Swanscombe Peninsula SSSI
Kent

Supporting Information

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Contact points and further information

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Summary

Swanscombe Peninsula SSSI is notified under section 28C of the Wildlife and Countryside Act 1981. The site is a complex of open mosaic habitats on previously developed land and traditional estuarine habitats located near and within the River Thames, Kent. Habitats include chalk pits, free-draining grassland, scrub, wetlands, grazing marsh, mudflats and saltmarsh (see habitat map at Annex 1). Swanscombe Peninsula SSSI is of special interest for the following nationally important features:

- Quaternary geology at Bakers Hole, a key Pleistocene site with a complex sequence of periglacial and temperate climate deposits, and Middle Palaeolithic archaeology;
- populations of the plants divided sedge *Carex divisa*, yellow vetchling *Lathyrus aphaca*, slender hare's-ear *Bupleurum tenuissimum*, Bithynian vetch *Vicia bithynica* and round-leaved wintergreen *Pyrola rotundifolia* subsp. *maritima*;
- assemblages of invertebrates chiefly associated with bare sand and chalk; open short swards; open water on disturbed mineral sediments; and saltmarsh and transitional brackish marsh; and
- two diverse assemblages of breeding birds: one associated with lowland open waters and their margins, lowland fen and lowland damp grassland; the other with lowland scrub.

1. Information used to support the selection of Swanscombe Peninsula SSSI

Feature	Data source	Author	Date	Content
General	Guidelines for the Selection of Biological SSSIs. Part 1: Rationale, Operational Approach and Criteria for Site Selection. JNCC, Peterborough. https://data.jncc.gov.uk/data/dc6466a6-1c27-46a0-96c5-b9022774f292/SSSI-Guidelines-Part1-Rationale-2013.pdf.	Bainbridge, I., Brown, A., Burnett, N., Corbett, P., Cork, C., Ferris, R., Howe, M., Maddock, A. & Pritchard, S. (eds).	2013	General principles and guidance for the selection of SSSIs.
Geology	GCR Block Site Report Northfleet (Ebbsfleet valley): Baker's Hole Complex. Quaternary of the Thames. JNCC, Peterborough.	Bridgland, D.R.	1994	Detailed description and justification for inclusion of Bakers Hole in the Geological Conservation Review.
	An Introduction to the Geological Conservation Review. Geological Conservation Review Series. JNCC, Peterborough. https://data.jncc.gov.uk/data/ab60570e-9e70-4216-924d-90c3390b0715/GCR-Intro.pdf.	Ellis, N.V. (ed.), Bowen, D.Q., Campbell, S., Knill, J.L., McKirdy, A.P., Prosser, C.D., Vincent, M.A. & Wilson, R.C.L.	1996	Background to the Geological Conservation Review.
	Baker's Hole SSSI/SAM Field Survey Report. University of Southampton.	Wenban-Smith, F.	2012	Field survey and recommendations for future management of Bakers Hole SSSI.
	Project 6478, Baker's Hole SM and SSSI, Strategic Condition Field Survey Final Report: Current Condition and Future Management recommendations. University of Southampton.	Wenban-Smith, F.	2015	Field survey, condition assessment and recommendations for future management of Bakers Hole SSSI.
	Baker's Hole SM and SSSI, Area B: Report on Assessment of the Temperate Bed under HAR Programme. University of Southampton.	Wenban-Smith, F.	2016	Field survey, assessment of samples and recommendations for future management of Bakers Hole SSSI.
	Baker's Hole SM and SSSI Field Survey (Area B) closure report: Temperate Bed vulnerability, management priorities and collation of specialist analyses. University of Southampton.	Wenban-Smith, F.	2018	Field survey, assessment of samples and recommendations for future management of Bakers Hole SSSI.
Vascular plants	British Red Data Books: Vascular Plants. Society for Nature Conservation, Lincoln.	Perring, F.H. and Farrell, L.	1977	Status definitions for vascular plants.

Feature	Data source	Author	Date	Content
	British Red Data Books: 1. Vascular Plants, 2nd ed. Royal Society for Nature Conservation, Lincoln.	Perring, F.H. and Farrell, L.	1983	Status definitions for vascular plants.
	The Vascular Plant Red Data List for Great Britain. *Species Status* **7**: 1-116. JNCC, Peterborough. https://data.jncc.gov.uk/data/cc1e96f8-b105-4dd0-bd87-4a4f60449907/SpeciesStatus-7-VascularPlant-WEB-2005.pdf.	Cheffings, C.M. & Farrell, L. (Eds), Dines, T.D., Jones, R.A., Leach, S.J., McKean, D.R., Pearman, D.A., Preston, C.D., Rumsey, F.J., Taylor, I.	2005	Status definitions for threatened plants.
	England Rare and Scarce Taxa, a report for NE. Botanical Society of Britain and Ireland.	Stroh, P.	2013	Status definitions for threatened plants.
	A Vascular Plant Red Data List for England. Botanical Society of Britain and Ireland, London. https://bsbi.org/wp-content/uploads/dlm_uploads/England_Red_List_1.pdf.	Stroh, P.A., Leach, S.J., August, T. A., Walker, K.J., Pearman, D.A., Rumsey, F.J., Harrower, C.A., Fay, M.F., Martin, J.P., Pankhurst, T., Preston, C.D. & Taylor, I.	2014	IUCN assessment of vascular plants in England.
	Biological Records Centres.	Kent & Medway Biological Records Centre, Greenspace Information for Greater London and Essex Wildlife Trust.	1987 to 2020	Records with abundance of *Pyrola rotundifolia* subsp. *maritima* and *Pyrola rotundifolia* subsp. unspecified within the Greater Thames Estuary NCA.
	JNCC Taxon Designations Spreadsheet, accessed November 2020. https://hub.jncc.gov.uk/assets/478f7160-967b-4366-acdf-8941fd33850b	JNCC	2020	GB and England conservation status.
	The BSBI Distribution Database and rare plant registers. https://database.bsbi.org/. https://bsbi.org/rare-plant-registers	Botanical Society of Britain and Ireland	2020	Distribution of plants by Area of Search and details of the rarest species in the county.
	The London Resort Preliminary Environmental Information Report. Appendix 12.1 Ecology Baseline Report. https://londonresort.info/appendices/.	The Environmental Dimension Partnership Ltd	2020	Report on baseline ecology and important ecological features within Swanscombe Peninsula.

Feature	Data source	Author	Date	Content
	Annex EDP 1 - habitat descriptions and illustrative photographs. **Annex EDP 12** – desk study and phase 1 habitat survey with 2012 habitat descriptions for key plants. Chris Blandford Associates. **Annex EDP 13** – 2012 survey records for key plants. Chris Blandford Associates. **Annex EDP 14** - phase 1 habitat and botanical survey with 2015 survey records for key plants. Chris Blandford Associates. **Plan EDP 5** - rare plant species population plan with 2020 survey records for key plants. The Environmental Dimension Partnership Ltd.			
	Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 11 Vascular Plants. JNCC, Peterborough. https://data.jncc.gov.uk/data/04b923cd-7658-4b8c-bead-4a65c3af330e/sssi-guidelines-11-vascular-plants-2021.pdf.	Taylor, I., Leach, S. J., Martin, J. P., Jones, R. A., Woodman, J. and Macdonald, I.	2021	Selection guidance for vascular plants.
Invertebrates	Aquatic invertebrate surveys of the Inner Thames Marshes SSSI 1998-2001. https://www.researchgate.net/publication/306031399_Aquatic_invertebrate_surveys_of_the_Inner_Thames_Marshes_SSSI_1998-2001	Leeming, D.J & England, J.	2005	Comparison of site with others in the NCA. Tables 4 and 5.
	Invertebrate Survey and Assessment for West Thurrock Lagoons.	Harvey, P.R.	2005	Comparison of site with others in the NCA. Tables 3 and 5.
	Invertebrate Survey and Assessment for Corys Wharfe, Purfleet.	Harvey, P.R.	2005	Comparison of site with others in the NCA. Table 3.
	Site A, East Tilbury Saltings and Silt Lagoons, S. Essex. Invertebrate Survey and Assessment.	Harvey, P.R.	2006	Comparison of site with others in the NCA. Table 5.
	Isle of Grain, Kent, National Grid Property Holdings, Invertebrate Survey Report No BS/2506/10.	Colin Plant Associates (UK)	2010	Comparison of site with others in the NCA. Tables 3 and 5.
	Grain 2010 Aquatic Invertebrate Survey. Report to RPS.	Kirby, P.	2010	Comparison of site with others in the NCA. Tables 4 and 5.
	Land at Vopack Terminal, Oliver Road, West Thurrock, Essex. Revised Mitigation Proposals Based on ISIS Analysis of Invertebrate Interest.	Aspect Ecology	2010	Comparison of site with others in the NCA. Table 3.
	Thurrock Thameside Nature Park Invertebrate Survey Report.	Harvey, P.R.	2014	Comparison of site with others in the NCA. Table 3.

Feature	Data source	Author	Date	Content
	Isle of Grain, Kent, National Grid Property Holdings, Invertebrate Survey Report No BS/2879/14.	Colin Plant Associates (UK)	2014	Comparison of site with others in the NCA. Tables 3 and 5.
	W M Morrison Supermarkets Plc. Proposed Non Food Retail Warehouse, Off Northwick Road, Canvey Island, Essex. Ecological Mitigation Plan – Results of Ecological Monitoring	Penny Anderson Associates Ltd	2014	Comparison of site with others in the NCA. Table 3.
	Invertebrate Survey at Foulness Island.	Harvey, P.R.	2015	Comparison of site with others in the NCA. Table 5.
	Hadleigh Park Invertebrate Assemblage Monitoring.	Harvey, P.R.	2015	Comparison of site with others in the NCA. Table 5.
	Pantheon: A New Resource for Invertebrate Survey Standards and Analysis https://cieem.net/wp-content/uploads/2019/11/InPractice98_Dec2017.pdf	Heaver, D., Webb, J., Roy, D., Dean, H., Harvey, M., Macadam, C. and Curson, J.	2017	Description of how Pantheon works and what it does.
	Guidelines for the Selection of Biological SSSIs Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 20 Terrestrial and Freshwater Invertebrates. JNCC, Peterborough. https://data.jncc.gov.uk/data/747968a5-a8a7-4bd6-b12c-3329c3b5b6ca/SSSI-Guidelines-20-Invertebrates-2019.pdf.	Curson J., Howe, M, Webb, J., Heaver D. & Tonhasca, A.	2019	SSSI selection guidance for invertebrates.
	Oikos Marine & South Side Development Protected Species Report – Draft.	Waterman Infrastructure & Environment Ltd	2020	Comparison of site with others in the NCA. Table 3.
	Stanhope Industrial Park Invertebrate Survey	Smith, M.	2020	Comparison of site with others in the NCA. Table 3.
	The London Resort Preliminary Environmental Information Report. Appendix 12.1 Ecology Baseline Report. https://londonresort.info/appendices/.	The Environmental Dimension Partnership Ltd.	2020	Report on baseline ecology and important ecological features within Swanscombe Peninsula.
	Annex EDP 27 - Survey records for terrestrial invertebrates 2012. Chris Blandford Associates. **Annex EDP 28 -** Survey records for terrestrial invertebrates 2015. Edwards Ecological Services Limited. **Annex EDP 29** - Survey records for spiders and related groups 2012. Chris Blandford Associates.			

Feature	Data source	Author	Date	Content
	Annex EDP 30 - Survey records for aquatic macroinvertebrates within waterbodies and wetlands 2015. Aquatic Survey & Environmental Data Analyses (Aseda). **Annex EDP 31** - Survey records for aquatic macroinvertebrates within selected waterbodies 2015. Aquatic Survey & Environmental Data Analyses (Aseda).			
	The London Resort Development Consent Order Environmental Statement Volume 2: Appendix 12.1 Ecology Baseline Report, Annex EDP 10. https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/BC080001/BC080001-000480-6.2.12.1%20ES%20Appendix%2012.1%20Ecology%20Baseline%20Report%20(1%20of%203).pdf	The Environmental Dimension Partnership Ltd.	2020	2020 invertebrate survey report.
	Pantheon analysis of invertebrate survey records. NERR in prep.	Natural England	2020	Pantheon analysis of 2012 and 2015 survey data.
Birds	Kent Ornithological Society records. https://kentos.org.uk/	Kent Ornithological Society	2010 to 2020	Breeding season records for bird species within Swanscombe Peninsula.
	Biological Records Centre. Unpublished.	Kent & Medway Biological Records Centre	2010 to 2020	Breeding season records for bird species within Swanscombe Peninsula.
	BTO Heronries Census. https://www.bto.org/our-science/projects/heronries-census.	British Trust for Ornithology	2011 to 2020	Numbers of breeding pairs of heron species in the UK.
	BTO BirdTrack data.	British Trust for Ornithology	2015 to 2020	Breeding season records for bird species within Swanscombe Peninsula.
	Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 17: Birds. JNCC, Peterborough. https://data.jncc.gov.uk/data/16bd76ad-bb74-4724-9e06-5df02b459524/SSSI-Guidelines-17-Birds-2020revised-A.pdf	Drewitt, A. L., Whitehead, S. and Cohen, S.	2020	SSSI selection guidance for birds.

Feature	Data source	Author	Date	Content
	The London Resort Preliminary Environmental Information Report. Appendix 12.1 Ecology Baseline Report. https://londonresort.info/appendices/.	The Environmental Dimension Partnership Ltd	2020	Report on baseline ecology and important ecological features within Swanscombe Peninsula.
	Annex EDP 17 - breeding bird survey 2012. Chris Blandford Associates. **Annex EDP 18** – breeding bird survey 2015. Corylus Ecology. **Annex EDP 4** - breeding and passage bird surveys 2020. The Environmental Dimension Partnership Ltd. **Plans EDP 8, 9 & 10** – breeding bird survey mapped data for April, May and June 2020. The Environmental Dimension Partnership Ltd.			

2. Explanation of how Swanscombe Peninsula meets the SSSI selection guidelines

This section explains how the information listed in Section 1 has informed the decision to notify the SSSI, according to the *Guidelines for the selection of Biological SSSIs. Part 1: Rationale, Operational Approach and Criteria for Site Selection* (Bainbridge *et al.* 2013) and *Part 2: Detailed Guidelines for Habitats and Species Groups*, hereafter referred to as 'the Guidelines' and according to the selection guidelines listed in '*An Introduction to the Geological Conservation Review'* (Ellis et al. 1996).

2.1 Geology

The special geological interests at Bakers Hole were selected for inclusion in the Geological Conservation Review (GCR) of Great Britain and are described under 'Northfleet (Ebbsfleet valley): Baker's Hole Complex'. The GCR systematically assesses sites to identify key localities that aid the interpretation of the geological evolution of Great Britain. Each GCR site demonstrates a unique and/or representative feature of this geological evolution, and the relationship between sites is particularly important in building up a picture of landscape evolution and biological and environmental change over time.

All SSSIs with a geological interest have been assessed through the GCR process and sites described in the Review are eligible for selection on the basis of at least one of the following categories:

1. Sites of importance to the **international** community of Earth scientists.
2. Sites that are scientifically important because they contain **exceptional** features.
3. Sites that are nationally important because they are **representative** of an Earth science feature, event or process that is fundamental to Britain's Earth history.

Bakers Hole has been selected under category 3. It is a key Pleistocene site exposing a complex sequence of periglacial and temperate climate deposits associated with the Ebbsfleet Valley. The deposits have yielded palaeoenvironmental information including fossils of mammals, ostracods and molluscs in addition to Levallois artefacts from the Middle Palaeolithic. The site records the penultimate interglacial known as Marine Isotope Stage (MIS) 7. It is thought that the three temperate episodes from MIS 7 are all represented at Bakers Hole.

2.2 Vascular plants

Data from a range of surveys and sources has been collated to determine the qualifying plant species present at Swanscombe Peninsula SSSI. The surveys/data are as follows:

- Surveys undertaken in 2012, 2015 and 2020 as part of the Preliminary Environmental Report (PIER) for the London Resort.
- Botanical Society of Britain and Ireland (BSBI) records.

- Verified Record Centre data covering the Greater Thames Estuary NCA (1987-2020).
- Kent Botanical Recording Group records.

2.2.1 Nationally Scarce and Vulnerable Species

The Guidelines (Chapter 11, section 4.1.1, p8) state that:

> '*Restricted Range (GB or country-level Rare/Scarce[1]) threatened taxa qualifying as CR, EN or VU under IUCN criteria A, B, C and/or D, IUCN (2012a).* ***All*** *localities with sustainable populations should be considered for selection.'*

Populations of four vascular plant species listed as Nationally Scarce in Great Britain (and in one case in England) in the most recent national review (Stroh 2013) have been recorded at Swanscombe Peninsula SSSI. The upper threshold for Scarce status is 100 hectads in Great Britain (Perring & Farrell 1977, 1983). They are also assessed as Vulnerable (VU[2]) in Great Britain (Cheffings & Farrell 2005) and in some cases England (Stroh et al 2014) under IUCN criterion A2c.

The species are:

- Divided sedge *Carex divisa,* recorded post 1987 from 93 hectads – Nationally Scare (GB), IUCN Vulnerable (GB), Native. Also listed as a 'species of principal importance in England' under Section 41 of the Natural Environment and Rural Communities Act (2006).
- Yellow vetchling *Lathyrus aphaca*, recorded post 1987 from 62 hectads – Nationally Scarce (GB), IUCN Vulnerable (England and GB), Native or Alien.
- Slender hare's-ear *Bupleurum tenuissimum* recorded post 1987 from 69 hectads – Nationally Scarce (GB), IUCN Vulnerable (England and GB), Native. Also listed as a 'species of principal importance in England' under Section 41 of the Natural Environment and Rural Communities Act (2006).
- Bithynian vetch *Vicia bithynica* recorded post 1987 from 35 hectads – Nationally Scarce (England and GB), IUCN Vulnerable (England and GB), Native.

In addition to the selection criteria stated above, the Guidelines (Chapter 11, section 4, p7) provide the following guidance on sustainable populations:

> *'Sustainability is hard to define, and in many cases population size will have to serve as a 'proxy' measure of its sustainability – the assumption being that a large population is likely to be more 'sustainable' than a small one. Evidence of a population being long-established, whether through its long-recorded history or (in the case of long-lived perennial taxa) the presence of old plants along with cohorts of younger plants of different ages, will also be helpful in ascertaining its likely sustainability. Further supporting evidence could include observations of plants flowering and setting seed, the presence of seedlings and an understanding of seed bank viability. Evidence of long continuity of suitable habitat, and appropriate habitat management, may also be important.'*

An assessment of the sustainability of populations of the above four species within Swanscombe Peninsula SSSI is summarised in Table 1. The assessments take account of population size, continuity, mechanism of propagation, current location and supporting habitat. All are considered to be native to Kent.

[1] At the GB level Nationally Rare (NR) species are those occurring in 1 to 15 hectads. Nationally Scarce (NS) species are those occurring in 16 to 100 hectads.

[2] Vulnerable (VU) - IUCN Red List category where the best available evidence indicates that a species meets any of the criteria A to E and is therefore considered to be facing a high risk of extinction in the wild.

Table 1: Assessment of population sustainability.

Species	Population sustainability assessment
Divided sedge - *Carex divisa*	Small to medium population mainly on Botany Marsh but also recorded in Black Duck Marsh in 2016. This species has been consistently recorded at Swanscombe Peninsula SSSI since 1992 (BSBI database) and specifically in relict grazing marsh between 1995 (KMBRC) and 2020 (London Resort PEIR Annex EDP 1). Due to its perennial life cycle, continued presence in well-established coastal grassland, some of which is under active management as part of a Local Wildlife Site, the population at Swanscombe Peninsula SSSI is considered to be sustainable.
Yellow vetchling - *Lathyrus aphaca*	Large population estimated as thousands in 2015 mainly on grassland areas of Broadness and the sea wall corridor. Since then new populations have been found in the north east of the site and Botany Marsh. This species has been consistently recorded at Swanscombe Peninsula SSSI since 1991 (KMBRC, Kent Rare Plant Register, BSBI database). Populations in the Swanscombe area are regarded as native (BSBI database accessed Jan 2021). Due to its long established presence, habitat requirements and capacity to spread by seed the population at Swanscombe Peninsula SSSI is considered to be sustainable.
Slender hare's-ear - *Bupleurum tenuissimum*	Small – medium populations (>200 plants) were recorded in 2015 in trackways between Botany Marsh West and Broadness. Slender hare's-ear has been consistently recorded at Swanscombe Peninsula SSSI since 1995 (KMBRC, BSBI database). This species is very hard to identify when not in fruit (late summer and autumn). No records from the most recent survey in 2020 may be due to the timing of the survey. Experience from other Thames Estuary sites indicates that populations are persistent despite annual fluctuations and that this species readily takes advantage of suitable conditions created by targeted soil disturbance. On this basis, the population at Swanscombe Peninsula SSSI is considered to be sustainable.
Bithynian vetch - *Vicia bithynica*	Large population estimated as hundreds to thousands mainly on grassland areas of Broadness and the sea wall corridor. This species has been consistently recorded at Swanscombe Peninsula SSSI since 2012 (London Resort PEIR Annex EDP 13). Although it has an annual life cycle and will be subject to population fluctuations, experience on other sites within the Thames Estuary indicates that it will readily take advantage of suitable conditions. On this basis, the population at Swanscombe Peninsula SSSI is considered to be sustainable.

2.2.2 Nationally Scarce Species

The Guidelines (Chapter 11, section 4.4, p9) state that:

> *'A locality with a sustainable population of **one** GB or country-level Scarce taxon should be considered for selection if any of the following applies:*
>
> *4.4.1 In the case of a **GB** Scarce taxon, it is one of the **three** largest populations in GB.*

*4.4.2 In the case of either a **GB** or **country**-level Scarce taxon, it is the largest (or only) sustainable population within an AoS[3].'*

Two National Character Areas (NCAs[4]) define the Area of Search (AoS) for Swanscombe Peninsular SSSI. The majority of the SSSI falls within the Greater Thames Estuary NCA. The remainder, which includes Bamber pit, Craylands pit, Sports Field East Quarry, Bakers Hole and a strip of land between the Channel Tunnel Rail Link and Stanhope Road, lies within the North Kent Plain NCA.

Within GB the Nationally Scarce round-leaved wintergreen *Pyrola rotundifolia* subsp. *maritima* has been recorded in 23 hectads (Stroh 2013). There are eleven records for this subspecies within the Greater Thames Estuary and North Kent Plain NCAs. Table 2 compares these records and confirms that Swanscombe Peninsula SSSI supports the largest known population within the Area of Search.

Table 2. Records of round-leaved wintergreen subsp. *maritima* within the Greater Thames Estuary and North Kent Plain NCAs.

Site	Date	Records
Swanscombe Peninsula SSSI	1991	KMBRC[5] - location confirmed. No population details.
	1991-99	Kent Rare Plant Register - location confirmed. No population details.
	1999	BSBI database – location confirmed. No population details.
	2014	BSBI database & KMBRC – several loosely associated groups of 16, 18 and 10 flowering spikes.
	2015	BSBI database & KMBRC – flowering and flowered plants spread over several metres.
	2020	London Resort Holdings Ltd survey – single population covering 3 square metres.
West Kent	1970-86	BSBI database – location confirmed. No population details.
Otterham Quay	1991	KMBRC - location confirmed. No population details.
	1999	BSBI - location confirmed. No population details.
Stone/Atlas Stone pit	1991	KMBRC - location confirmed. No population details.
Hectad TQ57	1992	GIGL[6] - location confirmed. No population details.

Taking account of the population size, location, supporting habitat and that this subspecies is perennial the population is considered to be sustainable. It is therefore selected under section 4.4.2 of the Guidelines, as the largest sustainable population of a Nationally Scarce species within the Area of Search.

2.3 Invertebrates

Species data from surveys carried out in 2012 (Chris Blandford Associates) and 2015 (Edwards Ecological Services Limited and Aquatic Survey & Environmental Data Analyses) has been imported into Pantheon. Further surveys commissioned by London Resort Company Holdings Limited were carried out in 2020. Although the detailed data from the 2020 surveys has not been made available to Natural England, a summary report and Pantheon analysis is provided within the

[3] To provide a good representation of the range and diversity of "best example" sites across Great Britain, SSSI selection has been carried out since 1979 on a basis which subdivides Britain into a number of geographical units. These are called "Areas of Search" (AoS)". In England AoS are defined as National Character Areas (NCAs).

[4] National Character Areas (NCAs) divide England into 159 natural areas, each defined by a unique combination of landscape, biodiversity, geodiversity and economic and cultural activity. For more information on NCA's see https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making.

[5] Kent and Medway Biological Record Centre.

[6] Greenspace Information for Greater London.

London Resort Development Consent Order Environmental Statement. The results of the 2020 surveys are consistent with those from 2012 and 2015.

Pantheon is a database tool developed by Natural England and the Centre for Ecology & Hydrology which analyses survey data for invertebrates. Pantheon determines associated habitats, assemblage types and conservation status. This information can be used to determine site quality (Heaver *et al.* 2017). Quality has primarily been assessed on the basis of species numbers, diversity and rarity. Quality can also be summarised using the species quality index[7] (SQI) for the site.

The Guidelines (Chapter 20, section 3, p7) state that:

> '*Ideally, site selection for species and assemblages should be based on stable populations that have been resident for at least three years*. *However, since many threatened species are experiencing severe declines this approach should be used as a guideline only and there may be ample justification for the selection of species and assemblages in unfavourable condition'.*

The assessments in sections 2.3.1 to 2.3.4 are based on two sets of survey data which are three years apart.

There are four principal invertebrate assemblages present at Swanscombe Peninsula SSSI. Two are present within brownfield habitat and the remaining two within wetland and saltmarsh.

2.3.1 Brownfield habitat invertebrate assemblages.

The Guidelines (Chapter 20, section 3.10, p9) state that:

> *'All sites that support assemblages which are of either national or international importance should be selected.*
>
> *Sites with assemblages which, because of the nature of the supporting habitat, are scarce and/or poorly represented within the biological SSSI series may all be selected within the AoS. The species within the assemblages may be few, and may show high site fidelity. This would include cave and mine faunas, faunas of aquifers, metalliferous and chemically rich sites, including those of* ***post-industrial origin****. These will always be rare within the SSSI series in the UK'.*

Brownfield habitat, in particular 'open mosaic habitat on previously developed land'[8], is poorly represented within the biological SSSI series. The Guidelines (Chapter 20, section 3.10, p10) state that:

> *'Habitat-based assemblages that should be represented in the series are:*
>
> - *those whose quality is high when compared to similar sites in the same geographical area or AoS'.*

The assemblages present within brownfield areas at Swanscombe Peninsula SSSI are bare sand and chalk (F111) and open short swards (F112). Table 3 compares Swanscombe Peninsula SSSI with other known brownfield sites within the Greater Thames Estuary NCA (see map at Annex 2 for site locations). For all assessments in section 2.3 there are no known comparable sites within the North Kent Plain NCA. Swanscombe Peninsula SSSI supports the highest numbers of F111, F112 and S41[9] species within the NCA with the exception of Canvey Wick SSSI, which is very rich in F111 species. To give an indication of pollen and nectar resource Table 3 also includes figures for F002 species. Swanscombe Peninsula SSSI supports the highest number of F002 species within the NCA. This assemblage is not recommended for notification because its species are constituents of several assemblages.

[7] Species Quality index (SQI). A measure of the number of rare species in a sample. Scores are based on summed rarity values divided by the total number of species in the sample.
[8] A habitat of principal importance in Section 41 of the Natural Environment and Rural Communities Act (2006). https://data.jncc.gov.uk/data/a81bf2a7-b637-4497-a8be-03bd50d4290d/UKBAP-BAPHabitats-40-OMH-2010.pdf.
[9] S41 – 'species of principal importance for the conservation of biodiversity in England' under Section 41 of the Natural Environment and Rural Communities Act (2006).

Table 3: **Comparison of brownfield invertebrate assemblage sites within the Greater Thames Estuary NCA.**

Map Ref No	Site	No of species in sample[10]	Number of species[11]				SQI
			F111	F112	F002	S41	
1	Swanscombe Peninsula SSSI	1755	**61**	**52**	110	9	146
2	Canvey Wick SSSI[12]	1502	61	25	61	10	150
3	Mucking to Thurrock Thameside Nature Park	988	43	30	53	10	145
4	West Thurrock PFA lagoons	934	55	25	65	9	159
5	Isle of Grain	1149	32	14	58	9	146
6	Ashfield1, Tilbury[13]	590	36	17	43	8	158
7	Cory's Wharf, Purfleet	620	29	19	58	6	140
8	Vopak, Oliver Rd, Thurrock	595	25	18	37	6	131
9	Oikos Marine	410	13	15	37	4	138
10	Northwick Road, Canvey	368	11	23	5	1	132
11	Stanhope-Ex Fisons	183	7	3	47	3	119

2.3.2 Wetland habitat invertebrate assemblage.

Wetland areas at Swanscombe Peninsula SSSI include Black Duck Marsh, Botany Marsh and the Channel Tunnel Rail Link (CTRL) ponds. The brownfields of the Greater Thames Estuary are generally free draining. Where standing water is present it is usually small in extent and either saline or of very low quality. Swanscombe Peninsula SSSI, the Isle of Grain and Inner Thames Marshes SSSI are the only sites within the Greater Thames Estuary NCA which are known to support a high quality wetland assemblage adjacent to brownfield assemblages. The aquatic community present at these sites is associated with the open water on disturbed mineral sediments (W211) assemblage. Table 4 compares the three sites. All three sites support a wetland W211 assemblage of high quality and are regarded as complementary. Swanscombe Peninsula supports larger areas of more diverse wetland habitat whilst the Isle of Grain's much smaller wetlands demonstrate a more pronounced gradation from freshwater to brackish conditions. The Inner Thames Marshes SSSI differs from these two sites. It is predominantly grazing marsh but also includes brownfield silt lagoons. Swanscombe Peninsula SSSI therefore meets the selection criteria for this invertebrate assemblage as it supports a high quality assemblage when compared to other sites within the NCA.

Table 4: **Comparison of brownfield wetland within the Greater Thames Estuary NCA.**

Site	Total No of aquatic species	No of W211 species	No of species with conservation status	SQI
Isle of Grain	143	14	1 [Na][i]; 1 Nb[i]; 3 NR[ii]; 20 NS[ii]; 124 LC[iii]; 3 NT[iv]	164
Swanscombe Peninsula SSSI	145	13	1 NR; 15 NS; 112 LC; 2 NT	146
Inner Thames Marshes SSSI	174	11	1 [Nb]; 1 Nb; 1 NR; 18 NS; 1 RDB K[v], DD[vi]; 121 LC; 4 NT	142

N.B. Many species retain their historic assessments as their status has not been reviewed. These species are bracketed [ ].

[10] Sample refers to a group of species records. In this case data from all surveys carried out in 2012 and 2015 with duplicates removed.
[11] Figures are for the number of species in each assemblage.
[12] Data from Natural England CSM survey.
[13] Data from Pantheon public database sample.

2.3.3 Saltmarsh habitat invertebrate assemblage.

Saltmarsh is known to be present on only two brownfield sites, Swanscombe Peninsula SSSI and Mucking Flats & Marshes SSSI, within the Greater Thames Estuary NCA. The assemblage present within saltmarsh areas at Swanscombe Peninsula SSSI is associated with saltmarsh and transitional brackish marsh (M311). Many of the saltmarsh systems within the NCA support generic saltmarsh invertebrate communities which have a low M311 representation. The exception to this is Foulness SSSI which at 10,946ha is large and very rich in M311 species.

Table 5 compares Swanscombe Peninsula SSSI with saltmarsh SSSIs within the Greater Thames Estuary NCA (see map at Annex 3 for site locations). Each site has been analysed for M311 assemblage representation. It confirms that Swanscombe Peninsula SSSI supports the joint second highest number of M311 taxa and joint highest number of S41 species when compared with other brownfield and saltmarsh sites in the NCA. The high species count at West Thurrock PFA lagoons is a result of the very saline character of the pulverised fly ashfields.

Table 5: **Comparison of brownfield and saltmarsh sites within the Greater Thames Estuary NCA supporting a saltmarsh and transitional brackish marsh (M311) invertebrate assemblage.**

Map Ref No	Site	No of M311 species	No of S41 species with high saltmarsh fidelity
1	Swanscombe Peninsula SSSI	13	3
2	Foulness SSSI	39	3
3	West Thurrock PFA lagoons	13	2
4	South Thames Estuary & Marshes SSSI[14]	9	0
5	Mucking Flats & Marshes SSSI	8	1
6	Isle of Grain	7	0
7	Crouch & Roach Estuary SSSI[14]	6	0
8	The Swale SSSI[14]	6	0
9	Blackwater Estuary SSSI[14]	5	0
10	Colne Estuary SSSI[14]	5	0
11	Benfleet & Southend Marshes SSSI	1	0
12	Inner Thames Marshes SSSI	No data	1
13	Pitsea Marsh SSSI[14]	0	0
14	Medway Estuary & Marshes SSSI[14]	No data	0

2.3.4 Representation of international, nationally threatened, rare, scarce and S41 species

The guidelines make provision for the selection of SSSIs which support international site features, nationally threatened, nationally rare/scarce and S41 species. The invertebrate surveys listed in Section 1 recorded 1755 species of invertebrate at Swanscombe Peninsula SSSI. Of these 208 species have a recorded conservation status (see Annex 4). No Annex II species were recorded. Table 6 lists the number of species recorded in the most significant conservation status categories. It should be noted that the conservation status of some species is still under review and/or provisional. Also, that some species will have more than one conservation status.

Table 6: Number of species recorded at Swanscombe Peninsula SSSI in each conservation status category.

Conservation Status	No of species
Critically Endangered (CR[vii]) - *Sitticus distinguendus*, distinguished jumping spider.	1
Endangered (EN[viii]) - *Praestigia duffeyi*, Duffey's bell-head spider.	1
Near Threatened (NT) - *Arctosa fulvolineata*, yellow-striped bear-spider.	9
Nationally Rare	4
Nationally Scarce	168

[14] Data from CSM assessment – 2009.

Conservation Status	No of species
Section 41 Priority Species	12
Section 41 Priority Species - research only	4
Red Data Book 1 species[ix]	3
Red Data Book 2 species[x]	3
Red Data Book 3 Species[xi]	17
Red Data Book K Species	4
Endangered (EN) European	1

The Guidelines (Chapter 20, cover note, p2) state that:

> *'the 'Species assemblage' sub-section has been extensively re-written to reflect our current knowledge of invertebrate assemblages and the move to notifying habitat-based assemblages of invertebrates'.*

In the case of individual species recorded at Swanscombe Peninsula SSSI it is considered that they are best conserved as part of an appropriate, habitat-based invertebrate assemblage. The critically endangered distinguished jumping spider forms part of the F111 assemblage and the endangered Duffey's bell-head spider forms part of the M311 assemblage.

2.4 Assemblages of breeding bird species

The Guidelines (Chapter 17, section 3.8, p5) state that:

> *'Localities which support an especially good range of bird species characteristic of a particular habitat as defined by an index value, will qualify for SSSI selection'*.

Data from a range of surveys and sources has been collated to determine the qualifying breeding bird assemblages present at Swanscombe Peninsula SSSI. The surveys/data are as follows:

- Common bird census (CBC) surveys undertaken in 2012, 2015 and 2020 as part of the Preliminary Environmental Report (PIER) for the London Resort.
- BTO Heronries census 2011-2020.
- Kent Ornithological Society records (2010 and 2020).
- BTO BirdTrack data (2015-2020).
- Verified Kent Record Centre data for Swanscombe Peninsula (2010-2020).

To satisfy the SSSI selection guidelines it is necessary to establish at least probable breeding for each species contributing to the assemblage index value. The breeding status of each species has been established using BTO protocols.

The Swanscombe Peninsula SSSI meets the qualifying threshold values for four breeding bird assemblages. These are:

- Lowland fen (without open water).
- Lowland damp grassland.
- Lowland open waters and their margins.
- Lowland scrub (excluding heath).

Annex 1 of the Guidelines (Chapter 17, p10) states that:

> *'Although the general habitat categories are broad it is recognised that many bird species depend on a combination of habitats and that such habitats might exist within one site. Two approaches are possible:*
>
> *i. 'if one (or more) of the composite habitats reaches the threshold value for that habitat, the whole site may be selected if the other habitats clearly form integral parts of the site;*

ii. if two habitats are included in one well-defined site, the indices for species which are on both habitat lists and have been recorded for the site should be double-counted; other species score in the usual way; for the site to qualify on this basis, its total score should exceed the qualifying threshold value for the two habitats combined'.

At Swanscombe Peninsula SSSI lowland fen, damp grassland and open water habitats are present in a mosaic. Many of the breeding bird species recorded at the site depend on a combination of habitats and are represented across all three assemblages. Although each of these assemblages qualifies in its own right, as shown in Table 7, it is appropriate to present them as a mixed habitat assemblage.

Table 7: Mixed habitat assemblage score - lowland open waters and their margins, lowland fen (without open water) and lowland damp grassland.

Species	Species Score	Lowland open waters and their margins	Lowland Fen (without open water)	Lowland damp grassland	Mixed habitat assemblage score
Greylag goose	2	Y			2
Water rail	3	Y	Y		6
Mute swan	3	Y		Y	6
Shelduck	3	Y		Y	6
Gadwall	3	Y		Y	6
Shoveler	3	Y		Y	6
Pochard	4	Y		Y	8
Tufted duck	2	Y			2
Cuckoo	2.5	Y	Y	Y	7.5
Little egret	3	Y		Y	6
Bearded tit	4	Y	Y		8
Grey heron	3	Y	Y	Y	9
Cettis warbler	3	Y	Y		6
Grasshopper warbler	3	Y	Y	Y	9
Little grebe	3	Y			3
Sedge warbler	1	Y	Y	Y	3
Reed warbler	1	Y	Y		2
Marsh harrier	4	Y	Y	Y	12
Reed bunting	1	Y	Y	Y	3
Lapwing	2			Y	2
Total site score		**51.5**	**25.5**	**35.5**	**112.5**
Guideline threshold score		47	16	25	88

The fourth breeding bird assemblage is lowland scrub (excluding heath) which occupies some distinct parts of the site including the chalk pits. Table 8 summarises the score for and species which contribute to this assemblage.

Table 8: Lowland scrub (excluding heath) assemblage score.

Species	Species score
Grasshopper Warbler	3
Cuckoo	2.5
Nightingale	3
Linnet	1
Long-tailed tit	1
Bullfinch	1
Garden warbler	1
Lesser whitethroat	2
Total site score	**14.5**
Guideline threshold score	14.5

2.5 Site boundary determination

The Guidelines (Part 1, section 8.2, p.34) state that:

> '*SSSI boundaries should be drawn to encompass the special features of the site and all land necessary to ensure the sustainability of those features. Consideration should be given to the inclusion of whole management units, entire ecological units and supporting processes (such as hydrology or sediment supply). Boundaries should take account of dynamic processes (such as active coastal and floodplain geomorphology*)'.

And that (Part 1, section 8.10, p.37):

> '*The lower or seaward boundaries of SSSIs should normally extend to the extent of the local authority planning area. This varies between countries. In England it is normally to Mean Low Water Mark (MLWM*).

In order to maintain the saltmarsh which supports a nationally important invertebrate assemblage and include feeding habitat for breeding birds the boundary of Swanscombe Peninsula SSSI has been drawn to Mean Low Water Mark at its northern perimeter. Consideration of the boundary rationale for features which have had greatest influence in determining the extent of the SSSI is set out below.

2.5.1 Vascular Plants

The guidelines (Part 2, Chapter 11, section 5.1, p13) state that:

> *'The SSSI boundary should include a sufficient area of suitable habitat to enable the longterm maintenance of populations of taxa qualifying either as notified features in their own right or as parts of a species assemblage or Taxonomically Complex Group (sections 4.12 and 4.13). Populations are frequently dynamic, with individuals colonising new patches of suitable habitat whilst others may be lost due to natural change in habitat condition, etc. Therefore, patches of suitable (or potentially suitable) habitat within the same management unit that do not currently support the qualifying taxon should still be included within the SSSI boundary. Areas of suitable habitat nearby should also be considered for inclusion, especially if the habitat is particularly rare or unusual (such as heavy metal contaminated ground and mine spoil), or if the taxon in question is known to be opportunistic or highly mobile, thus allowing appropriate management to be applied across a wider area to provide additional opportunities for the spread of rare or threatened taxa. For some taxa in certain habitats the SSSI boundary may have to include quite large areas which lack the taxon but which are ecologically and functionally part of the same site'.*

2.5.2 Invertebrates

The guidelines (Part 2, Chapter 20, section 4.2) provide guidance on the types of habitat that are valuable for invertebrates and should be considered for inclusion within the boundary as follows:

Habitat Type	Habitat patches for consideration of inclusion in SSSI boundaries
Grassland and Heathland	Adjoining scrub, woodland, tall ruderal and wetland systems, old sand and marl pits.
Wetlands and pools	The catchment as a whole, connections with river systems, muddy areas, accumulations of leaf litter, and trees (e.g. willow clumps).
Coastal habitats	Connections with all other habitats (e.g. the ecotones between saltmarsh and heathland/grassland or with freshwater wetlands, the ecotones between beach and dune etc. Also, the interconnectivity of different coastal habitats (such as saltmarsh and intertidal sediment).

Using the above guidance the boundary has been drawn to include a mosaic of free-draining grassland, scrub, wetlands, grazing marsh, transitional grassland, saltmarsh and chalk pits which collectively support and will maintain the nationally important vascular plant, invertebrate and bird features of special interest.

3. Current condition of Swanscombe Peninsula SSSI

The current condition of features within Swanscombe Peninsula SSSI is summarised in Table 9.

Table 9. Current condition of Swanscombe Peninsula SSSI

Interest feature	Reported condition*	Date assessed
Invertebrate assemblage F111 – bare sand and chalk	Favourable	February 2021
Invertebrate assemblage F112 – open short sward	Favourable	February 2021
Invertebrate assemblage W211 – open water on disturbed mineral sediments	Favourable	February 2021
Invertebrate assemblage M311 – saltmarsh & transitional brackish marsh	Favourable	February 2021
Mixed breeding bird assemblage of lowland open waters and their margins, lowland fen (without open water) and lowland damp grassland	Favourable	February 2021
Breeding bird assemblage of lowland scrub	Favourable	February 2021
Divided sedge *Carex divisa*	Favourable	February 2021
Yellow vetchling *Lathyrus aphaca*	Favourable	February 2021
Slender hare's-ear *Bupleurum tenuissimum*	Favourable	February 2021
Bithynian vetch *Vicia bithynica*	Favourable	February 2021
Round-leaved wintergreen *Pyrola rotundifolia* subsp. *maritima*	Favourable	February 2021
Quaternary geology of the Thames	Unfavourable no change	February 2021

***Reported condition**. SSSIs are notified because they support special biological or geological features. When these features are being managed so that their special nature conservation interest is being maintained they are said to be in favourable condition. This is a United Kingdom standard and the terminology and definitions are more fully described in 'A Statement on Common Standards for Monitoring Protected Sites' produced by the JNCC in 2019.

3.1 Reasons for unfavourable condition

The sediments at Bakers Hole are shallow, finite and fragile, and are therefore vulnerable. Damage has occurred to some key horizons due to vegetation growth, animal burrowing and potentially decalcification as samples taken in 2015, funded by Historic England's Heritage at Risk Programme, showed a lower prevalence of fossils compared to those taken in 1969 and 1993/94. Part of the site has also suffered from collapsing archaeological trenches which were infilled in 2015 by the landowner, supported by a grant from Historic England's Heritage at Risk Programme.

Vegetation control took place up to 2019. Although the site has been stabilised in the short term, management arrangements have now expired. Vegetation continues to grow, and the long term physical and chemical stability of the sediments needs to be investigated further and secured.

Part of the site on the eastern boundary comprising former allotments/waste ground has been covered by the CTRL car park. Although not accessible the special interest in this area is still present. A management plan taking account of the above issues for the medium to long term is now required to return the site to favourable condition.

4. Selection of 'Operations Requiring Natural England's Consent'

Natural England selects operations from a master list when determining the list of operations requiring consent for individual SSSIs. The selection is based on the likelihood that the operations may cause damage to the special features that are the reasons for notification of the SSSI. As well

as selecting operations from the master list, the precise wording of each operation may be tailored to suit the particular circumstances at the site.

It is not possible to predict every possible eventuality that may arise on a site but the aim is to identify all operations where it is reasonably foreseeable that, if carried out at certain times or in a particular manner somewhere within the SSSI, they are likely to damage the special interest features. The table below records at least one reason justifying the inclusion of each operation in the list for Swanscombe Peninsula SSSI. It is not intended to be exhaustive and, in most cases, there will be other ways in which the specified operation is likely to cause damage.

Standard reference number	Type of operation	At least one reason for listing
1.	Cultivation, including ploughing, rotovating, harrowing and re-seeding.	Could directly impact on populations of vascular plant features and adversely impact on supporting habitats for invertebrate assemblages and breeding birds. Could cause direct damage to or destruction of geological features.
2.	Grazing and alterations to the grazing regime (including type of stock, intensity or seasonal pattern of grazing).	Grazing is acceptable in areas of the grazing marsh but inappropriate grazing management could directly impact on breeding bird habitat and vascular plant features. The introduction of grazing to currently ungrazed areas could directly impact on low-nutrient habitats supporting invertebrate and vascular plant features and fen/marginal vegetation that is important for breeding birds.
3.	Stock feeding and alterations to stock feeding practice.	Could lead to localised nutrient enrichment or poaching and damage to supporting habitats for vascular plant features and assemblages of invertebrates and breeding birds.
4.	Mowing or cutting vegetation and alterations to the mowing or cutting regime (such as from haymaking to silage).	Could directly impact on populations of vascular plant features and adversely impact on supporting habitats for invertebrate assemblage and breeding birds.
5.	Application of manure, slurry, silage liquor, fertilisers and lime.	Could lead to a detrimental increase in nutrient levels in habitats e.g. grasslands and wetlands, supporting vascular plant features, and assemblages of invertebrates and breeding birds.
6.	Application of pesticides, including herbicides (weedkillers) whether terrestrial or aquatic, and veterinary products.	Could directly impact on populations of vascular plant features and lead to damage to habitats supporting invertebrate assemblages and breeding birds. Could also impact on wetland vegetation and contaminate water bodies risking disruption of food chains for water birds.

Standard reference number	Type of operation	At least one reason for listing
7.	Dumping, spreading or discharging of any materials.	Could directly impact on populations of vascular plant features and adversely impact on supporting habitats for invertebrate assemblages and breeding birds. Risk of obscuring the geological features and access for study.
8.	Burning.	Could directly impact on populations of vascular plant features and adversely impact on supporting habitats for invertebrate assemblage and breeding birds.
9.	Release into the site of any wild, feral, captive-bred or domestic animal, plant, seed or micro-organism (including genetically modified organisms).	Could lead to unforeseen interactions with vascular plant features or impacts on supporting habitats for invertebrate assemblages and breeding birds e.g. effects on indigenous species and changes in community composition.
10.	Killing, injuring, taking or removal of any wild animal (including dead animals or parts thereof), or their eggs and nests, including pest control and disturbing them in their places of shelter.	Death or disturbance of key breeding bird species and incidental damage to supporting habitats.
11.	Destruction, displacement, removal or cutting of any plant or plant remains, including tree, shrub, herb, hedge, dead or decaying wood, moss, lichen, fungal fruiting bodies, leaf-mould and turf.	Direct and indirect impact on populations of vascular plant features and incidental damage to habitats supporting invertebrate assemblages and breeding birds.
12.	Tree and/or woodland management and alterations to tree and/or woodland management (including, planting, felling, pruning and tree surgery, thinning, coppicing, changes in species composition, removal of fallen timber).	Could directly impact on breeding birds and cause incidental damage to their supporting habitat. Vegetation obscures the geological features of interest and hinders access for study. Tree roots can damage geological features and management operations may damage or obscure exposed and near-surface geological features.
13a.	Draining (including the use of mole, tile, tunnel or other artificial drains).	Direct damage to vascular plant features and habitats supporting invertebrate assemblages and breeding birds. Changes in drainage are most likely to impact on the wetland habitats such as grazing marsh and wetlands but could also impact on grasslands and scrub.
13b.	Modification to the structure of water courses (ditches and drains), including their banks and beds, as by re-alignment, regrading, damming or dredging.	Risk of incidental damage to and direct loss of marginal vegetation and wetland habitats.

Standard reference number	Type of operation	At least one reason for listing
13c.	Management of aquatic and bank vegetation for drainage purposes.	Risk of incidental damage to and direct loss of marginal vegetation and impacts to habitats supporting vascular plant features and invertebrate assemblages through inappropriate deposition of cut/dredged material.
14.	Alterations to water levels and tables and water utilisation (including irrigation, storage and abstraction from existing water bodies and through boreholes). Also the modification of current drainage operations.	Could impact directly on invertebrate assemblages and supporting habitat (including food chains) for breeding birds. Direct impact on fen, marginal vegetation and grazing marsh in the immediate vicinity. Could cause direct damage to or destruction of geological features.
15.	Infilling or digging of ditches, drains, ponds, pools, marshes or pits.	Direct and indirect damage to habitats supporting vascular plant features, invertebrate assemblages and breeding birds. Could increase erosion of the geological features. Could also cause direct damage or destruction of geological features.
16a	Freshwater fishery production and/or management, including sporting fishing and angling and alterations to freshwater fishery production and/or management.	Increased fish stocking changing fishery type from e.g. coarse to specimen carp, can have a marked adverse effect on aquatic vegetation and water quality, directly impacting on invertebrate assemblages and indirectly on wetland habitats supporting breeding birds. Fishing activities could directly impact on breeding birds and habitats supporting breeding birds.
16b.	Coastal fishing, fisheries management and seafood or marine life collection, including the use of traps or fish cages and alterations to coastal fishing practice or fisheries management and seafood or marine life collection.	Fishing activities could impact on habitats supporting breeding birds and invertebrate assemblages.
17.	Reclamation of land from sea, estuary or marsh.	Direct and indirect impact to vascular plant features and invertebrate assemblages, and habitats supporting these features and breeding bird assemblages.
18.	Bait digging in intertidal areas	Could directly impact on habitats supporting breeding birds and invertebrate assemblages e.g. habitat loss and increasing erosion. Risk of disturbance to breeding birds in the feeding habitats.

Standard reference number	Type of operation	At least one reason for listing
19.	Erection and repair of sea defences or coastal protection works.	Could directly and indirectly impact on habitats supporting breeding birds and invertebrate assemblages e.g. habitat loss, smothering, increasing erosion.
20.	Extraction of minerals including topsoil, subsoil, chalk, sand, gravel and spoil.	Extraction from inappropriate locations within the SSSI could directly impact the interest features and the habitats supporting them. Could cause direct damage to or destruction of geological features.
21.	Destruction, construction, removal, rerouting, or regrading of roads, tracks, walls, fences, hardstands, banks, ditches or other earthworks, including soil and soft rock exposures or the laying, maintenance or removal of pipelines and cables, above or below ground.	Direct loss or incidental damage to habitats supporting vascular plant features, invertebrate assemblages and breeding birds. Increase in disturbance levels for breeding birds. Could cause direct damage or destruction of geological features.
22.	Storage of materials.	Direct impact e.g. smothering or incidental damage e.g. pollution, increased disturbance to habitats supporting vascular plant features, invertebrate assemblages and breeding birds. Risk of obscuring or damaging geological features of interest or impeding access to the features.
23.	Erection of permanent or temporary structures or the undertaking of engineering works, including drilling.	Direct impact e.g. excavation, smothering or incidental damage e.g. pollution, increased disturbance to habitats supporting vascular plant features, invertebrate assemblages and breeding birds. Risk of obscuring or damaging geological features of interest or impeding access to the features.
24a.	Modification of natural or man-made features and clearance of boulders, large stones, loose rock or spoil.	Direct loss of or incidental damage to important geological features. Loss of resource for study, education and amenity.
24b.	Battering, buttressing, grading or seeding of geological exposures (spoil and soil) and infilling of pits and quarries.	Direct loss of or damage to important geological features. Loss of resource.
25.	Removal of geological specimens including rock samples, minerals and fossils.	Direct loss of and/or damage to geological and/or archaeological features.
26.	Use of vehicles or craft.	Could directly and indirectly impact vascular plant features and habitats supporting invertebrate assemblages and breeding birds e.g. habitat loss or degradation and disturbance of breeding birds.

Standard reference number	Type of operation	At least one reason for listing
27.	Recreational or other activities likely to damage or disturb the features of special interest.	Activities could impact directly and indirectly on vascular plant features and habitats supporting breeding birds and invertebrate assemblages e.g. habitat loss or degradation and disturbance of breeding birds. Could cause direct damage to or destruction of geological features.
28a.	Game and waterfowl management and hunting practices and alterations to game and waterfowl management and hunting practice.	Disturbance and killing of breeding birds.
28b.	Use of lead shot.	Some breeding birds are vulnerable to lead poisoning through accidental ingestion with grit or secondary ingestion by predatory and scavenging species.

5. Photographs

Photograph 1: Aerial view of Swanscombe Peninsula SSSI

Photograph 2: *Sitticus distinguendus*, distinguished jumping spider (F111 assemblage). Photo courtesy of Ian Hughes

Photograph 3: *Scotopteryx bipunctaria* Chalk Carpet Moth (F112 assemblage). Photo courtesy of Butterfly Conservation/Stuart Reed.

Photograph 4: Area B of the Baker's Hole SSSI following scrub and tree clearance. 2014

Photograph 5: Trench 1, Area B of the Baker's Hole SSSI re-examined in 2014.

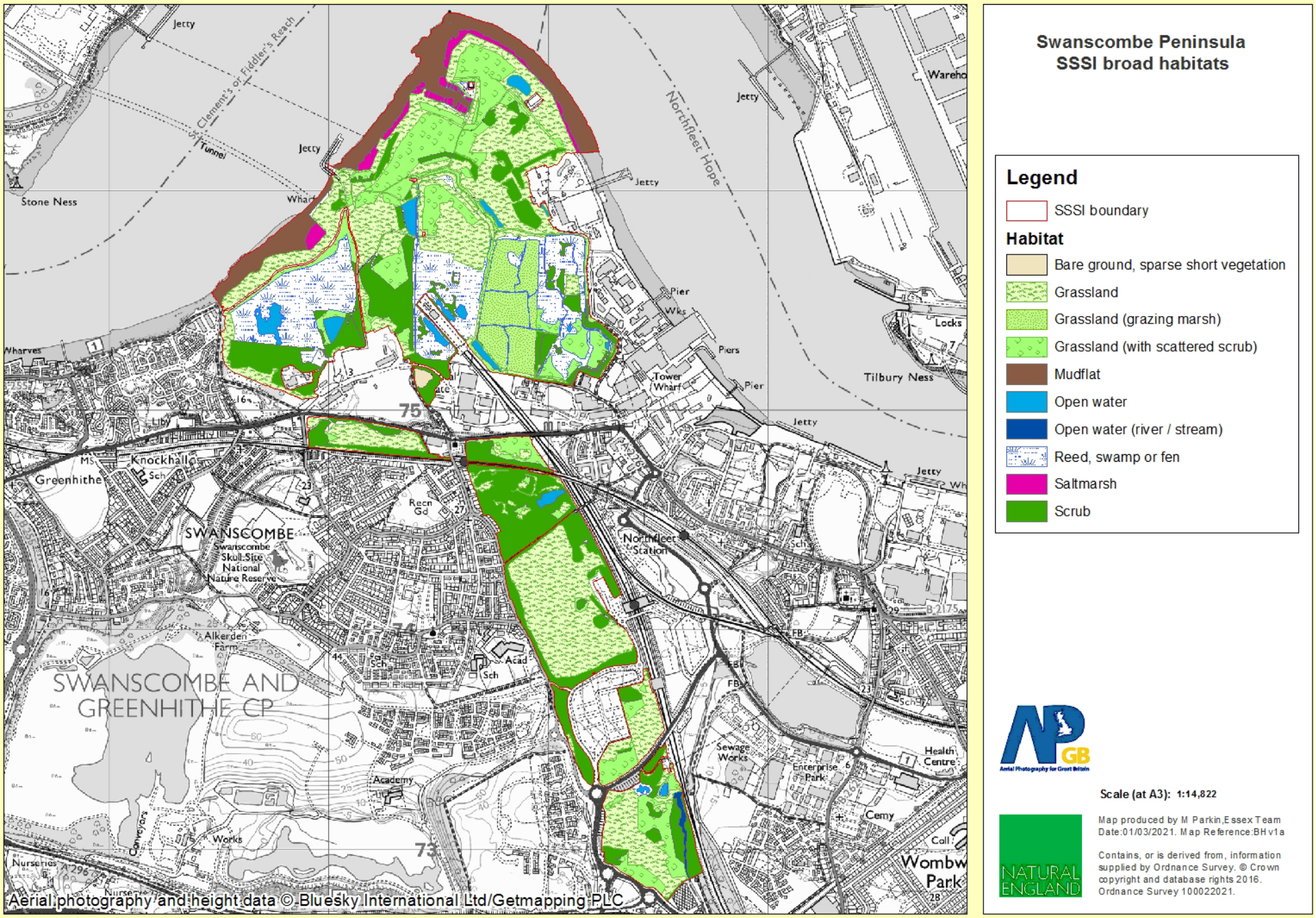
Photograph 6: Yellow vetchling *Lathyrus aphaca*. Photograph courtesy of John Martin.

Photograph 7: *Round-leaved wintergreen Pyrola rotundifolia subsp. maritima.* Photograph courtesy of John Martin.

Photograph 8: Divided sedge *Carex divisa.*
Photograph courtesy of John Martin.

Photograph 9: Bithynian vetch *Vicia bithynica.*
Photograph courtesy of John Martin.

Annex 1: Habitat Map



Annex 2: Map showing location of comparison sites listed in Table 3.

Table 3 - Brownfield sites within NCA Greater Thames Estuary

Key

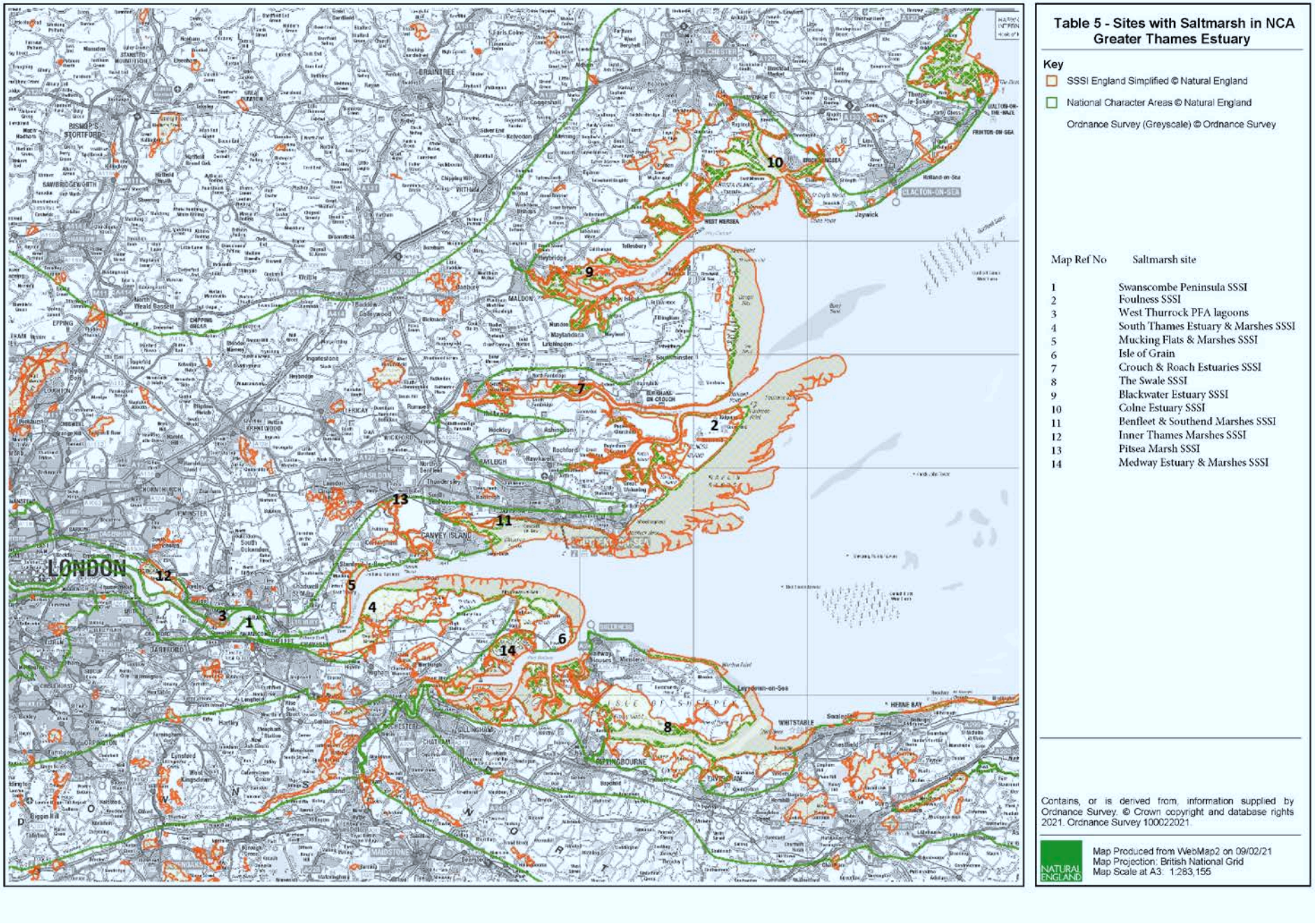
- SSSI England Simplified © Natural England
- National Character Areas © Natural England

Ordnance Survey (Greyscale) © Ordnance Survey

Map Ref No.	Brownfield site
1	Swanscombe Peninsula SSSI
2	Canvey Wick SSSI
3	Mucking to Thurrock Thameside Nature Pk
4	West Thurrock PFA lagoons
5	Isle of Grain
6	Ashfield 1 Tilbury
7	Cory's Wharf, Purfleet
8	Vopak Oliver Rd Thurrock
9	Oikos Marine nr Canvey Wick SSSI
10	Northwick Rd, Canvey
11	Stanhope-ex Fisons

Map Produced from WebMap2 on 09/02/21
Map Projection: British National Grid
Map Scale at A3: 1:141,578

Annex 3: Map showing location of comparison sites listed in Table 5.



Annex 4: List of invertebrate Species with Conservation Status recorded at Swanscombe Peninsula SSSI.

Species	Order	Conservation status
Empis woodi	Diptera	pNS
Anthribus fasciatus	Coleoptera	[Na]
Catapion curtisii	Coleoptera	[Na]
Squamapion cineraceum	Coleoptera	[Na]
Cathormiocerus spinosus	Coleoptera	[Na]
Polydrusus formosus	Coleoptera	[Na]
Andrena labiata	Hymenoptera	[Na]
Andrena minutuloides	Hymenoptera	[Na]
Andrena tibialis	Hymenoptera	[Na]
Nomada fucata	Hymenoptera	[Na]
Colletes marginatus	Hymenoptera	[Na]
Hylaeus cornutus	Hymenoptera	[Na]
Crossocerus distinguendus	Hymenoptera	[Na]
Lasioglossum pauxillum	Hymenoptera	[Na]
Sphecodes longulus	Hymenoptera	[Na]
Sphecodes reticulatus	Hymenoptera	[Na]
Sphecodes rubicundus	Hymenoptera	[Na]
Aporus unicolor	Hymenoptera	[Na]
Colletes halophilus	Hymenoptera	[Na]; Section 41 Priority Species
Odynerus melanocephalus	Hymenoptera	[Na]; Section 41 Priority Species
Oxystoma cerdo	Coleoptera	[Nb]
Hippodamia variegata	Coleoptera	[Nb]
Hypera meles	Coleoptera	[Nb]
Microplontus campestris	Coleoptera	[Nb]
Orthochaetes setiger	Coleoptera	[Nb]
Phyllobius vespertinus	Coleoptera	[Nb]
Rhinocyllus conicus	Coleoptera	[Nb]
Sitona macularius	Coleoptera	[Nb]
Andrena humilis	Hymenoptera	[Nb]
Andrena trimmerana	Hymenoptera	[Nb]
Bombus rupestris	Hymenoptera	[Nb]
Nomada flavopicta	Hymenoptera	[Nb]
Hylaeus signatus	Hymenoptera	[Nb]
Nysson dimidiatus	Hymenoptera	[Nb]
Nysson trimaculatus	Hymenoptera	[Nb]
Lasioglossum malachurum	Hymenoptera	[Nb]
Megachile leachella	Hymenoptera	[Nb]
Osmia bicolor	Hymenoptera	[Nb]
Dasypoda hirtipes	Hymenoptera	[Nb]
Melitta tricincta	Hymenoptera	[Nb]
Priocnemis cordivalvata	Hymenoptera	[Nb]
Tiphia minuta	Hymenoptera	[Nb]
Sphecodes crassus	Hymenoptera	[Nb]
Acanthiophilus helianthi	Diptera	[Notable]
Orellia falcata	Diptera	[Notable]

Species	Order	Conservation status
Merzomyia westermanni	Diptera	[Notable]
Forficula lesnei	Dermaptera	[NS]
Cistogaster globosa	Diptera	[RDB 1]
Gymnosoma nitens	Diptera	[RDB 1]
Nephus quadrimaculatus	Coleoptera	[RDB 2]
Philanthus triangulum	Hymenoptera	[RDB 2]
Lygus pratensis	Hemiptera	[RDB 3]
Andrena alfkenella	Hymenoptera	[RDB 3]
Andrena florea	Hymenoptera	[RDB 3]
Ceratina cyanea	Hymenoptera	[RDB 3]
Nomada hirtipes	Hymenoptera	[RDB 3]
Hedychrum niemelai	Hymenoptera	[RDB 3]
Gorytes laticinctus	Hymenoptera	[RDB 3]
Lasioglossum pauperatum	Hymenoptera	[RDB 3]
Stelis ornatula	Hymenoptera	[RDB 3]
Calophasia lunula	Lepidoptera	[RDB 3]
Nomada fulvicornis	Hymenoptera	[RDB 3]
Cerceris quinquefasciata	Hymenoptera	[RDB 3]; Section 41 Priority Species
Lixus scabricollis	Coleoptera	[RDB K]
Sitticus distinguendus	Araneae	CR;NR; Section 41 Priority Species
Heringia verrucula	Diptera	DD;NS
Colletes fodiens	Hymenoptera	EN (European)
Praestigia duffeyi	Araneae	EN;NR; Section 41 Priority Species
Mogulones euphorbiae	Coleoptera	Na
Diplapion stolidum	Coleoptera	Nb
Protapion difforme	Coleoptera	Nb
Protapion filirostre	Coleoptera	Nb
Phytoecia cylindrica	Coleoptera	Nb
Cathormiocerus aristatus	Coleoptera	Nb
Hypera fuscocinerea	Coleoptera	Nb
Mecinus collaris	Coleoptera	Nb
Polydrusus flavipes	Coleoptera	Nb
Polydrusus pulchellus	Coleoptera	Nb
Pselactus spadix	Coleoptera	Nb
Sibinia arenariae	Coleoptera	Nb
Sitona waterhousei	Coleoptera	Nb
Tychius schneideri	Coleoptera	Nb
Tychius squamulatus	Coleoptera	Nb
Zacladus exiguus	Coleoptera	Nb
Athous campyloides	Coleoptera	Nb
Olibrus millefolii	Coleoptera	Nb
Temnocerus coeruleus	Coleoptera	Nb
Temnocerus longiceps	Coleoptera	Nb
Nicrophorus interruptus	Coleoptera	Nb
Quedius invreae	Coleoptera	Nb
Anoscopus limicola	Hemiptera	Nb
Aphrodes aestuarina	Hemiptera	Nb
Paralimnus phragmitis	Hemiptera	Nb

Species	Order	Conservation status
Reptalus (Reptalus) panzeri	Hemiptera	Nb
Asiraca clavicornis	Hemiptera	Nb
Megalonotus antennatus	Hemiptera	Nb
Andrena pilipes	Hymenoptera	Nb
Andrena varians	Hymenoptera	Nb
Anthophora quadrimaculata	Hymenoptera	Nb
Pseudomalus violaceus	Hymenoptera	Nb
Ectemnius sexcinctus	Hymenoptera	Nb
Lestiphorus bicinctus	Hymenoptera	Nb
Ponera coarctata	Hymenoptera	Nb
Lasioglossum puncticolle	Hymenoptera	Nb
Lasioglossum xanthopus	Hymenoptera	Nb
Sphecodes miniatus	Hymenoptera	Nb
Stelis punctulatissima	Hymenoptera	Nb
Auplopus carbonarius	Hymenoptera	Nb
Priocnemis agilis	Hymenoptera	Nb
Priocnemis confusor	Hymenoptera	Nb
Oncocera semirubella	Lepidoptera	Nb
Enicmus brevicornis	Coleoptera	Notable
Meligethes rotundicollis	Coleoptera	Notable
Anotylus hamatus	Coleoptera	Notable
Rugilus angustatus	Coleoptera	Notable
Zodion cinereum	Diptera	Notable
Hydrovatus cuspidatus	Coleoptera	NR
Arctosa fulvolineata	Araneae	NR;NT; Section 41 Priority Species
Argenna patula	Araneae	NS
Argenna subnigra	Araneae	NS
Drassodes pubescens	Araneae	NS
Hypomma fulvum	Araneae	NS
Meioneta simplicitarsis	Araneae	NS
Panamomops sulcifrons	Araneae	NS
Parapelecopsis nemoralioides	Araneae	NS
Pardosa agrestis	Araneae	NS
Cheiracanthium virescens	Araneae	NS
Sibianor aurocinctus	Araneae	NS
Synageles venator	Araneae	NS
Kochiura aulica	Araneae	NS
Zodarion italicum	Araneae	NS
Cordicollis instabilis	Coleoptera	NS
Cyclodinus constrictus	Coleoptera	NS
Agrilus viridis	Coleoptera	NS
Trachys scrobiculatus	Coleoptera	NS
Rhagonycha lutea	Coleoptera	NS
Amara montivaga	Coleoptera	NS
Brachinus crepitans	Coleoptera	NS
Harpalus attenuatus	Coleoptera	NS
Ophonus azureus	Coleoptera	NS
Panagaeus bipustulatus	Coleoptera	NS

Species	Order	Conservation status
Poecilus lepidus	Coleoptera	NS
Cryptocephalus hypochaeridis	Coleoptera	NS
Longitarsus ballotae	Coleoptera	NS
Longitarsus fowleri	Coleoptera	NS
Podagrica fuscicornis	Coleoptera	NS
Podagrica fuscipes	Coleoptera	NS
Dasytes plumbeus	Coleoptera	NS
Graptodytes bilineatus	Coleoptera	NS
Rhantus frontalis	Coleoptera	NS
Gyrinus paykulli	Coleoptera	NS
Haliplus apicalis	Coleoptera	NS
Peltodytes caesus	Coleoptera	NS
Ochthebius viridis	Coleoptera	NS
Enochrus bicolor	Coleoptera	NS
Enochrus halophilus	Coleoptera	NS
Helophorus alternans	Coleoptera	NS
Helophorus nanus	Coleoptera	NS
Anthocomus fasciatus	Coleoptera	NS
Mordellistena neuwaldeggiana	Coleoptera	NS
Mordellistena variegata	Coleoptera	NS
Variimorda villosa	Coleoptera	NS
Anaspis costai	Coleoptera	NS
Apterygida media	Dermaptera	NS
Dolichopus signifer	Diptera	NS
Cheilosia cynocephala	Diptera	NS
Cheilosia velutina	Diptera	NS
Chrysotoxum elegans	Diptera	NS
Neoascia interrupta	Diptera	NS
Pipizella maculipennis	Diptera	NS
Hybomitra ciureai	Diptera	NS
Henia vesuviana	Geophilomorpha	NS
Alydus calcaratus	Hemiptera	NS
Bathysolen nubilus	Hemiptera	NS
Ceraleptus lividus	Hemiptera	NS
Corixa affinis	Hemiptera	NS
Sigara (Halicorixa) selecta	Hemiptera	NS
Sciocoris (Sciocoris) cursitans	Hemiptera	NS
Eurygaster maura	Hemiptera	NS
Assiminea grayana	Littorinimorpha	NS
Stosatea italica	Polydesmida	NS
Oecetis furva	Trichoptera	NS
Hydrochus ignicollis	Coleoptera	NS;NT
Hydrophilus piceus	Coleoptera	NS;NT
Lejops vittatus	Diptera	NS;NT
Anisodactylus poeciloides	Coleoptera	NS; Section 41 Priority Species
Coenonympha pamphilus	Lepidoptera	NT; Section 41 Priority Species
Lasiommata megera	Lepidoptera	NT; Section 41 Priority Species
Melieria picta	Diptera	pNS

Species	Order	Conservation status
Eurina lurida	Diptera	pNS;pNT
Blaesoxipha plumicornis	Diptera	pNS;pNT
Dorycera graminum	Diptera	pNS;pNT; Section 41 Priority Species
Pammene agnotana	Lepidoptera	pRDB 1
Myopa vicaria	Diptera	RDB 2;RDB 3
Gymnosoma rotundatum	Diptera	RDB 3
Hylaeus dilatatus [Genus inferred]	Hymenoptera	RDB 3
Pemphredon lethifer	Hymenoptera	RDB 3
Pemphredon rugifer	Hymenoptera	RDB 3
Myrmica specioides	Hymenoptera	RDB 3
Atomaria scutellaris	Coleoptera	RDB K
Olibrus flavicornis	Coleoptera	RDB K
Tachinus flavolimbatus	Coleoptera	RDB K
Bombus humilis	Hymenoptera	Section 41 Priority Species
Scotopteryx bipunctaria	Lepidoptera	Section 41 Priority Species
Tyria jacobaeae	Lepidoptera	Section 41 Priority Species - research only
Chiasmia clathrata	Lepidoptera	Section 41 Priority Species - research only
Scotopteryx chenopodiata	Lepidoptera	Section 41 Priority Species - research only
Malacosoma neustria	Lepidoptera	Section 41 Priority Species - research only

[i] Na and Nb – historic versions of Nationally Scarce.

[ii] At the GB level Nationally Rare (NR) species are those occurring in 1 to 15 hectads. Nationally Scarce (NS) species are those occurring in 16 to 100 hectads.

[iii] Least Concern (LC) - IUCN Red List category. Species does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened.

[iv] Near Threatened (NT) - IUCN Red List category. Species does not qualify for Critically Endangered, Endangered or Vulnerable status now, but is close to qualifying for, or is likely to qualify for a threatened category in the near future.

[v] RDB K - Insufficiently Known. Species with very few or a single known locality but which belong to poorly recorded or taxonomically difficult groups.

[vi] Data Deficient (DD) - IUCN Red List category. Inadequate information to make assessment of risk of extinction based distribution and/or population status.

[vii] Critically Endangered (CR) - a category on the IUCN Red List of Threatened Species which indicates a taxon is considered to be facing an extremely high risk of extinction in the wild.

[viii] Endangered (EN) - a category on the IUCN Red List of Threatened Species which indicates a taxon is considered to be facing a very high risk of extinction in the wild.

[ix] Red Data Book category 1 (RDB 1) – Endangered species whose numbers have been reduced to a critical level or whose habitats have been so dramatically reduced that they are deemed to be in immediate danger of extinction.

[x] Red Data Book category 2 (RDB 2) – Vulnerable species likely to move into the endangered category in the near future if the causal factors continue operating.

[xi] Red Data Book category 3 (RDB 3) – Rare species with small populations in Great Britain that are not at present endangered or vulnerable but are at risk. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.