	Asilidae	Diptera	
Dolichopus atratus	Dolichopodidae	Diptera	
Dolichopus griseipennis	Dolichopodidae	Diptera	
Dorycera graminum	Ulidiidae	Diptera	pNS; pNT; Section 41 Priority Species*
Eloeophila submarmorata	Limoniidae	Diptera	
Empis livida	Empididae	Diptera	
Empis scutellata	Empididae	Diptera	
Episyrphus balteatus	Syrphidae	Diptera	
Eristalis arbustorum	Syrphidae	Diptera	
Euphylidorea dispar			
Euthycera fumigata	Sciomyzidae	Diptera	
Eutrichapion vorax	Apionidae	Coleoptera	
Geomyza tripunctata	Opomyzidae	Diptera	
Helophilus pendulus	Syrphidae	Diptera	
Hemicoelus fulvicornis	Ptinidae	Coleoptera	
Heterotoma planicornis	Miridae	Hemiptera	
Himacerus (Himacerus) apterus	Nabidae	Hemiptera	
Hypera rumicis	Curculionidae	Coleoptera	
Imantimyia albiseta			
Lasius fuliginosus	Formicidae	Hymenoptera	
Leptophyes punctatissima	Phaneropteridae	Orthoptera	
Libellula quadrimaculata	Libellulidae	Odonata	
Limodromus assimilis	Carabidae	Coleoptera	
Limonia nubeculosa	Limoniidae	Diptera	
Liocoris tripustulatus	Miridae	Hemiptera	
Lonchoptera bifurcata	Lonchopteridae	Diptera	
Lygocoris (Lygocoris) rugicollis	Miridae	Hemiptera	
Malachius bipustulatus	Malachiidae	Coleoptera	
Malthodes marginatus	Cantharidae	Coleoptera	
Meconema thalassinum	Meconematidae	Orthoptera	

Scientific name	Family	Order	National status
Meiosimyza rorida	Lauxaniidae	Diptera	
Micropeza corrigiolata	Micropezidae	Diptera	
Miris striatus	Miridae	Hemiptera	
Myathropa florea	Syrphidae	Diptera	
Nephrotoma flavescens	Tipulidae	Diptera	
Nephrotoma scurra	Tipulidae	Diptera	
Orthotylus (Orthotylus) marginalis	Miridae	Hemiptera	
Orthotylus (Orthotylus) ochrotrichus	Miridae	Hemiptera	
Oxycera nigricornis	Stratiomyidae	Diptera	
Pachygaster atra	Stratiomyidae	Diptera	
Pachygaster leachii	Stratiomyidae	Diptera	
Palloptera quinquemaculata	Pallopteridae	Diptera	
Panorpa communis	Panorpidae	Mecoptera	
Pararge aegeria	Nymphalidae	Lepidoptera	
Perapion hydrolapathi	Apionidae	Coleoptera	
Phylidorea ferruginea	Limoniidae	Diptera	
Phyllobius pomaceus	Curculionidae	Coleoptera	
Pieris rapae	Pieridae	Lepidoptera	
Pilaria discicollis	Limoniidae	Diptera	
Plagiognathus (Plagiognathus) arbustorum	Miridae	Hemiptera	
Platycheirus scutatus	Syrphidae	Diptera	
Poecilobothrus nobilitatus	Dolichopodidae	Diptera	
Polygonia c-album	Nymphalidae	Lepidoptera	
Pseudolimnophila lucorum	Limoniidae	Diptera	
Pseudolimnophila sepium	Limoniidae	Diptera	
Ptychoptera albimana	Ptychopteridae	Diptera	
Pyrausta aurata	Crambidae	Lepidoptera	
Rhagio lineola	Rhagionidae	Diptera	
Rhaphium appendiculatum	Dolichopodidae	Diptera	
Rhopalum coarctatum	Crabronidae	Hymenoptera	
Sitona lineatus	Curculionidae	Coleoptera	
Sphegina verecunda	Syrphidae	Diptera	
Stenus ossium	Staphylinidae	Coleoptera	

Scientific name	Family	Order	National status
Syntormon denticulatum	Dolichopodidae	Diptera	
Syntormon submonilis	Dolichopodidae	Diptera	
Tachina fera	Tachinidae	Diptera	
Tipula fascipennis	Tipulidae	Diptera	
Tipula lunata	Tipulidae	Diptera	
Volucella inanis	Syrphidae	Diptera	
Volucella pellucens	Syrphidae	Diptera	

*Widely accepted as being much more common than this status suggests; likely to be downgraded.

APPENDIX 7

BREEDING BIRD SURVEY RESULTS 2023

Common name	Scientific name
Blackcap	Sylvia atricapilla
Moorhen	Gallinula chloropus
Redwing	Turdus iliacus
Grey Heron	Ardea cinerea
House Sparrow	Passer domesticus
Yellowhammer	Emberiza citrinella
Coot	Fulica atra
Wheatear	Oenanthe oenanthe
Canada Goose	Branta canadensis
Greylag Goose	Anser anser
Mallard	Anas platyrhynchos
Tufted Duck	Aythya fuligula
Little Grebe	Tachybaptus ruficollis
Little Ringed Plover	Charadrius dubius
Curlew	Numenius arquata
Black-headed Gull	Chroicocephalus ridibundus
Starling	Sturnus vulgaris
Song Thrush	Turdus philomelos
Meadow Pipit	Anthus pratensis
Bullfinch	Pyrrhula pyrrhula
Stock Dove	Columba oenas
Woodpigeon	Columba palumbus
Buzzard	Buteo buteo
Raven	Corvus corax
Skylark	Alauda arvensis
Whitethroat	Curruca communis
Wren	Troglodytes troglodytes
Dunnock	Prunella modularis
Linnet	Linaria cannabina

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ARBORICULTURAL IMPACT ASSESSMENT:

COOKS HOLE QUARRY AND THORNHAUGH LANDFILL SITE, PETERBOROUGH

FINAL

FEBRUARY 2024

DOCUMENT CONTROL

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Contents

		Page
1	INTRODUCTION	1
1.1	SCOPE OF WORK	1
1.2	LIMITATIONS	1
2	SURVEY METHODOLOGY	1
2.1	STANDARDS AND HARDWARE USED	1
3	ARBORICULTURAL IMPACT ASSESSMENT	2
3.1	STATUTORY SITES, TREE PRESERVATION ORDERS AND CONSERVATION AREAS	2
3.2	STATUTORILY-PROTECTED WILDLIFE	2
3.3	THE PETERBOROUGH LOCAL PLAN (ADOPTED JULY 2019) - POLICY LP29: TREES AND WOODLAND	2
3.4	SURVEY RESULTS	4
3.5	IMPACT ASSESSMENT	6
4	ARBORICULTURAL METHOD STATEMENT	9
4.1	CONTACT INFORMATION	9
4.2	AUDITING	9
4.3	PRE-COMMENCEMENT TREE OPERATIONS	9
4.4	BARRIERS AND FENCING	9
4.5	ROOT PROTECTION AREAS/CONSTRUCTION EXCLUSION ZONES	10
4.6	BIOSECURITY	10
4.7	CONTRACTOR PARKING, SITE HUTS AND FACILITIES, STORAGE AREAS	10
4.8	WORKING SPACE	10
4.9	DUST MANAGEMENT	11
4.10	MITIGATION PLANTING/RESTORATION LANDSCAPING	11
5	POST-DEVELOPMENT	11
5.1	REMOVAL OF PROTECTIVE MEASURES	11
APPENDIX 1		12
APPENDIX 2		15

FIGURES

1 Tree Protection Plan.

EXECUTIVE SUMMARY

ESL (Ecological Services) Limited (ESL) has been commissioned by MJCA to undertake an Arboricultural Impact Assessment on behalf of Augean South Limited (Augean) for proposed works at the Cooks Hole Quarry and Thornhaugh Landfill Site, Peterborough.

The proposed works comprise the continuation of the landfilling operations at Thornhaugh Landfill Site and the importation of clean naturally-occurring materials to create an integrated restoration landform with nature conservation habitats at Cooks Hole Quarry and Thornhaugh Landfill Site.

Statutory Sites, Tree Preservation Orders and Conservation Areas.

- Natural England's GIS datasets were used to locate any statutorily-protected sites relevant to the proposed works. The Bedford Purlieus Site of Special Scientific Interest (SSSI), National Nature Reserve (NNR) and Ancient Woodland Site (AWS) is adjacent to the western boundary of the site.
- Peterborough City Council's website was used to locate any Tree Preservation Orders or Conservation Areas. There is none on or adjacent to the site.

Summary of potential impacts:

- The proposed works are in proximity to mature trees. There is the potential to impact the soil, roots, stems and canopies.
- Some of the hedgerows and trees groups within the site boundary will be lost.

Summary of proposed mitigation:

- Protective measures and Construction Exclusion Zones will be implemented to protect the retained trees.
- Mitigation for losses will be by way of landscaping post-works.

Summary of Impact Assessment:

- Trees within the SSSI/NNR/AWS will not be impacted. The riparian woodland will also be retained.
- There will be a permanent loss of five hedgerows and three tree groups from the site. These losses will be more than mitigated during the restoration of the site, which results in a significant increase in hedgerow and other woody vegetation on site.
- It is intended to restore the listed buildings on site and integrate them into a wider-area scheme including footpaths and other public access. Overall, the proposed works will have a positive impact on the site's public amenity value.

ARBORICULTURAL IMPACT ASSESSMENT: COOKS HOLE QUARRY AND THORNHAUGH LANDFILL SITE, PETERBOROUGH

1 INTRODUCTION

1.1 SCOPE OF WORK

1.1.1 ESL (Ecological Services) Limited has been commissioned by MJCA to undertake an Arboricultural Impact Assessment on behalf of Augean for proposed works at the Cooks Hole Quarry and Thornhaugh Landfill Site, Peterborough.

1.1.2 The site is located approximately 1km west of the village of Wansford, 1.7km south of RAF Wittering and 4.1km northwest of King's Cliffe (approximate central grid reference TL 05192 99845). The site comprises a mineral extraction and an active landfill set within a predominantly arable landscape.

1.1.3 A schedule of the survey results is given as Appendix 1 and a series of site photographs as Appendix 2. A Tree Protection Plan is given as Figure 1.

1.1.4 The entire working area, together with its immediate surroundings, was surveyed on 22nd and 23rd June 2023 to assess the impact of the proposed works, with an additional visit on 18th January 2024.

1.2 LIMITATIONS

1.2.1 ESL does not carry out soil assessments or pronounce on the health of trees beyond the initial informal visual assessment.

1.2.2 The surveyor had generally good access throughout the site. Areas of steep, unstable ground, deep water, dense scrub and vehicle movements made accessing some areas difficult but this is considered a minor constraint on the survey; all key areas could be accessed. The surveyor had some access to adjacent land but again, any restrictions were not a significant constraint.

2 SURVEY METHODOLOGY

2.1 STANDARDS AND HARDWARE USED

2.1.1 The survey was carried out within the guidelines detailed in 'BS 5837:2012 – Trees in relation to design, demolition and construction – recommendations' (hereafter, 'the Standard').

2.1.2 Tree positions were recorded with a Trimble DA2 GNSS.

2.1.3 Stem diameters were measured using a stem diameter tape where practicable, otherwise by estimation, in accordance with Annex C of the Standard.

2.1.4 Given the nature of the proposed works, tree heights were not recorded.

2.1.5 Canopy spreads and other measurements were made by tape and/or Leica DISTO D110 where practicable, otherwise by estimation (also in accordance with Section 4.4.2.6 of the Standard).

2.1.6 Common names are used throughout this report with scientific names given in the schedule. Where species not listed in the schedule are mentioned, their scientific name is given at the first instance.

2.1.7 Prior to the site visit, a risk assessment was undertaken by the Project Manager in order to make all fieldworkers aware of any site-specific risks and of the required safe working methods. These assessments are updated as required during the course of the survey.

3 ARBORICULTURAL IMPACT ASSESSMENT

3.1 STATUTORY SITES, TREE PRESERVATION ORDERS AND CONSERVATION AREAS

3.1.1 Natural England's GIS datasets were used to locate any statutorily-protected sites relevant to the proposed works. The Bedford Purlieus SSSI/NNR/AWS is near to the western boundary of the site. Trees within a SSSI are protected under Part 2 of the Wildlife and Countryside Act 1981 (as amended) and as such, must not be impacted without prior approval from Natural England.

3.1.2 Peterborough City Council's website was used to locate any Tree Preservation Orders or Conservation Areas. There is none on or adjacent to the site.

3.2 STATUTORILY-PROTECTED WILDLIFE

3.2.1 Statutorily-protected species are addressed in a separate ecological report and are not considered further in this report.

3.3 THE PETERBOROUGH LOCAL PLAN (ADOPTED JULY 2019) - POLICY LP29: TREES AND WOODLAND

3.3.1 "*Development proposals should be prepared based on the overriding principle that:*

- *The existing tree and woodland cover be maintained, improved and expanded.*
- *Opportunities for expanding woodland are actively considered and implemented where practical and appropriate to do so.*

3.3.2 Existing Trees and Woodland. Planning permission will only be granted if the proposal provides evidence that it has been subject to adequate consideration of the impact of the development on any existing trees and woodland found on-site (and off-site, if there are any trees near the site, with 'near' defined as the distance comprising 12 times the stem diameter of the off-site tree). If any trees exist on or near the development site, 'adequate consideration' is likely to

mean the completion of a British Standard 5837 Tree Survey and, if applicable, an Arboricultural Method Statement.

3.3.3 *Where the proposal will result in the loss or deterioration of ancient woodland and/or the loss of aged or veteran trees found outside ancient woodland, permission will be refused unless and on an exceptional basis the need for and benefits of the development in that location clearly outweigh the loss. Where the proposal will result in the loss or deterioration of a tree protected by a Tree Preservation Order or a tree within a Conservation Area, then permission will be refused unless:*

- *There is no net loss of amenity value, which arises as a result of the development.*
- *The need for and benefits of the development in that location clearly outweigh the loss.*

3.3.4 *Where the proposal will result in the loss of any other tree or woodland not covered by the above, the council will expect the proposal to retain those trees that make a significant contribution to the landscape or biodiversity value of the area, provided this can be done without compromising the achievement of good design for the site.*

3.3.5 *Mitigating for loss of Trees and Woodland. Where it is appropriate for higher value tree(s) (category A or B trees (BS 5837)) and/or woodland to be lost as part of a development proposal, appropriate mitigation via compensatory tree planting will be required. Such tree planting should:*

- *Take all opportunities to meet the five Tree Planting Principles.*
- *Unless demonstrably impractical or inappropriate, provide the following specific quantity of compensatory trees:*

Stem diameter(mm) at 1.5m above ground level of tree lost to development	***Number of replacement trees required per tree lost****
75 -200	*1*
210-400	*4*
410-600	*6*
610-800	*9*
810-1,000	*10*
1,000+	*11*

** replacement based on selected standards 10/12 cm girth at 1m*

3.3.6 *New Trees and Woodland. Where appropriate and practical, opportunities for new tree planting should be explored as part of all development proposals (in addition to, if applicable, any necessary compensatory tree provision). Where new trees are proposed, they should be done so on the basis of the five Tree Planting Principles. Proposals which fail to provide practical opportunities for new tree planting will be refused.*

3.3.7 *The five Tree Planting Principles are that it:*

- *Create habitat and, if possible, connect the development site to the Strategic Green Infrastructure Network.*
- *Assist in reducing or mitigating run-off and flood risk on the development site.*

- *Assist in providing shade and shelter to address urban cooling and in turn, assist in mitigating the effects of climate change.*
- *Create a strong landscaping framework to either (a) enclose or mitigate the visual impact of a development or (b) create new and enhanced landscape.*
- *Be of an appropriate species for the site.*

3.3.8 *Management and Maintenance. In instances where new trees and/or woodlands are proposed, it may be necessary for the council to require appropriate developer contributions to be provided to ensure provision is made for appropriate management and maintenance of the new trees and/or woodland*".

3.4 SURVEY RESULTS

3.4.1 Roughly triangular, the site is described as having a western boundary, an eastern boundary and a southern boundary. The site covers an area of approximately 84ha and comprises a mix of active landfill, restored landfill, areas of mineral extraction, a nature conservation area, hedgerows, woodland and a river corridor that runs west to east roughly parallel with the southern boundary.

3.4.2 A recurring characteristic of the site is colonisation by scrub, particularly butterfly bush *Buddleja davidii* but also scatterings of elder, birch, willow and sycamore. Most areas not currently being worked have become colonised by this scrub and in some areas, the stands of butterfly bush have become quite dense. There are also two areas of new planting: one being the restored landfill in the northern corner of the site, which has a scattering of young (sub-75mm) trees in collars and the second being along the eastern boundary, which has a denser strip of planting (again, all young sub-75mm).

3.4.3 Tree group TG01 comprises the Bedford Purlieus, which lies west of an access track that extends the entire length of the western boundary. The Bedford Purlieus are an ancient woodland site with a rich variety of species including sycamore, field maple, willow, English oak, sessile oak, ash, horse chestnut, birch, sweat chestnut, small-leaf lime and witch elm with an understory of blackthorn, common- and midland-hawthorn, elder and hazel. To the southern end is a pine plantation. There are public rights of way throughout the Purlieus, some of which lead into the Thornhaugh Landfill Site site. The woodland is well managed with tree ages ranging from young to ancient.

3.4.4 Tree group TG01a comprises a narrow strip of woodland east of the access track between the Purlieus and the site; it has a similar but reduced species composition to TG01.

3.4.5 Tree group TG02 comprises the area of the Country Wildlife Site on the western boundary of Thornhaugh, which includes a series of ponds with scrub and young trees adjacent. Tree group TG02 comprises a mix including sycamore, ash and birch with an understorey of spindle, hawthorn, elder and blackthorn. This group is Cat C by virtue of its stem diameters and age rather than quality.

3.4.6 Tree group TG03 forms the western end of the river corridor. Drier than the eastern end and set within a steeper cutting, the area is dominated by hawthorn, elder and blackthorn with some sycamore and birch.

3.4.7 Tree groups TG04 and TG05 form an area of riparian woodland, separated by Cooks Hole Farmhouse (Grade II listed) and the associated farm buildings, within the river corridor. TG04 has formed around a spring and comprises a mix including several species of willow with hazel, hawthorn, apple and plum. TG05 comprises a similar mix but also includes ash, sycamore, birch elder and blackthorn. Of particular interest was a veteran crack willow at the eastern end of the group that has formed over a footbridge.

3.4.8 The area between tree groups TG04 and TG05 is rapidly infilling with elder scrub, particularly north of the two main buildings. The area to the south of the eastern building is still relatively clear.

3.4.9 Tree Group TG06, which is outside the application boundary, comprises a stand of mature trees adjacent to the old weighbridge. It comprises a mix including ash, field maple, birch, crack willow and poplar. There is some standing deadwood and fungal fruiting bodies were noted (*Hymenochaetaceae* low down on one stem; an active fruit and an old bracket were present suggesting the fungus is historic and active).

3.4.10 Tree group TG07 forms the southern part of the western boundary and comprises ash, lime and field maple over hawthorn, elder and blackthorn. The larger trees are to the road-side of the group.

3.4.11 Tree groups TG08 and TG09 form the northern part of the eastern boundary and are located around the main site access. Both are similar in composition and comprise a mix including oak, birch, field maple, ash and lime over elder, hawthorn, privet, blackthorn and cherry laurel.

3.4.12 Tree group TG10 is a dispersed stand including birch and willow that has formed around a storage tank opposite the active weighbridge and along the southern edge of the restored landfill area.

3.4.13 Tree group TG11 is a stand of Scots pine, horse chestnut, spindle and elder present midway along the central hedgerow, adjacent to a steep cutting.

3.4.14 Hedgerows H01-H04 comprise the central hedgerow system that runs west to east across the site. They are similar in composition, being dominated by hawthorn and elder with some areas of dense blackthorn. A public right of way runs adjacent to this row, connecting into the Bedford Purlieus to the west.

3.4.15 Hedgerow H05 forms part of the eastern boundary, running between and merging with TG07 and TG08. It comprises a mix including hawthorn, elder and blackthorn with cherry, ash, lime and field maple. Again, the larger trees are on the road-side of the row.

3.4.16 Hedgerow H06 is a grown-out row running south from the mid-point of the central hedgerow system to the derelict buildings in the river corridor. Again, this row comprises a mix of hawthorn and elder.

3.4.17 The southern 300m of the western boundary is characterised by a grown-out hedgerow (H07) marking the edge of the site with a track adjacent. Beyond the track is a pine plantation. The southern boundary is marked by H08, which comprises a mix including midland- and common-hawthorn, elder and blackthorn with field maple, hazel, elm and ash. The western half of the row is well managed but to the east, several larger trees are present and row becomes more grown-out. Hedgerow H09 completes the southern boundary.

3.4.18 Between H05/TG07 and the site is an area of newly-planted trees comprising a mix including oak, privet, hazel, birch, hawthorn, wayfaring tree and wild service tree. All are sub-75mm, still in collars and they do not appear to be being managed.

3.5 IMPACT ASSESSMENT

3.5.1 The boundary of the Bedford Purlieus SSSI/NNR/AWS (as given by Natural England and shown as TG01 on the Tree Protection Plan for reference) falls to the west of an access track that follows the entire western boundary of the site. There is a narrow strip (ca.6m) of woodland to the east of the track shown as TG01a on the Tree Protection Plan (for reference), which will buffer the Purlieus from the site.

3.5.2 The first 120m at the northern end of the western boundary is adjacent to an area of restored landfill; this will not be impacted by the proposed works and will act as a buffer to the adjacent Purlieus. At a point approximately 400m south of the A47, the western boundary is characterised by a steep cliff face. This feature runs for approximately 290m until it meets the river corridor and forms a natural barrier to the Purlieus.

3.5.3 The Root Protection Area for the Purlieus based on stem diameter measurements would be 15m as per clause 4.6 of the Standard and 18.7m as per standing advice from the Forestry Commission with regard to ancient trees. Both these Root Protection Areas would fall outside the western site boundary.

3.5.4 Given the above, a direct impact on the Purlieus from the proposed works is considered unlikely. Indirect impacts as a result of dust deposition or effects resulting from a change to site hydrology are addressed later in this report.

3.5.5 Tree group TG01a is predominantly small scrub and young trees but several larger standards are present (mature ash, oak and sycamore). Nine of these trees (the majority and largest within the group) were measured and Root Protection Areas were calculated ranging from 4.20m to 9.60m. The boundary of the working area is approximately 18.50m from the trees at its closet point so a direct impact on TG01a is considered unlikely (as above for indirect

impacts). Fencing exists along this boundary that will be retained for the duration of the proposed works. Given the sensitivity of the Purlieus, additional signage will be installed.

3.5.6 Following discussions with the client, it was agreed the Root Protection Area for the tree groups within the river corridor would be set at 20m to ensure this resource is not impacted. Appropriate protective fencing will be installed outside the Construction Exclusion Zone as shown on the Tree Protection Plan prior to any works (including any site investigations or enabling works) commencing. Tree groups TG03, TG04 and TG05 will be retained.

3.5.7 Tree group TG02 will be retained. Again, existing fencing, augmented with appropriate signage, could serve to mark the Construction Exclusion Zone.

3.5.8 The western boundary of the site adjacent to TG01 between TG02 and TG03 is separated from the proposed works by a tall, vertical cliff. The Root Protection Area for TG01 in this area would run concurrent with the top of the cliff.

3.5.9 Hedgerow H07 will be retained. All works adjacent will fall outside the Root Protection Area to this hedgerow and appropriate protective fencing will be installed prior to any works (including any site investigations or enabling works) commencing. Tree group TG01 is approximately 15m from the centre-line of H07 and is separated from the hedgerow by the access track.

3.5.10 Hedgerows H01-H04 and H06 will be lost, as will tree group TG11; tree group TG10 could be impacted by the proposed development. While this will be a permanent loss from the site, restoration of the site will include significant planting and open it up to public access that will ultimately result in notable improvement to the site's public amenity value. The species within the rows and groups are common and widespread; diversity is low. The opportunity to increase the species diversity on site is significant, possibly even matching that of the Purlieus to the west.

3.5.11 An existing compacted-earth bund running along the north-eastern edge of TG05 will be re-profiled consistent with the existing planning permission to tie in with the proposed landform. The bund is ca.6m wide and falls inside and concurrent with the northern edge of TG05's Construction Exclusion Zone. A temporary set-back limited by the existing post-and-wire fence located ca.10m south of the Construction Exclusion Zone's northern edge will be implemented and, working from the existing bare ground north of the bund, a top-down draw-back method will be used to remove the bund material; a system will be put in place to prevent spoil rolling into the river corridor. Once the material has been removed, the full Construction Exclusion Zone will be restored for the remainder of the proposed works.

3.5.12 The proposed works have the potential to create dust. Dust and debris deposition on foliar surfaces and soils can seriously impact a tree's ability to photosynthesise and can change soil composition, both of which can have a negative impact on a tree's vitality. The dust control measures that are successfully implemented at the site currently will continue to be implemented for the duration of the operations.

3.5.13 The proposed works will create an integrated landform that incorporates surface water management. Sudden dewatering/wetting of soils can have disastrous impacts on trees. The surface water at the site will continue to be managed. The surface water management scheme during operation and restoration is presented in the Environmental Statement.

3.5.14 On completion of the operations at the site, the buildings in the centre of Cooks Hole will be restored (subject to a separate permission). The encroaching elder scrub will be cleared from the area north and east of the buildings (the area to the south is already clear). An access track will be installed outside the Root Protection Areas as shown on the Tree Protection, mitigating possible impacts to the retained trees.

3.5.15 In summary, provided the content of this report is followed, the impacts to the site from the proposed works are considered positive.

3.5.16 The contents of the following method statement must be communicated to all site staff and visitors, by way of induction or a toolbox-talk, to ensure everyone on site is aware of their responsibilities.

4 ARBORICULTURAL METHOD STATEMENT

4.1 CONTACT INFORMATION

Report Author	Client/Agent
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4.1.1 The Client may retain the services of a specialist to carry out specific tasks relating to this project (e.g., Access Facilitation Pruning); contact details for specialist contractors are available from the Client.

4.2 AUDITING

4.2.1 It is strongly recommended an auditable record of all protection measures be kept including specifications and inspection regimes &c.

4.3 PRE-COMMENCEMENT TREE OPERATIONS

4.3.1 All tree related operations (e.g., felling, crown modification &c.) will be completed before works commence on site.

4.3.2 These operations will be undertaken by a suitably-qualified arborist working to industry best practice (e.g., BS 3998). Method statements must be submitted prior to any proposed operations commencing.

4.4 BARRIERS AND FENCING

4.4.1 All barriers and associated signage, along with all other protective measures (e.g., ground protection), will be in place prior to works commencing (this includes any site investigations or enabling works).

4.4.2 All barriers and other protective measures will be fit for purpose and inspected by the site manager to ensure they remain effective throughout the duration of the works.

4.5 ROOT PROTECTION AREAS/CONSTRUCTION EXCLUSION ZONES

4.5.1 A Tree Protection Plan is given as Figure 1.

4.5.2 The following restrictions must be applied to all Root Protection Areas/Construction Exclusion Zones. By default:

- No access by foot- or vehicular-traffic.
- No storage of spoil, materials, chemicals &c. on or adjacent.
- No changes to ground level.
- The site manager will safeguard against contamination of the Root Protection Area/Construction Exclusion Zone (e.g., wash-off, chemical/fuel spill &c.).
- No fires within 20m of a Root Protection Area/Construction Exclusion Zone (this includes areas designated for smokers). Always note wind direction before starting a fire so that debris (especially that capable of causing ignition) does not blow into a Root Protection Area/Construction Exclusion Zone.
- No sprayed herbicide will be used near to a Root Protection Area/Construction Exclusion Zone as overspray or drift could affect retained trees. Only use topical application and follow the manufacturer's instructions at all times.

4.6 BIOSECURITY

4.6.1 Good biosecurity practices must be used at all times, such as disinfecting tools used on one tree before using them on another and cleaning soil/debris from vehicles, boots and clothing prior to leaving site.

4.7 CONTRACTOR PARKING, SITE HUTS AND FACILITIES, STORAGE AREAS

4.7.1 These facilities are restricted to the footprint of existing carriageways, hardstanding or on land outside the Root Protection Areas/Construction Exclusion Zones as shown on the Tree Protection Plan.

4.7.2 Areas used for storing, fuelling or maintenance of tools and equipment must be located away from Root Protection Areas/Construction Exclusion Zones. Where this is not possible, measures must be implemented (e.g., spill mats) to ensure there is no pollution of the soil within or adjacent to a Root Protection Area/Construction Exclusion Zone.

4.8 WORKING SPACE

4.8.1 Consideration must be given to working space required for construction. Operatives and materials must be able to move without entering into/passing over a Root Protection Area/Construction Exclusion Zone or impacting adjacent trees. Particular care must be taken with regard to the overhanging canopies. Where necessary, use a banksman.

4.9 DUST MANAGEMENT

4.9.1 Dust controls will be implemented to reduce the chance of dust escaping the site and contaminating adjacent soils.

4.9.2 At a minimum, retained trees will be inspected at least twice per month during the growing season for deciduous species and twice per month throughout the year for coniferous species.

4.9.3 If dust/debris is noted on foliar surfaces, it will be removed using a low-pressure water system; clean water will be used. Dust/debris must not be brushed or knocked from the trees as this may cause abrasions or other damage.

4.10 MITIGATION PLANTING/RESTORATION LANDSCAPING

4.10.1 All mitigation planting/restoration landscaping must make use of locally-appropriate stock supplied and planted by a competent contractor working to industry best practice guidelines (e.g., BS 3936-1).

4.10.2 A minimum five-year aftercare plan must be in place for all mitigation planting, including a suitable monitoring programme.

5 POST-DEVELOPMENT

5.1 REMOVAL OF PROTECTIVE MEASURES

5.1.1 Works to remove any protective measures (such as fencing) must be carried out in a way that respects the restrictions associated with a Root Protection Area/Construction Exclusion Zone.

APPENDIX 1

TREE SCHEDULE

Tree group number	Species	Stem type	Estimated	Stem Diameter	Height	Branch spread	Height above ground - First significant branch and direction	Height above ground - Canopy	Life stage	Physiological condition	Structural condition	Preliminary Management Recommendations	Estimated Remaining Contribution	Category	RPA (m)
TG01	Apse Acam Salb Scap Qrob Qpet Fexc Ahip Csat Ugla Pnig Pspi Cmon Clat Snig Cave Bpen Tcor	S/MS		1250		5.00	1E	1.00	Ancient	Good	Good	None	40+	A1	15.00
TG01a	Qrob Fexc Snig Cmon	S/MS		800		5.00	1E	1.00	Mature	Good	Good	None	40+	A2/3	9.60
TG02	Apse Fecx Bpen Eeur Cmon Snig Pspi	S/MS		150		4	1E	1.00	Young	Fair	Fair	None	10+	C1	1.80
TG03	Apse Pspi Cmon Snig	S/MS		325		5.5	1N	1.00	Mature	Good	Good	None	40+	A2/3	3.90
TG04	Salb Scin Cave Pcer Snig Mdom Cmon	S/MS		900		8	1E	1.00	Mature	Good	Good	None	40+	A2/3	10.80
TG05	Salb Sfrag Fexc Apse Bpen Snig Pspi	S/MS		1250		9.5	1S	1.00	Mature	Good	Good	None	40+	A2/3	15.00
TG06	Fexc Acam Bpen Sfra Lpop	S/MS		275		4.5	2-SW	2.00	Mature	Fair	Fair	None	20+	B1	3.30
TG07	Snig Qrob Cmon Lvul Bpen	S/MS		200		2.5	1S	1.00	Mature	Good	Good	None	40+	A2/3	2.40
TG08	Fex Teur Acam Cmon Snig Pspi	S/MS		300		5.5	1SW	1.00	Mature	Good	Good	None	40+	A2/3	3.60
TG09	Cmon Acam Bpen Fexc Qrob Pspi Teur Snig Plau Lvul	S/MS		500		5.5	1S	1.00	Mature	Good	Good	None	40+	A2/3	6.00
TG10	Bpen Scap Scin Salb Cmon	S/MS		350		4.5	1SW	1.00	Mature	Fair	Fair	None	10+	C1	4.20
TG11	Psyl Ahip Eeur Snig	S/MS		250		4.5	1E	1.00	Mature	Fair	Fair	None	20+	B3	3.00

Hedgerow number	Species	Estimated	Stem diameter (average or max)	Height (average or max/min)	Width (average)	Life stage	Physiological condition	Structural condition	Preliminary Management Recommendations	Estimated Remaining Contribution	Category	RPA (m)
H01	Cmon Snig		150	3.50	4.00	Mature	Good	Good	None	40+	A3	1.80
H02	Cmon Snig Pspi		100	4.00	5.00	Mature	Fair	Fair	None	20+	B1	1.20
H03	Cmon Snig		125	5.00	5.00	Mature	Good	Good	None	40+	A3	1.50
H04	Cmon Snig		150	4.50	5.00	Mature	Good	Good	None	40+	A3	1.80
H05	Cmon Snig Pave Fexc Pspi Teur Acam		250	3.50	8.00	Mature	Good	Good	None	40+	A2/3	3.00
H06	Cmon Snig		200	5.00	8.00	Mature	Good	Good	None	40+	A3	2.40
H07	Cmon		200	6.00	6.00	Mature	Good	Good	None	40+	A3	2.40
H08	Cmon Snig Acam Cave Pspi Umin Fexc Clat		650	3.50	8.00	Mature	Good	Good	None	40+	A3	7.80
H09	Pspi Cave Cmon		125	3.50	4.00	Mature	Good	Good	None	40+	A3	1.50

Code	Scientific name	Common name
Acam	*Acer campestre*	Field maple
Ahip	*Aesculus hippocastanum*	Horse chestnut
Apse	*Acer pseudoplatanus*	Sycamore
Bpen	*Betula pendula*	Silver birch
Cave	*Corylus avellana*	Hazel
Clat	*Crataegus laevigata*	Midland hawthorn
Cmon	*Crataegus monogyna*	Hawthorn
Eeur	*Euonymus europaeus*	Spindle
Fexc	*Fraxinus excelsior*	Ash
Lpop	*Populus nigra 'Italica'*	Lombardy poplar
Lvul	*Ligustrum vulgare*	Wild privet
Mdom	*Malus domestica*	Orchard apple
Pcer	*Prunus cerasifera*	Myrobalan plum
Plau	*Prunus laurocerasus*	Cherry laurel
Pnig	*Pinus nigra*	Black pine
Pspi	*Prunus spinosa*	Blackthorn
Psyl	*Pinus sylvestris*	Scots pine
Qrob	*Quercus robur*	English oak
Salb	*Salix alba*	White willow
Scap	*Salix caprea*	Goat willow
Scin	*Salix cinerea*	Grey willow
Sfra	*Salix fragilis*	Crack willow
Snig	*Sambucus nigra*	Elder
Tcor	*Tilia cordata*	Small-leaf lime
Teur	*Tilia* x *europaea*	Common lime
Ugla	*Ulmus glabra*	Witch elm
Umin	*Ulmus minor*	Elm

Key to Tree Schedule

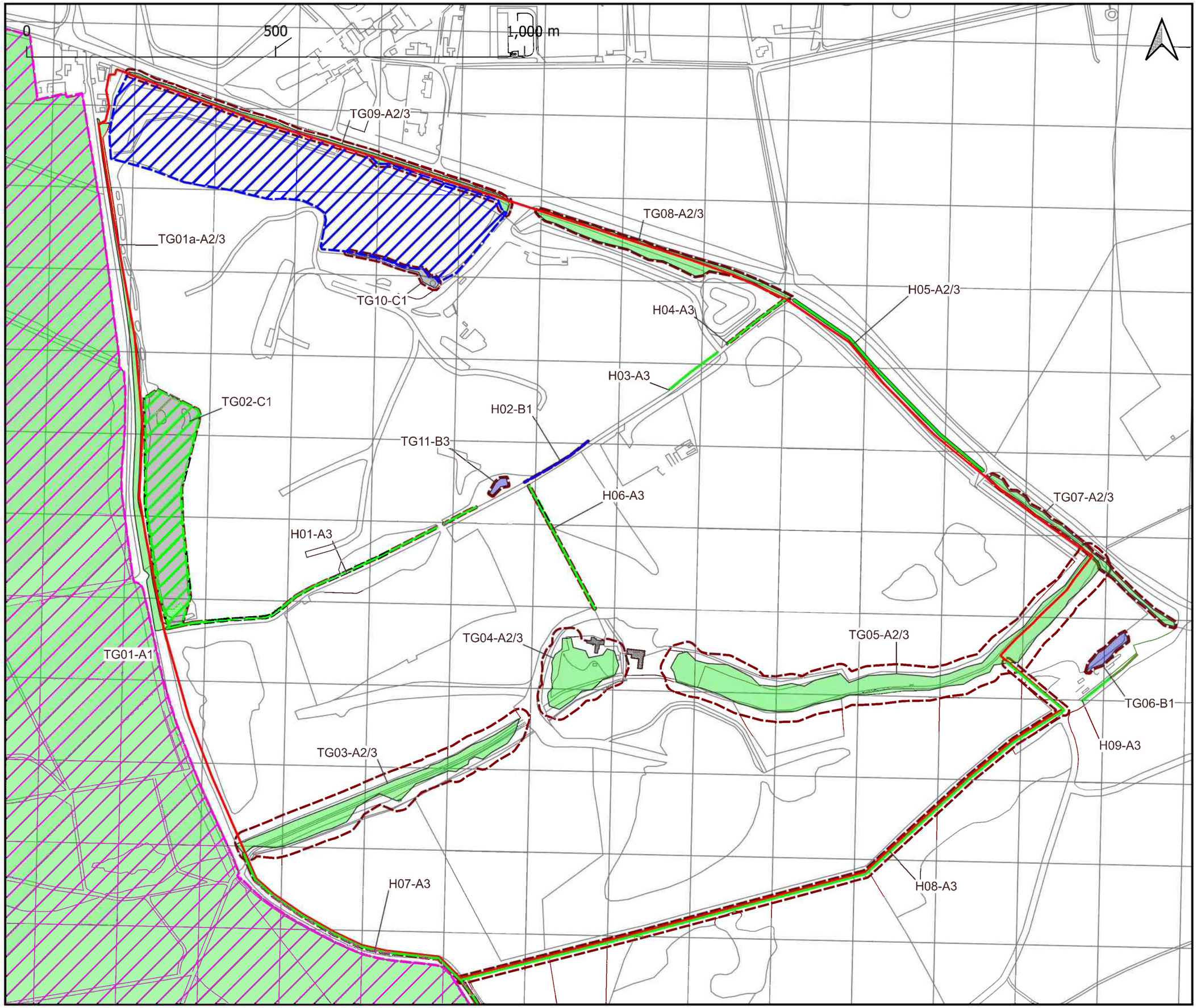
PHYSIOLOGICAL CONDITION
Good – A tree in good health with no significant defects.
Fair – A tree in generally good health that might require remediation for some issues.
Poor – A tree in poor health having issues that cannot be remediated.
Dead – A tree without sufficient live material to sustain life.

STRUCTURAL CONDITION
Good – A tree with no obvious sign of defect.
Fair – A tree with minor defects or defects that can be corrected.
Poor – A tree with major defects or defects beyond remediation.

CATEGORY
U - Trees unlikely to contribute beyond 10 years.
A - Trees of HIGH quality with an estimated remaining life expectancy of at least 40 years.
B - Trees of MODERATE quality with an estimated remaining life expectancy of at least 20 years.
C - Trees of LOW quality with an estimated remaining life expectancy of at least 10 years or young trees with a stem diameter of less than 150mm.

KEY

- Site boundary
- Cat A hedgerow
- Cat B hedgerow
- Cat A tree group
- Cat B tree group
- Cat C tree group
- Building
- Site of Special Scientific Interest
- Restored landfill
- Nature conservation area
- RPA/CEZ



esl
(ecological services) limited

SITE NAME:
Thornhaugh and Cook's Hole.

DRAWING TITLE:
Tree Protection Plan.

Dwg no.: 125-L032-003
Scale: 1:7,000 @ A3

Date: Jan 2024
Figure: 1-01

Appendix 2

Photographs

Photograph 1. View west along TG09.

Photograph 2. Indicative view of restored landfill area.

Photograph 3. Looking south along TG01 north of the nature reserve.

Photograph 4. Indicative view over working landfill site.

Photograph 5. Indicative view of scrub in unworked area of the site.

Photograph 6. Looing east along TG10.

Photograph 7. Looking south towards nature reserve.

Photograph 8. Indicative view of track running through Beford Purlieus. Looking south.

Photograph 9. Indicative view along central hedgerow system.

Photograph 10. Looking south along H05 showing new planting adjacent.

Photograph 11. Looking south along H06.

Photograph 12. Looking north along TG01 (western boundary), showing cliff edge.

Photograph 13. Looking east along river corridor (TG03).

Photograph 14. Looking east along southern boundary.

Photograph 15. Looking east at old weighbridge area.

Photograph 16. Looking north at listed buildings in river corridor.

	
Photograph 17. Looking south at TG04 showing area north of listed buildings.	Photograph 18. Looking west along riparian woodland east of listed buildings (TG05).