Condition review: Arun Valley Sites

Freshwater-dependent features

May 2025

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Executive summary

The Arun Valley (River Arun Catchment) is seen as one of the most important areas for wildlife within the United Kingdom (UK) supporting many Nationally and Internationally protected species. As part of Natural England's (NE) responsibility as the government's advisor on the natural environment, we are required to undertake the monitoring and evaluation of designated sites within the England, and to advise land managers, partners, and stakeholders how best to sustain, or restore sites back to favourable condition.

Previously, condition assessments conducted on the designated sites within the Arun Valley had highlighted several potential issues (detailed below), impacting both the condition of the species and habitats (known as notified features) of these sites and their overall resilience in the face of future pressures. This included:

1. Inappropriate water levels
2. Water pollution
3. Inappropriate ditch management
4. Change in land management
5. Hydrological changes
6. Agriculture – overgrazing
7. Agriculture – under grazing
8. Forestry and woodland management
9. Freshwater – water abstraction

The cumulative results of these impacts had led to many of the designated features across the five Arun Valley Site(s) of Special Scientific Interest (SSSI) Arun Banks, Upper Arun, Amberley Wild Brooks, Pulborough Brooks, Waltham Brooks) as being assessed as being in Unfavourable condition, or unassessed classification, with only 41 % of features achieving Favourable condition. To complete the assessment of all notified features on the site, and to update previous assessments, NE undertook desk-based evidence reviews and field surveys. Where possible, historic trends of populations were considered, and condition status of designated features were determined. The results of this assessment have aided in identifying the key gaps within evidence.NE commissioned projects to better understand some of these uncertainties which are summarised in this report). This assessment also concluded that all previously stated pressures, apart from *Agriculture – overgrazing*, are still impacting on the Arun Valley designated sites and their associated features.

This report also discusses the existing conservation features and targets, and how these may need to be amended to ensure that the appropriate designated features are maintained or are able to recover to Favourable condition, thus ensuring the site(s) can make an effective contribution to favourable conservation status.

An overview of the designated sites, designated features and condition status following this condition assessment is detailed below.

Arun Banks SSSI

Arun Banks SSSI consists of an upper tidal stretch of the River Arun and an old, abandoned meander loop. A range of habitats are evident on site (reedbed, fen, tall herb, and woodland communities) which aid in supporting communities of rich and varied flora, including the locally uncommon Marsh-mallow *Althaea officinalis*. There are three monitored features on site, floodplain fen (lowland), wet woodland, and a population of the Vulnerable (VU) (Cheffings et al., 2005) hybrid club-rush as *Schoenoplectus x kuekenthalianus* (a hybrid between Grey Club-rush *Schoenoplectus tabernaemontani* and Triangular Club-rush *Schoenoplectus triqueter*). Of the monitored interest features, only the *Schoenoplectus x kuekenthalianus* was assessed during NE's 2021 surveys and the confirmed presence (and increase in extent) of this species resulted in this feature achieving Favourable condition status. However, it should be noted that the presence of competing species was not assessed, or considered, but identified as potentially impacting the resilience of this feature in the future. The floodplain fen (lowland) and wet woodland interest features remain unchanged from the previous assessment and therefore are in Favourable condition status.

Upper Arun SSSI

The Upper Arun SSSI consists of a 13 kilometre (KM) stretch of the River Arun where a presence of diverse riverine flora provides the supporting habitat for this site's only monitored interest feature, the outstanding assemblage of breeding dragonflies (Odonata). At the time of its notification at least 15 species were known to breed in the river. This included several Nationally Rare or notable species, such as the Scarce Chaser *Libellula fulva,* Brilliant Emerald *Somatochlora metallica*, Club-tailed dragonfly *Gomphus vulgatissimus* and the Hairy dragonfly *Brachytron pratense*.

Previously the Upper Arun SSSI was in Unfavourable Recovering condition. The current assessment showed 60 % of the assessed feature attributes achieving, or exceeding, targeted range (particularly the number of Odonata species and presence of breeding) and favourable condition is currently being achieved. Whilst this change in classification is positive, several pressures were subsequently identified, primarily focused on the presence of poor water quality, invasive non-native species (INNS), and the wider supporting habitats of Odonata. This should be considered within future assessments, and conservation efforts made to further improve and maintain the condition status of this sites notified feature, informing the basis for appropriate management measures to be undertaken.

Floodplain sites, Ramsar and SSSIs

For this review, the three SSSIs (Amberley Wild Brooks, Pulborough Brooks, Waltham Brooks) that underpin the Arun Valley Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site (designated wetland habitat) have been grouped

together and referred to as floodplain sites. There are slight variations within the monitored interest features across the three SSSI's, however, these sites were primarily designated because they support a rich and diverse range of water-dependent flora and fauna. This includes some specifically uncommon invertebrates, outstanding dragonfly assemblages, breeding and wintering bird populations, and rare plant species.

Previously undertaken assessments showed a wide variability in the condition status of interest features over the three Arun Valley floodplain SSSI's, the corresponding SAC, SPA and Ramsar these are detailed in the report. The results from NE's 2021 condition assessment of the Arun Valley designated sites (SSSIs, SAC, SPA and Ramsar), have demonstrated (as shown in the table below) significant deterioration in many notified features since previous assessments. Several pressures were identified as potentially impacting the monitored interest features and their long-term resilience acting alone or together. The general categories for the pressures includes freshwater impacts, invasive non-native species (INNS), land management, pollution and climate change, and have been attributed, partly or wholly to the following major deteriorations:

- An observed loss of rare and scarce plant populations across all three floodplain SSSI sites,
- A significant decline in breeding and non-breeding bird species, namely Bewick's swan *Cygnus columbianus bewickii* critically low numbers on Amberley Wild Brooks and Pulborough Brooks SSSIs, with no recent sightings at Waltham Brooks SSSI. However, trends on site match national declines, indicating a reduction due to broadscale changes) and Redshank *Tringa totanus* declines are considered site specific to Amberley Wild Brooks SSSI where only one pair was observed during NE's 2021 assessment,
- A severe decline in the presence and extent of the SAC species, the Little Whirlpool Ram's-horn snail *Anisus vorticulus,* indicating a potential for future localised extinction (Amberley Wild Brooks SSSI) or the presence of environmental restrictions hindering the successful re-colonisation of the species within its former range (Pulborough Brooks SSSI),
- The predominant water-dependent habitats; the ditches, wet grassland, swamp and wetland habitats are in Unfavourable Declining condition across all three sites, and,
- Historical degradation and, or modification of a priority habitat feature (peatland), which has previously been mismanaged, or overlooked.

Throughout this assessment, NE have taken into consideration the interest features of the Arun Valley sites as they were designated, but also the representative ecological communities and environmental characteristics of these sites as identified during surveys. This identified several targets and features that should be considered in the next updates to monitoring specifications. This has been reflected within the current assessment, with an overview of the interest features and their current condition status following NE's 2021 assessment, as concluded and detailed below. The condition status of these SSSIs (where relevant) has also informed the condition status of the overlapping SAC, SPA and Ramsar site features / criteria, which is also detailed in this report.

Condition overview of the three floodplain sites (Amberley Wild Brooks, Pulborough Brooks and Waltham Brooks SSSIs), their monitored notified features, condition status and confidence rating (High, Medium, or Low). For more detail regarding the interest features and links to accessible information online please see Table 1.1 in section 1:

Feature	Amberley Wild Brooks	Pulborough Brooks	Waltham Brooks
Odonata	Condition Status Following Assessment	Condition Status Following Assessment	Condition Status Following Assessment
Outstanding Odonata assemblage	Favourable(M)	Favourable(M)	Not applicable
Rare Odonata: *Libellula fulva*, Scarce chaser	Not applicable	Favourable(L)	Not applicable
Rare Odonata: *Gomphus vulgatissimus*, Club-tailed dragonfly	Not applicable	Unfavourable No Change(M)	Not applicable
Invertebrates			
Outstanding diverse Invertebrate assemblages (W21, W31, F21)	Unfavourable No Change(M)	Not applicable	Not applicable
Outstanding diverse Invertebrate assemblages (W21, W31)	Not applicable	Unfavourable No Change(M)	Not applicable
Ornithology			
Aggregations of non-breeding birds (ANBB) - variety of wintering species	Favourable(M)	Not applicable	Not applicable
ANBB - Bewick's swan, *Cygnus columbianus bewickii*	Unfavourable Declining(H)	Unfavourable Declining(H)	Unfavourable Declining(M)
ANBB - Shoveler, *Spatula clypeata*	Favourable(L)	Unfavourable Declining(L)	Unfavourable Declining(M)
ANBB - Teal, *Anas crecca*	Favourable(H)	Favourable(H)	Unfavourable Declining(M)
ANBB - Pintail, *Anas acuta*	Not applicable	Unfavourable Declining(L)	Not applicable
ANBB - Wigeon, *Mareca penelope*	Not applicable	Unfavourable Declining(L)	Not applicable
ANBB - Ruff, *Calidris pugnax*	Not applicable	Unfavourable Declining(H)	Not applicable
Assemblages of breeding birds - Mixed: Lowland damp grassland, woodland	Not Assessed	Not applicable	Not applicable
Assemblages of breeding birds - Lowland damp grasslands	Not applicable	Favourable(H)	Not Assessed
Aggregations of breeding birds - Redshank, *Tringa totanus*	Unfavourable Declining(H)	Not applicable	Not applicable
Feature	**Amberley Wild Brooks**	**Pulborough Brooks**	**Waltham Brooks**
Habitat Features	Condition Status Following Assessment		

Ditch systems	Unfavourable Declining(H)	Unfavourable Declining(H)	Unfavourable Declining(H)
Alluvial grazing marshes with ditches/swamp (S4, S5, S6, S7, S11, S12, S19) communities [note 1]	Unfavourable Declining(H)	Unfavourable Declining(H)	Unfavourable Declining(H)
Wet Woodland (W1, W5c, W6b, W10c)	Not Assessed	Not applicable	Not applicable
Lowland neutral grassland (M23, MG6, M25) [note 1]	Unfavourable Declining(H)	Unfavourable Declining(H)	Unfavourable Declining(H)
Plants			
Vascular Plant Assemblage [note 2]	Unfavourable Declining(M)	Unfavourable Declining(M)	Unfavourable Declining(M)
Population of Schedule 8 plant - *Leersia oryzoides*, Cut-grass	Unfavourable Declining(H)	Not applicable	Unfavourable Declining(H)
Population of RDB plant - *Carex vulpina*, True Fox-sedge	**Unfavourable Declining(L)**	Not applicable	Not applicable
Molluscs			
Population of RDB mollusc - *Anisus vorticulus*, Little Whirlpool Ramshorn Snail	**Unfavourable Declining(H)**	**Unfavourable No Change(H)**	Not applicable

Note 1: Alluvial grazing marshes, and lowland neutral grassland are not designated features of Amberley Wild Brooks and Pulborough Brooks SSSI's. However, are noted within the MS as an attribute of supporting habitat for notified features. Therefore, it has been included within this report.

Note 2: VPA at Waltham Brooks is not a designated feature of the SSSI. However, it is mentioned within the MS as an attribute under the ditch habitat feature of the SSSI. Therefore, it has been included within this report.

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Abbreviations

BAT: Broad Assemblage Type

BOD: Biochemical Oxygen Demand

BFTB: Back From the Brink

BTO: British Trust for Ornithology

CSMG: Common Standards Monitoring Guidance

DAFOR: Dominant, Abundant, Frequent, Occasional, Rare

DO: Dissolved Oxygen

EA: Environment Agency

ENSIS: English Nature Site Information System

FCT: Favourable Condition Table

ha: Hectare

HBES: Hardham Basin Environmental Study

INNS: Invasive Non-Native Species

IUCN: International Union for Conservation of Nature

JNCC: Joint Nature Conservation Committee

MS: Monitoring Specification

NE: Natural England

NERC: Natural Environment and Rural Communities

NGR: National Grid References

NTU: Nephelometric Turbidity Units

NVC: National Vegetation Classification

RAD: Resist Accept Direct

RSPB: Royal Society for the Protection of Birds

SAC: Special Area of Conservation

SACO: Supplementary Advice to the Conservation Objectives

SAT: Specific Assemblage Type

SIP: Site Improvement Plan

SPA: Special Protection Area

SRS: Structural Recording Surveys

SSSI: Site of Special Scientific Interest

TraC: Transitional and Coastal

TN: Total Nitrogen

TP: Total Phosphorus

VPA: Vascular Plant Assemblage

WeBS: Wetland Bird Survey

WINEP: Water Industry National Environmental Programme

WFD: Water Framework Directive

WQ: Water Quality

1. Conservation designations, features, and interests

The area of interest for this report, the River Arun and Western Streams catchment; Arun Valley, is in the South Downs National Park, West Sussex (National Character Area 125: South Downs). The Arun Valley catchment is one of the most biodiverse within the United Kingdom and has wildlife (features) that are internationally and nationally protected. The designations of sites within this catchment include, a Special Protection Area (SPA), Ramsar site (designated wetland) and a Special Area of Conservation (SAC). These sites are either underpinned, overlapped, or situated within close proximation to several of the five Site(s) of Special Scientific Interest (SSSI), which form the basis of this report (Figure 1.1). This includes:

- Upper Arun SSSI
- Arun Banks SSSI
- Amberley Wild Brooks SSSI (Part of the Arun Valley SPA, Ramsar and SAC)
- Pulborough Brooks SSSI (Part of the Arun Valley SPA, Ramsar and SAC)
- Waltham Brooks SSSI (Part of the Arun Valley SPA and Ramsar)

For ease of reference, the three SSSIs within the Ramsar site and SPA (Amberley Wild Brooks SSSI, Pulborough Brooks SSSI and Waltham Brooks SSSI) are treated together within this report, and in headings are referred to as floodplain sites.

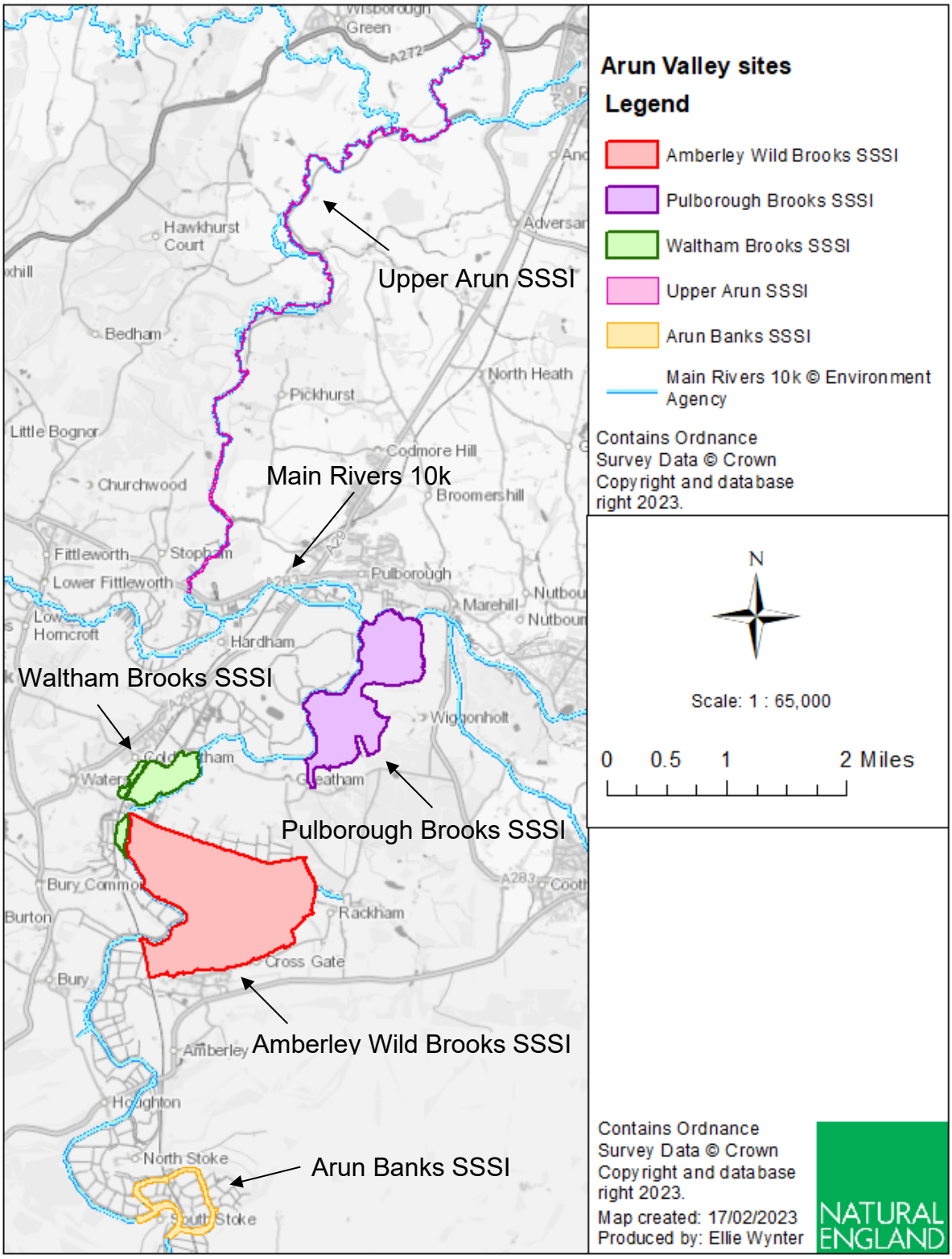


Figure 1.1 - Map of Arun Valley designated sites, showing the geographic location and the River Arun (Blue) for Amberley Wild Brooks SSSI (Red), Pulborough Brooks SSSI (Purple), Waltham Brooks SSSI (Green), Upper Arun SSSI (River, Pink) and Arun Banks SSSI (Orange).

The Arun Valley contains numerous priority habitats including low-lying grazing marsh. It is largely on alluvial soils but also supports areas of peat believed to have formed under fen and, unusually for Southeast England, raised bog conditions. Significant hydrological changes to the valley have been made over centuries, including major river engineering and embankment, and artificial drainage of the floodplain, resulting in the loss of both peat-forming and inter-tidal conditions, but creating the floodplain landscape that remains today of low-lying pastures dissected by a rectilinear pattern of ditches and drains and small areas of standing water. Variation in soils and water supply led to a wide range of ecological conditions and a rich flora and fauna. The Upper Arun SSSI is a river habitat and sits in the Weald landscape. The ditches and open water of the three floodplain sites support a rich community of aquatic and wetland species that are protected under UK and international legislation. The Arun Banks SSSI is an old meander loop that is interlinked with drainage ditches on the landward side of the site.

This report provides the condition assessment based on recent surveys (between 2021-22) undertaken within the five SSSIs as mentioned above. The assessment, where possible, aimed to assess the designated sites at both the unit and feature level using best available and emerging data.

Natural England undertakes periodic monitoring of protected sites to assess whether the features of interest for which the site is notified are meeting their conservation objectives. If all the interest features are meeting their objectives, then a site is considered to be in Favourable condition. The requirements for SACs and SPAs are set out in conservation objectives as prescribed in the Conservation of Habitats and Species Regulations 2017 (as amended).

Site Improvement Plans (SIPs) have been developed for all SACs and SPAs (known collectively as European sites) in England. The plans provide a high-level overview of the issues (both current and predicted) affecting the condition of the conservation features on the site(s) and outline the priority measures required to improve the condition of the features.

The issues highlighted in the Arun Valley SIP and/or threats that have been identified with associated SSSIs are listed below:

1. Inappropriate water levels
2. Water pollution
3. Inappropriate ditch management
4. Change in land management
5. Hydrological changes
6. Agriculture – overgrazing
7. Agriculture – under grazing
8. Forestry and woodland management
9. Freshwater – water abstraction

Objective of this report

The objective of this report is to review the evidence base for the designated features (where feasible and resourced) of the listed SSSIs. This can be used to:

- Assess their current condition.
- Assess the trend in condition (recovering, no change, or declining).
- Identify significant evidence gaps that cannot be filled by available data and identify where further study is required.
- Include in the assessment, findings from relevant and recent projects/studies undertaken on these sites and from projects commissioned by Natural England to address some of the initially identified evidence gaps.
- Discuss the existing threats and pressures affecting the designated sites, identifying any changes required to the site documentation to facilitate maintaining and/or restoring the sites to Favourable condition (such as revising the SIPs, Monitoring Specifications (MSs), and/ or the Conservation Objectives and Supplementary advice to the Conservation Objectives (SACOs)).

Arun Banks and Upper Arun SSSIs are not within the Arun Valley SAC, SPA and Ramsar site and therefore the condition assessments for these sites are outlined in separate sections (sections 3 and 4). The sections following this provide the results of the condition assessment per notified feature, and where applicable reviewing the results for the three SSSIs that are within the Arun Valley SAC, SPA, and Ramsar site (section 5 onwards).

Table 1.1 sets out the site condition status (as a percentage of total site area (ha) prior to this review) and interest features designated under each relevant water-dependent designated site, as well as links to the citations, MSs, SACOs, and SIPs.

Table 1.1 - Designated site features for the SSSIs assessed in this report.

Designated site	Site condition prior to this review and objectives [note 1, 2]	Interest features
Amberley Wild Brooks SSSI	6.38 hectares Favourable condition (1.95%) 321.11 hectares Unfavourable recovering condition (98.05%)	The SSSI citation and MS show the interest features, which can be summarised as follows: • Outstanding invertebrate assemblages (W11 fast flowing water, W21 mineral marsh and open water, W31 permanent wet mire, F21 grassland scrub matrix) • Individually designated vascular plants (Cut-grass *Leersia oryzoides* and True Fox-sedge *Carex* vulpina) and a Vascular Plant Assemblage (Cut-

Designated site	Site condition prior to this review and objectives [note 1, 2]	Interest features
	Monitoring Specifications	grass *Leersia oryzoides*; True Fox-sedge *Carex vulpina)* Sharp-leaved Pondweed *Potamogeton acutifolius*; Greater Water-parsnip *Sium latifolium,* Small Water-pepper *Persicaria minor* and Narrow-leaved Water-dropwort *Oenanthe silaifolia*) • Lowland ditch systems • Outstanding Odonata assemblage • Aggregations of breeding birds (Redshank, *Tringa totanus*) • Breeding bird assemblage (lowland damp grassland, woodland) • Aggregations of non-breeding birds (variety of wintering species) • Aggregations of non-breeding birds (Bewick's Swan, *Cygnus columbianus bewickii,* Shoveler, *Spatula clypeata* and Teal, *Anas crecca)* • RDB snail species: Little Whirlpool Ramshorn snail, *Anisus vorticulus* • Wet Woodland - W1 *Salix cinerea-Galium palustre* woodland, W5c *Alnus glutinosa-Carex paniculata* woodland, *Chrysosplenium oppositifolium* sub-community, W6b *Alnus glutinosa-Urtica dioica* woodland, *Salix fragilis* and *Salix viminalis/triandra* sub-communities, W10c *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland, *Holcus lanatus* sub-community.
Pulborough Brooks SSSI	160 hectares Favourable condition (100%) Monitoring Specifications	The SSSI citation and MS show the interest features, which can be summarised as follows: • Outstanding invertebrate assemblages (W53 saltmarsh, estuary, and mudflat, W21 mineral marsh and open water, W31 permanent wet mire) • Outstanding Odonata assemblage, including RDB listed dragonfly species Scarce chaser (*Libellula fulva*), Club tailed dragonfly (*Gomphus vulgatissimus)*

Designated site	Site condition prior to this review and objectives [note 1, 2]	Interest features
		• Population of *Anisus vorticulus*, Little Ramshorn Whirlpool Snail • Assemblage of breeding birds - Lowland damp grasslands • Aggregations of non-breeding birds (Wigeon, Teal, Pintail, Shoveler, Ruff, Bewick's swan). • Lowland ditch systems • Vascular Plant Assemblage including Cut-grass *Leersia oryzoides,* Sharp-leaved Pondweed *Potamogeton acutifolius*, Greater Water-parsnip *Sium latifolium* and Narrow-leaved Water-dropwort *Oenanthe silaifolia.*
Waltham Brooks SSSI	47.39 hectares Unfavourable recovering (100%) Monitoring Specifications	The SSSI citation and MS show the interest features, which can be summarised as follows: • Aggregations of non-breeding birds (Bewick's swan, Shoveler, Teal) • Outstanding assemblage of breeding birds - Lowland damp grasslands • Alluvial grazing marsh with ditches, swamp including MG5, S5 and S22 (and S4, S12, S 14, S19 related communities) • Lowland neutral grassland: MG13-related; Inland wet grassland • Lowland ditch systems • Individual designated vascular plant (Cut-grass *Leersia oryzoides*)
Arun Valley SPA	Conservation Objectives & Supplementary Advice Site Improvement Plan	The SPA citation and MS show the SPA's interest features, which can be summarised as follows: • A037 Bewick's swan, *Cygnus columbianus bewickii* non-breeding • Water bird assemblage, non-breeding. Non qualifying interest features include Wigeon, Teal, Pintail, Shoveler, Golden Plover, Ruff and Kingfisher.

Designated site	Site condition prior to this review and objectives [note 1, 2]	Interest features
Arun Valley SAC	Conservation Objectives & Supplementary Advice Site Improvement Plan	The Natura 2000 Standard data form, the JNCC site description and SAC citation provide the designation details. Features are summarised below: • RBD mollusc, S4056 *Anisus vorticulus,* Little Whirlpool Ramshorn snail. Habitat class codes in the SAC data form are as follows: 95% humid grassland mesophile grassland 2% Bogs, marshes, water fringed vegetation, fens. 1% Broadleaved deciduous grassland 2% Inland water bodies.
Arun Valley Ramsar site	Not available separately (currently combined with SPA and SAC)	The Ramsar site information sheet, which has not been updated since 1999, shows the interest features: • Criterion 2: Site holds 7 wetland invertebrates listed on British RDB as threatened and 1 of these is endangered. Site holds 4 Nationally Rare and 4 Nationally Scarce plant species. • Criterion 3: Ditches hold outstanding aquatic native flora in addition to the rare and threatened species. • Criterion 5: Internationally important assemblage of waterfowl.
Upper Arun SSSI	17.58 hectares (100%) Unfavourable recovering condition Monitoring Specifications	The SSSI citation and MS show the interest features which can be summarised as: • Outstanding Odonata assemblage. (Supporting habitats/features include rivers & streams)
Arun Banks SSSI	25.8 hectares (100%) Favourable condition Monitoring Specifications	The SSSI citation and MS show the interest features which can be summarised as: • Alder – Greater Tussock sedge wet woodland • Alder – nettle wet woodland • Lowland neutral grassland and floodplain fen • Nationally Scarce plant – hybrid club-rush as *Schoenoplectus x kuekenthalianus*.

Note 1: The data was downloaded from various websites and Natural England's sites database in March 2023. Any changes since then are not reflected in this table. Many of the interest features and habitat types detailed in this table require amending; subject to resources NE will revise in accordance with the updates detailed within this report.

Note 2: The underpinning guidance on which the ditch habitat MSs are based is currently being updated and water quality targets on the relevant Arun Valley SSSIs will be revised to meet the requirements of mesotrophic species such as the Little Whirlpool Ramshorn Snail *Anisus vorticulus*. This includes the revision of current CSMG total phosphorous targets (Amberley Wild Brooks and Pulborough Brooks SSSIs only) and the addition of total nitrogen targets for all three floodplain sites.

Table 1.2 - Water Framework Direct Water Bodies for the SSSIs assessed in this report [Note 1].

Water Framework Directive Water Body	Ecological status
Pulborough Brooks	GB107041013040 **Moderate ecological status** – This does not include most of the designated sites, just parts of the mid brooks (Pulborough Brooks unit 3)
Arun U/S Pallingham	GB107041017950 **Moderate ecological status**– This includes parts of River Arun SSSI
Arun D/S Pallingham	GB107041013350 **Moderate ecological status** – This includes parts of the River Arun SSSI
Arun TRaC	GB540704105000 **Moderate ecological status** but this is based on the main channel only – this does not include information on the protected areas or Arun Banks
Lower Greensand Arun and Western Streams	GB40701G503100 **Overall groundwater status poor**
Rother	GB107041012810 **Moderate ecological status** The main designated freshwater wetlands are included in the Transitional and Coastal water (TraC) bodies and in the South East TraC management catchment which means they are divorced both from the underpinning aquifers (which are in a different management catchment) and the upstream catchment

Water Framework Directive Water Body	Ecological status
	in the South East River Basin District plan (RBD). This must be rectified in the next plan.

Note 1: None of the relevant surface or groundwater bodies are currently meeting good ecological status (details for relevant waterbodies associated with the SSSIs assessed in this report are provided in Table 1.2). However, each of these waterbodies are treated separately in the South East River Basin district and there is no WFD monitoring of the Habitats sites within the protected areas covered under WFD, therefore only the groundwater body status is relevant to the assessment of the floodplain designated sites.

2. Policy context and Natural England condition assessments

Natural England's vision is for thriving nature for people and planet, which will be achieved through our mission of building partnerships for people and planet. We contribute to this aim through our 4 strategic programmes:

- Resilient Landscapes and Seas
- Sustainable Development
- Greener Farming and Fisheries
- Connecting People with Nature

Water-dependent protected sites, like those within Arun Valley (the subject of this report) are critical for our mission as they present huge opportunities for greener farming, connecting people with nature and recovering and improving the resilience of landscapes. This type of water-dependent site are also critical in supporting delivery of the ambitions in the Environment Act 2021 and the Environmental Improvement Plan, the first revision of the 25 Year Environment Plan.

Natural England (NE) are an evidence-led organisation, and we are driven by science and evidence. Understanding the current condition of the existing designated sites in the Arun Valley, what the main pressures are, and what the long-term trends are, is critical to ensuring these objectives are met.

Condition assessments.

Under section 9A Conservation of Habitats and Species Regulations 2017, the United Kingdom is obliged to report on the conservation status of the habitats and species listed within the Habitats Directive (Annexes I and II), which is relevant for SACs, every 6 years. There are similar reporting requirements under the Birds Directive, relevant for SPAs. Post-EU Exit, the submission of these reports every 6 years is to the Secretary of State, rather than the European Commission. The Environmental Improvement Plan includes new interim targets for SSSIs to have an up-to date condition assessment and for 50% of SSSIs to have actions on track to achieve Favourable condition by 31 January 2028. Alongside these reporting requirements, the ability to provide a current view of feature condition within protected sites is crucial to underpin advice on-site management and casework.

Condition assessments on SSSIs are necessary to support Natural England's statutory work. They are undertaken to assess the condition of all notified features against the site's detailed Monitoring Specification (MS). Overlapping European sites usually have site features that are underpinned by the relevant SSSI features for freshwater and terrestrial sites. Conservation objectives and site supplementary advice indicate the aspects of a site that are important to its condition. A site in Favourable condition has all the appropriate

management measures in place, and all the notified features are meeting their conservation objectives and MS attribute objectives. If a site is in Unfavourable Recovering condition this indicates that all the management measures are in place to enable the site features to achieve Favourable condition status in the future. Site condition for freshwater and terrestrial sites is currently reported at a SSSI unit level, but that assessment should include as many of the features that occur on that unit as possible, as Natural England is moving towards feature-based assessments for freshwater and terrestrial features. Some features or attributes are assessed at a much larger scale than unit level, including the water quality attribute of the freshwater features and bird population trends. Management measures required to address Unfavourable condition are currently referred to as mechanisms on Natural England's recording system. Risks of deterioration or prevention of recovery are currently referred to as pressures on the same system.

The SSSI MSs are derived from an amalgamation and integration process from the relevant Common Standards Monitoring Guidance (CSMG) on the Joint Nature Conservation Committee (JNCC) website, and any national agreed information (such as SACOs). They are usually tailored to site-specific knowledge which is approved by national specialists.

For each feature that has been assessed, the surveys undertaken have recorded and provided data on the relevant attributes for that feature. Each attribute has standardised objectives and/or targets (as explained above) and the data has been analysed against those, assessing whether targets have been met or not. The results of this have then determined and informed the proposed condition status for that attribute. Natural England's current agreed methodology with setting condition status takes the precautionary approach: if one attribute/feature is in an Unfavourable condition, the feature/unit condition is based on that. There are occasions where expert judgement may determine a different decision, but the precautionary principle is still applied. From April 2023 the condition of each feature will be assigned at the whole feature scale with unit condition based on an amalgamation of feature condition with known pressures, mechanisms, and actions.

SSSI condition

Table 2.1 provides the condition status (**as a percentage of total site area (ha) prior to this review**) of the relevant SSSIs and their designated features (that are monitored) as published on Natural England's designated sites system (2021). The previous and subsequently concluded condition status for each feature and unit of the relevant SSSIs are included in Appendix 1.

Figure 2.1 provides a map of site condition prior to this assessment and can be compared against Figure 14.1 (section 14) which details the current site condition following the findings of this 2021-23 review.

Table 2.1 - Overarching condition status of the relevant SSSIs prior to this review and date of last assessment.

SSSI	Condition status and area in hectares	Year of the last assessment prior to this review
Amberley Wild Brooks SSSI	Favourable (1.95%) 6.38 ha (units 9, 12, 14) Unfavourable recovering (98.05%) 321.11 ha (units 1-8, 10-11, 13) Unfavourable No Change (0%) 0 ha Unfavourable Declining (0%) 0 ha	2011/2012
Pulborough Brooks SSSI	Favourable (100%) 160 ha (units 1-3) Unfavourable recovering (0%) 0 ha Unfavourable No Change (0%) 0 ha Unfavourable Declining (0%) 0 ha	2012
Waltham Brooks SSSI	Favourable (0%) 0 ha Unfavourable recovering (100%) 47.39 ha (units 1-3) Unfavourable No Change (0%) 0 ha Unfavourable Declining (0%) 0 ha	2013
Upper Arun SSSI	Favourable (0%) 0 ha Unfavourable recovering (100%) 17.58 ha (units 1-4) Unfavourable No Change (0%) 0 ha Unfavourable Declining (0%) 0 ha	2011
Arun Banks SSSI	Favourable (100%) 25.80 ha (units 1-2) Unfavourable recovering (0%) 0 ha Unfavourable No Change (0%) 0 ha Unfavourable Declining (0%) 0 ha	2009/2010

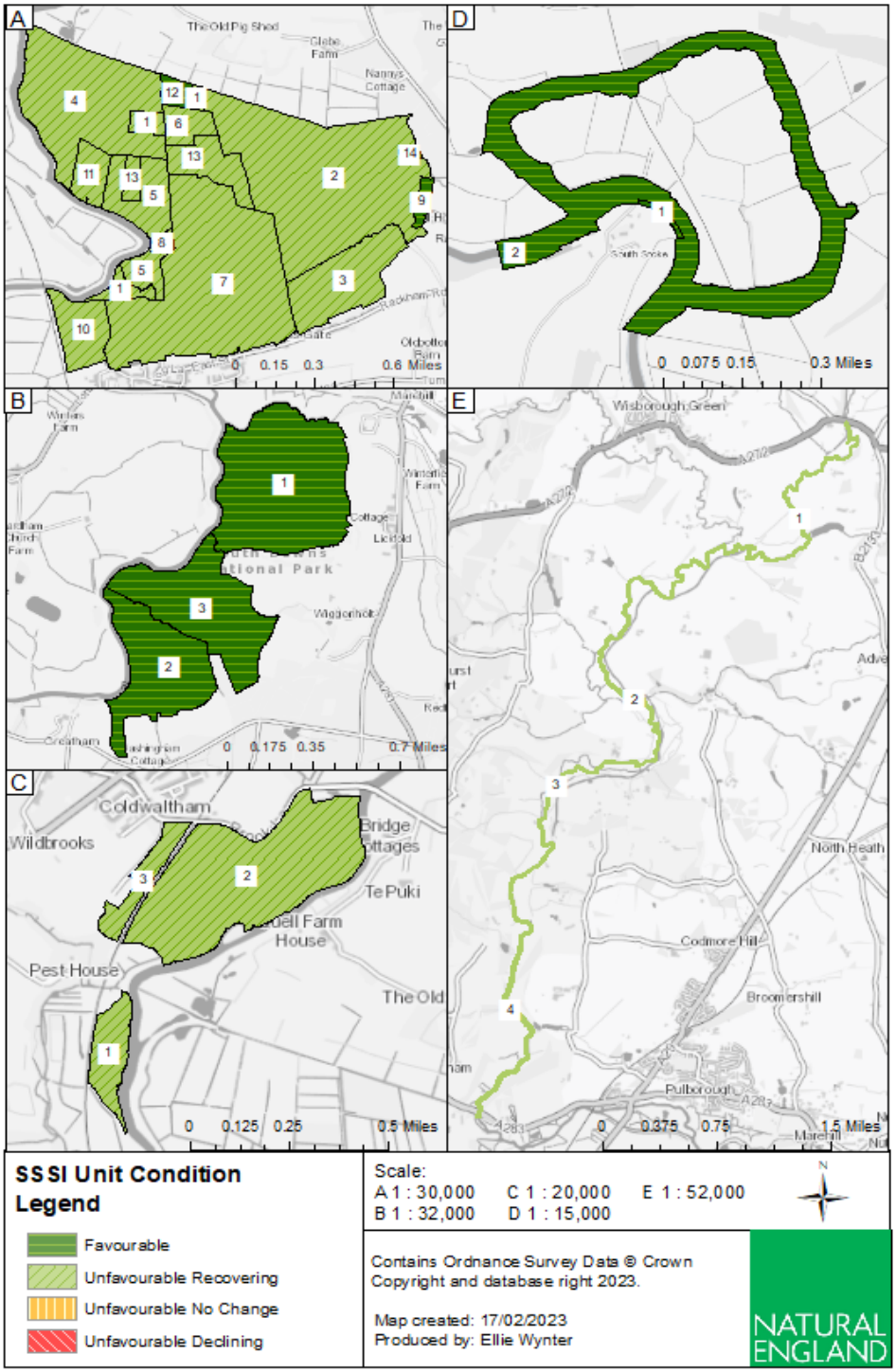


Figure 2.1 - Map of the Arun Valley designated sites assessed in this report (A: Amberley Wild Brooks SSSI, B: Pulborough Brooks SSSI; C: Waltham Brooks SSSI; D: Arun Banks SSSI; E: Upper Arun SSSI). Detail of the SSSI unit numbers and respective condition of designated features **prior to this review** are included (Dark Green/Horizontal lines – Favourable, Light Green/Diagonal lines – Unfavourable recovering, Orange/Vertical Lines – Unfavourable No Change, and Red/Opposing diagonal lines – Unfavourable Declining). Contains Ordnance Survey Data © Crown. Copyright and database right 2023.

3. Arun Banks SSSI

Background

Arun Banks is a 25.8 hectares (ha) SSSI consisting of an upper tidal stretch of the River Arun and a cut-off meander loop and berm. The site has rich and varied flora including reed bed, fen, tall herb, and woodland communities.

The meander still receives some water flow and contains a variety of habitats. The open channel of the meander is vegetated with Common Reed *Phragmites australis* and Reed Sweet-grass *Glyceria maxima,* while shallow water communities closer to the riverbank are vegetated by Reed Canary-grass *Phalaris arundinacea.* The meander embankments are vegetated by scrubby woodlands including tree species: Ash *Fraxinus excelsior,* White Willow *Salix alba*, Pedunculate Oak *Quercus robur,* Wild Privet *Ligustrum vulgare,* and Blackthorn *Prunus spinosa.* Open areas are dominated by ruderal herbs, including Bramble *Rubus fructicosus* agg.

On the small section of main river included within the SSSI, the river embankments are vegetated by rushes (*Juncus* spp.) with colonies of Ash woodland and Elder *Sambucus nigra*. Areas of deeper water are vegetated with reed beds, while shallow water communities are dominated by Reed Sweet-grass, Reed Canary-grass and species associated with brackish water. This includes Sea Club-rush *Scirpus maritimus,* Grey Club-rush *Schoenoplectus tabernaemontani*, and the Vulnerable (VU) (Cheffings et al., 2005) hybrid club-rush as *Schoenoplectus x kuekenthalianus* (a hybrid between Grey Club-rush *Schoenoplectus tabernaemontani* and Triangular Club-rush *Schoenoplectus triqueter*).

The berm is vegetated by Water Mint *Mentha aquatica,* Common Fleabane *Pulicaria dysenterica,* Silverweed *Potentilla anserina,* Meadowsweet *Filipendula ulmaria*, Hemlock Water-dropwort *Oenanthe crocata*, Yellow Iris *Iris pseudacorus* and the Nationally Scarce Marsh-mallow *Althaea officinalis*. Surrounding ditches support communities of Common Reed, rushes, bur-reeds (*Sparganium* spp.), and sedges (*Carex* spp.).

Appendix 2 of this assessment provides the CSMG, Natural England standardised guidance, and conservation objectives relevant to this site. The findings and condition status for this sites feature's attributes are summarised in the below sections.

Interest features and condition

An overview of the features assessed, and current condition status following the recent surveys and site check are detailed in Table 3.1.

Table 3.1 - Condition status of Arun Banks SSSI and its monitored notified features following the 2021-23 review.

Feature	Attributes	Meets CSMG target	New condition status	Confidence
Schoenoplectus x kuekenthalianus **Nationally Rare plant species: *Schoenoplectus lacustris* sub species *tabernaemontani x triqueter* hybrid [note 1].**	Presence	Pass	Favourable	High
Schoenoplectus x kuekenthalianus **Nationally Rare plant species: *Schoenoplectus lacustris* sub species *tabernaemontani x triqueter* hybrid [note 1].**	Negative indicators: competition	Unassessed	Unassessed	Not applicable
***Alnus glutinosa - Carex paniculata* woodland (W5) *Alnus glutinosa-Urtica dioica* woodland (W6)**	Habitat extent	Pass	Favourable	High
***Alnus glutinosa - Carex paniculata* woodland (W5) *Alnus glutinosa-Urtica dioica* woodland (W6)**	Structure and Natural processes	Unassessed	Unassessed	Not applicable

***Alnus glutinosa - Carex paniculata* woodland (W5) *Alnus glutinosa-Urtica dioica* woodland (W6)**	Composition	Unassessed	Unassessed	Not applicable
***Alnus glutinosa - Carex paniculata* woodland (W5) *Alnus glutinosa-Urtica dioica* woodland (W6)**	Indicators of local distinctiveness	Unassessed	Unassessed	Not applicable
***Alnus glutinosa - Carex paniculata* woodland (W5) *Alnus glutinosa-Urtica dioica* woodland (W6)**	Regeneration potential	Unassessed	Unassessed	Not applicable
Neutral Grassland - Lowland	Habitat extent	Unassessed	Unassessed	Not applicable

Note 1: Nationally Rare plant species as detailed within The Vascular Plant Red Data List for Great Britain (Cheffings et al., 2005).

In 2021, on behalf of Natural England, Southern Water's botanical ecologists undertook a presence/absence assessment of the nationally notable plant species: *Schoenoplectus x kuekenthalianus*, one of the interest features of this site. The results of this survey found the species to be in healthy condition, with numerous 'clumps' being observed in the area designated (within unit 1, Figure 3.1), a noticeable improvement compared to previous records. Due to this apparent increase in species presence and extent as identified by expert plant ecologists, this feature has been concluded to be meeting the associated targets, with a high confidence in the recorded data.

Figure 3.1 - *Schoenoplectus x kuekenthalianus* on the banks of the River Arun, Arun Banks SSSI. Photo by B.Bennatt (Southern Water).

A site visit in January 2023 (undertaken by the NE protected sites monitoring team) confirmed the continual presence of the wet woodland feature and resulted in the Habitat Extent attribute being concluded as Favourable condition. The monitoring team did not undertake a full assessment of this features attributes during the visit, however, noted the presence of some good quality wet woodland habitat, comprising of a mixture of tree species and age. A low abundance of young seedlings and saplings was also noted during the visit, and the significant level of overshading observed by the monitoring team was highlighted as a potential pressure impacting regeneration. The areas of standing water within the woodland habitat that follows the old cut-off meander of the River Arun were observed, to be dominated in places by Least Duckweed *Lemna minuta*, a non-native species that has rapidly spread and become naturalised in the England. Overshading from high canopy cover was also detailed across the vast majority of the water courses natural route, and a high-level of deadwood was observed within the water.

There was insufficient time to undertake the necessary surveys for all wet woodland attributes, and the lowland neutral grassland feature at this site. Therefore, there is not enough certainty or confidence to assess condition of all features and their attributes (refers to those deemed unassessed in Table 3.1). Despite the absence of a full assessment of features, the observations made during Natural England's site visit indicate that there are several potential pressures which could be impacting the site (detailed

further within section 15). Natural England acknowledge that further investigation is needed to better understand the current and required management of this site, including appropriate water level management as natural succession, overshading and hydrological changes (limited supply and flow of freshwater) were indicated to be restricting the diversity and abundance of aquatic vegetation. This requires ongoing work that will be completed at a later stage, subject to Natural England resources and should include a fully detailed condition assessment undertaken during the appropriate time of year.

4. Upper Arun SSSI

Background

The Upper Arun SSSI is a 13 kilometre (km), 17.58 ha stretch of the River Arun. Flowing south across the weald clay and lower greensand, this site was designated for its outstanding Odonata assemblage. At the time of its notification at least 15 species were known to breed in the river, including the Nationally Rare Scarce Chaser *Libellula fulva* (IUCN GB near threatened*),* Brilliant Emerald *Somatochlora metallica* (IUCN GB Vulnerable), and the Club-tailed Dragonfly *Gomphus vulgatissimus* (IUCN GB Near threatened*),* as well as the notable species Hairy Dragonfly *Brachytron pratense*.

This outstanding assemblage is supported by freshwater river type habitats with bank erosion and a diverse riverine flora. At the time of notification this included Common Club-rush *Schoenoplectus lacustris*, Reed Canary-grass, sedges *(Carex* spp.*)*, Water-plantain *Alisma plantago-aquatica*, Arrowhead *Sagittaria sagittifolia* and Yellow Water-lily *Nuphar lutea*. The riverbank is vegetated with Common Nettle *Urtica dioica* and docks (*Rumex* spp.*),* and in places unvegetated. Odonata populations depend on this complex habitat structure for breeding, feeding, and resting sites.

Natural England staff and expert dragonfly consultant Dr Alison Barker undertook surveys over the summer of 2021 (between May and September, Figures 4.1 – 4.6) following JNCC CSMG for Odonata (Barker, 2022). Appendix 3 of this assessment provides the CSMG, Natural England standardised guidance and conservation objectives relevant to this site. The findings and condition status for the feature's attributes are summarised in the below sections, relevant to the Upper Arun SSSI.

Odonata assemblage interest feature and condition

An overview of the attributes assessed and current condition status following the recent surveys is detailed in Table 4.1.

Table 4.1. - Condition status following 2021-23 review of the Upper Arun aggregations of outstanding Odonata assemblage.

Attribute	Meets CSMG target	New condition status	Confidence
Presence	Pass	Favourable	High
Evidence of breeding	Pass	Favourable	High

Attribute	Meets CSMG target	New condition status	Confidence
Number of species	Pass	Favourable	High
Larval habitat	Unassessed	Unassessed	Not applicable
% Cover emergent vegetation	Pass	Favourable	Low [note 1]
% Cover submerged vegetation	Fail	Unfavourable Declining	Medium [note 2]
% Water's edge shaded by overhanging trees	Pass	Favourable	High
Adult foraging habitat Vegetation heterogeneity	Pass	Favourable	High
Adult foraging habitat Record negative factors	Fail	Unfavourable Declining	Low [note 1]

Note 1: The results for these attributes have been assigned a low confidence rating as heavy rainfall and subsequent flooding of parts of the site meant fewer habitat surveys were carried out than would have been desired.

Note 2: This attribute has been assigned a medium confidence rating as the current target is not considered to be stringent enough for this site. Further information on this is provided in the narrative below.

At the time of notification, 15 species were known to be present and breeding within the SSSI, this includes four notable species: Scarce Chaser, Club-tailed Dragonfly, Hairy Dragonfly, and Brilliant Emerald (Figure 4.1). For the maintenance of Favourable condition of this feature, this number of species (15) must be achieved, and although not essential, it is desired that the four notable species should also be present. During the survey period (May-September 2021) it was observed that a total of 22 species were present, 17 of which had evidence of breeding, with all four of the notable species of importance recorded as present in good numbers. This exceeded all the required targets as detailed under the Presence, Evidence of breeding, and Number of species attributes (including notable species) and for these attributes, Favourable condition status was concluded.

In addition to assessing the physical presence and breeding of Odonata species, assessment of habitat and vegetation attributes are also used to determine condition status of the SSSI (relevant to the feature) and subsequent favourability of the Outstanding Odonata assemblage. Whilst concerted effort was undertaken to assess all

habitat and vegetation attributes (as detailed within Table 4.1) during Natural England's assessment of this feature, weather conditions faced by surveyors, including increasing cloud coverage, rising wind, and heavy rainfall (leading to the river being in spate, Figure 4.6) meant that fewer than desired site locations were able to be assessed. This resulted in a low confidence rating being concluded for some of these feature's attributes (as detailed within Table 4.1, Note 1).

For one of these low confidence attributes, the cover of emergent vegetation attribute (% Cover emergent vegetation), Favourable condition requirements were met (MS details target of 15 – 40%) with an observed calculated range equivalent to 22 % being recorded. Of the floral species noted during assessment, the most common emergent plants present were Branched Bur-reed (*Sparganium erectum)*, Common Club-rush*,* Reed Canary-grass*,* and Reed Sweet-grass (*Glyceria maxima)*. This presence of a range of emergent vegetation, particularly taller plant species such as Reed Canary-grass is deemed a vital requirement of supporting habitat for many species of Odonata, including the notable Scarce Chaser whose larvae utilise such botanical species as emergence sites.

The cover of submerged vegetation (% Cover submerged vegetation attribute) recorded at the surveyed sites was calculated to be equivalent to approximately 6%, failing to meet the targeted range of 30-50%. However, it has been noted (by a Natural England invertebrate specialist) that perhaps this target could be considered slightly stringent, and that a target of 10-40% would be more appropriate. Regardless of this, the results obtained from NE's assessment would still fail to meet the existing and/or revised target, and thus for this attribute Unfavourable Declining condition was concluded. Whilst a great abundance of submerged vegetation may not be pivotal for all species of Odonata, it still has some substantial benefits that can attribute towards their success, and as such is an important consideration. For example, some species of Odonata utilise submerged vegetation as a suitable substrate for oviposition (the laying of eggs), providing cover from potential predation. In addition to this, adequate coverage of submerged vegetation can also be beneficial in supporting adult Odonata, providing habitat for a diverse range of aquatic insects which can be utilised as a source of food.

Environmental shading is another factor, that dependent on the species can have varying effects on Odonata, both positive and negative. When managed appropriately, pockets of shade can be beneficial; regulating water temperature and reducing the amount of light reaching the water surface, thus limiting the growth of algae and other organisms that compete with Odonata larvae for resources. During NE's assessment, an average of 14 % of the water's edge (as noted from the surveyed sites) were shaded by overhanging trees. This met the target of less than 25 – 30 % coverage and for this attribute, Favourable condition was concluded.

In relation to adult foraging habitat, there are two attributes to assess against. The first, vegetation heterogeneity, has a target of; a single surface being present in no more than 50% of the stops, and more than 3 different surfaces present in at least 20% of the stops. The results obtained from NE's assessment showed that only 2% of stops had a single surface present, and 48% had more than 3 different surfaces, meeting both the required

targets for this attribute (Adult foraging habitat Vegetation heterogeneity) and enabling Favourable condition to be concluded. Ensuring such presence of habitats with good variety and availability is seen an important factor to support diverse populations of Odonata as fragmentation can inhibit the ability of Odonata to forage, move and establish new populations. The second attribute, which involves recording the presence of negative factors was assessed as Unfavourable Declining condition due to the presence of overly high and steep riverbanks, as well as the INNS Himalayan Balsam (*Impatiens glandulifera,* Figure 4.5) and Water Fern (*Azolla filiculoides).* Whilst Water Fern was not recorded within the boundaries of the SSSI and only noted to be present in the adjacent canal, this species is known to spread easily in a vegetative manner and as such has been included as a negative factor within this assessment.

Figure 4.1 - Brilliant emerald (*Somatochlora metallica*) dragonfly in Upper Arun SSSI. Photo by H. Stanworth (Natural England).

Figure 4.2 - Migrant Hawker (*Aeshna mixta*) dragonfly in Upper Arun SSSI. Photo by K. Fekete (Natural England).

Figure 4.3 - White-legged (*Platycnemis pennipes*) damselfly pair mating in Upper Arun SSSI Photo by K. Fekete (Natural England).

Figure 4.4 - Willow emerald (*Chalcolestes viridis*) damselfly oviposition scars on a broken stem in Arun Banks SSSI. Photo by A. Barker.

Figure 4.5 - Himalayan Balsam (*Impatiens glandulifera*) in Arun Banks SSSI. Photo by A. Barker.

Figure 4.6 - High water levels of the River Arun, Arun Banks SSSI, during the survey period. Photo by H. Stanworth (Natural England).

5. Floodplain sites – Odonata

Amberley Wild Brooks SSSI and Pulborough Brooks SSSI both underpin the Arun Valley SAC, SPA, and Ramsar sites. They are notable and designated for their rich aquatic flora and invertebrate fauna. One of the main invertebrate interest features under these designations is dragonflies (Odonata). Therefore, this section of the report will analyse and focus on the state, condition, and suitability of the sites to support the species.

Amberley Wild Brooks SSSI lies on acid greensand and river alluvium, with parts of the site being fed by calcareous springs, resulting in a range of pH. Alluvial grazing marsh dissected by drainage ditches is most prominent and supports a wide range of rich flora and several uncommon invertebrates including a rich assemblage of dragonflies. At the time of designation, seventeen species of dragonfly were known to be present and breeding on site, including the uncommon Downy Emerald *Cordulia aenea*.

Pulborough Brooks SSSI consists of a series of fields on the floodplain of the River Arun between Pulborough and Greatham. These fields are subject to winter and summer flooding and are dissected by a network of wet ditches, several of which support a rich aquatic flora and invertebrate fauna. Of the Odonata, there have been observations and records of some important and rare species, including the Nationally Rare Scarce Chaser and Club-tailed dragonflies, the notable Variable Damselfly *Coenagrion pulchellum* and the local, Red-eyed Damselfly *Erythromma najas*.

Assessments regarding the Odonata features have been based on external data, from land managers of the relevant sites (where data has been deemed CSMG compliant). Appendix 4 of this assessment provides the CSMG, Natural England standardised guidance and conservation objectives relevant to this feature. The findings and condition status for the feature's attributes are summarised in the below sections, relevant to each SSSI.

Amberley Wild Brooks SSSI

Interest features and condition

As above, Amberley Wild Brooks SSSI was known to support a rich assemblage of dragonflies. At the time of its notification, the site supported 17 breeding species of dragonfly, including the Nationally Scarce species: Downy Emerald, Scarce Chaser, and Hairy Dragonfly; and the locally rare species Club-tailed Dragonfly and Scarce Emerald Damselfly *Lestes sponsa*. The outstanding dragonfly assemblage is linked to the ditches, streams and areas of open water that crisscross the site, providing supporting habitat for both breeding and foraging, however, many will also forage extensively across the surrounding, open semi-natural habitat.

An overview of the attributes assessed and current condition status following the recent surveys is detailed in Table 5.1.

Table 5.1 - Condition status following 2021-23 review of Amberley Wild Brooks aggregations of outstanding Odonata assemblage.

Attribute	Meets CSMG target	New condition status	Confidence
Number of species	Pass	Favourable	High
Habitat extent	Pass	Favourable	High
Habitat structure: emergent vegetation	Unassessed	Unassessed	Not applicable
Habitat structure: submerged vegetation	Unassessed	Unassessed	Not applicable
Vegetation heterogeneity diverse surface topography of vegetation types	Unassessed	Unassessed	Not applicable
Presence of negative factors	Unassessed	Unassessed	Not applicable

The number of species attribute was assessed using RSPB (Royal Society for the Protection of Birds) Odonata data at the site. Over the 5-year period (2018-2022), 23 species of Odonata were recorded, therefore passing the target of more than 17 species required. Three of the species recorded in this period, Variable Damselfly, Club-tailed Dragonfly, and Scarce Chaser, are classified as near threatened in The Odonata Red Data List for Great Britain (2008). The locally rare Scarce Emerald Damselfly was also recorded in this period. Furthermore, there was a single recorded presence of a Norfolk Hawker (*Anaciaeschna isosceles)*, a species classified as Endangered on The Odonata Red Data List for Great Britain (2008) and a Biodiversity Action Plan Priority Species, protected under Schedule 5 of the Wildlife and Countryside Act. The Nationally Scarce Downy Emerald, which is named in the designation, was not recorded during this period.

The habitat extent attribute for this feature is related to the ditch systems on site. As there is no evidence of ditch infilling and no change in ditch extent, this attribute has been concluded to be in Favourable condition status. For the remaining habitat attributes, there was insufficient time to undertake all the necessary surveys to accurately determine favourability. Therefore, these remain currently Unassessed (as detailed within Table 5.1). Natural England acknowledge that further monitoring is required to fully assess this feature

and all associated attributes, and that specific surveys should be undertaken in future assessments.

Pulborough Brooks SSSI

Interest features and condition

At designation, Pulborough Brooks SSSI was known to support an assemblage of important invertebrate fauna including several notable species of Odonata. As detailed within the citation for this site, this included the Nationally Rare Scarce chaser and Club-tailed dragonfly, the notable, Variable damselfly, and the locally important, Red-eyed damselfly.

Despite the local or national importance of these species, none had previously been assigned as individual designated features and were only monitored as part of the broader invertebrate assemblage for the site, as detailed within the MS. During Natural England's recent assessment, advice was sought to determine whether these species should be added as designated features solely, or collectively as an Odonata assemblage for future monitoring.

As both the Variable damselfly, and Red-eyed damselfly are deemed to be only of local importance, these species were removed from contention as individual features. For the nationally important species, Scarce chaser and Club-tailed dragonfly, habitat characteristics and on-site records (RSPB Odonata data) was used to determine the suitability of these species as features, relative to the site. Assessment of RSPB data showed a noted absence of Club-tailed dragonfly throughout the 5-year period, and a subsequent review of an additional data source (The Sussex Dragonfly Atlas) showed no recorded presence of the species at, or around Pulborough Brooks (1 km grid square, 1989 - 2003) during the time of designation. Therefore, it has been concluded that the inclusion of the species within the original citation could be attributed to error, resulting from historical or incidental unverified records, and that Club-tailed dragonfly is not a suitable feature for this site (pers. Comms, NE Invertebrate specialist).

For the Scarce chaser dragonfly, positive species presence was determined and following guidance from Natural England's invertebrate specialist, it has been concluded that this species should be added as a designated feature for the site. This will be included when the specification is revised soon (subject to Natural England resources).

An overview of the features and attributes assessed and current condition status following the recent surveys is detailed in Table 5.2.

Table 5.1 Condition status following 2021-23 review of Pulborough Brooks aggregations of outstanding Odonata assemblage features.

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Rare Odonota: *Libellula fulva*, Scarce Chaser	Presence/Absence	Pass	Favourable	Low [note 1]
Rare Odonota: *Libellula fulva*, Scarce Chaser	Evidence of breeding	Unassessed	Unassessed	Not applicable
Rare Odonota: *Libellula fulva*, Scarce Chaser (Habitat structure)	Water movement	Unassessed	Unassessed	Not applicable
Rare Odonota: *Libellula fulva*, Scarce Chaser (Habitat structure)	Ditch edge profile	Unassessed	Unassessed	Not applicable
Rare Odonota: *Libellula fulva*, Scarce Chaser (Habitat structure)	(%) Emergent vegetation cover	Unassessed	Unassessed	Not applicable
Rare Odonota: *Libellula fulva*, Scarce Chaser (Habitat structure)	(%) Emergent vegetation structure	Unassessed	Unassessed	Not applicable
Rare Odonota: *Libellula fulva*, Scarce Chaser (Habitat structure)	(%) Cover of scrub	Unassessed	Unassessed	Not applicable

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Rare Odonota: *Libellula fulva*, Scarce Chaser (Habitat structure)	Predators	Unassessed	Unassessed	Not applicable
Rare Odonota: *Libellula fulva*, Scarce Chaser (Habitat structure)	Water quality	Unassessed	Unassessed	Not applicable

Note 1: A low confidence rating has been assigned as recording is carried out on an ad-hoc basis rather than through structured surveys. Further detail on this is included in the narrative below.

The presence of Scarce Chaser at Pulborough Brooks SSSI is detailed within the original MS, and describes the population as being “widespread” across the site. Whilst the assessment of RSPB Odonata data does show a positive presence of the species, meeting the targeted requirements for the Presence/Absence attribute, the on-site recorded observations are deemed to be representative of a low-level abundance, being noted only 5 times over the 5-year period. Although the apparent disparities between recently collated data and historical observations could be construed as being indicative of a declining population and by association, an Unfavourable Declining condition, in the absence of appropriate baseline data this could not be concluded with certainty. Therefore, although the species is present and Favourable condition status has been achieved, a low confidence rating for this attribute (Presence/Absence) has been concluded. Natural England acknowledge that further monitoring is required to increase certainty and ensure that Favourable condition can be maintained.

In addition to Presence/Absence, Evidence of breeding, and several Habitat Structure attributes; Water movement, Ditch edge profile, (%) Emergent vegetation cover, (%) Emergent vegetation structure, (%) Cover of scrub, Predators, and Water quality should also be assessed to determine feature favourability. Following guidance from Natural England’s invertebrate specialists, these attributes will be added to the MS for the site when the specification is reviewed soon. However, as these were not assessed during Natural England’s recent assessment, they currently remain unassessed (as detailed in Table 5.2).

6. Floodplain sites – Invertebrates

The three SSSIs that underpin the Arun Valley SAC, SPA, and Ramsar site (Amberley Wild Brooks, Pulborough Brooks, and Waltham Brooks) consist of an extensive area of alluvial grazing marsh interlinked with drainage ditches. These habitats and sites were designated because they support a rich and diverse range of flora and fauna. In terms of fauna, this includes many uncommon invertebrates and within this, an outstanding assemblage of dragonflies. Seventeen species of dragonfly have been known to breed on these sites, including the Nationally Rare Scarce Chaser and Club-tailed dragonflies. These sites are also the locality for two rare snails (molluscs): the Little Whirlpool Ramshorn Snail *Anisus vorticulus* (the SAC feature) and *Pseudamnicola confuse*, as well as numerous Nationally Scarce water beetles. Consequently, wetland invertebrate species form one of the criteria of the overlapping Ramsar designation.

Despite this, only Amberley Wild Brooks SSSI and Pulborough Brooks SSSI are noted as having invertebrate assemblage features, and as such only these two sites are covered within this report. Surveys for assessing the invertebrate assemblages at the floodplain SSSIs were commissioned by Natural England to assess this designated feature. The monitoring and assessment were undertaken in 2021 (Godfrey, available on request). Appendix 5 of this assessment provides the CSMG, Natural England standardised guidance and conservation objectives relevant to this feature. The findings and condition status for the feature's attributes relevant to each SSSI are summarised in the below sections.

Amberley Wild Brooks SSSI

Interest features and condition

Natural England invertebrate specialists have assigned three Specific Assemblage Types (SATs) of invertebrates that should be interest features of this SSSI; communities supported by open water & mineral marsh (W21), permanent wet mire, fen & seepage (W31) and grassland & scrub matrix (F001). Currently Grassland & scrub matrix (F001) is not included as a monitored interest feature. This SAT will be added as a monitored interest feature for this SSSI for inclusion within the MS and condition assessment criteria (timeframes to complete this will be dependent on Natural England resources).

The current designated features for this site also includes another SAT within the invertebrate assemblages; W11 fast-flowing water/river shingle. This feature has the following attributes to assess against; presence/absence and vegetation heterogeneity diverse surface typography. On review, Natural England invertebrate specialists have agreed this SAT is not appropriate for this SSSI and will therefore be removed within the MS and condition assessment criteria as it will no longer be a designated feature of the site (timeframes to complete this will be dependent on Natural England resources).

An overview of the SATs and attributes assessed and current condition status following the recent surveys is detailed in Table 6.1.

Table 6.1 - Condition status of Amberley Wild Brooks outstanding invertebrate assemblage following the 2021-23 review.

SAT	Meets CSMG target	New condition status	Confidence
Open water & mineral marsh (W21) Presence/Absence score	Fails	Unfavourable No Change	Medium [note 1]
Permanent wet mire, fen & seepage (W31) Presence/Absence score	Pass	Favourable	Low [note 2]
Grassland & scrub matrix (F001) Presence/Absence score	Fails	Unfavourable No Change	Medium [note 1]
Attribute	**Meets CSMG target**	**New condition status**	**Confidence**
Habitat extent for all SATs	Pass	Favourable	High
Vegetation heterogeneity Diverse surface topography (W21, W31, F001)	Unknown	Unassessed	Not applicable
Dead organic matter: litter	Unknown	Unassessed	Not applicable
Nectar sources	Unknown	Unassessed	Not applicable
Seed heads	Unknown	Unassessed	Not applicable

Note 1: Medium confidence has been assigned as there is no baseline to assess against. Further information is provided in the narrative below.

Note 2: Low confidence has been assigned as the results from Pantheon do not fully align with the observations made by the consultant.

The assessment of invertebrate assemblages has been undertaken by an expert consultant and the data analysed through Pantheon – a system developed by Natural

England for the purpose of condition assessment. This software analyses the data and determines condition status against the SATs. The condition status has been based on the Pantheon results, however some observations from the consultant do partially differ to the results from Pantheon, which is why confidence ratings in the table above vary. For example, for the Permanent wet mire, fen & seepage (W31) SAT as the appropriate species were present, this meets the target and therefore is in Favourable condition, however the score was borderline. Due to the low confidence in the data, this SAT requires further monitoring to be certain Favourable condition is maintained especially in light of the other pressures identified on the supporting habitat.

From the conclusions of both the consultant and Natural England invertebrate specialist, for those SATs where they have failed to achieve Favourable condition, Open water & mineral marsh (W21) and Grassland & scrub matrix (F001), the scoring indicated that thresholds were not met by a large margin. This implies that significant effort would be required to bring these features into Favourable condition. Natural England do not have baseline information on these SATs to accurately compare against; therefore, it is not possible to determine if these SATs are declining. For this reason, the condition is classed as Unfavourable No Change.

There was insufficient time to undertake the necessary surveys to assess all of the attributes associated with these SATs. Therefore, there is not enough certainty or confidence to assess condition of all of the attributes listed in Table 6.1.

Pulborough Brooks SSSI

Interest features and condition

Natural England invertebrate specialists have determined that there are two SATs of invertebrates that should be interest features of this SSSI; communities supported by Open water & mineral marsh (W21) and Permanent wet mire, fen & seepage (W31). Currently Permanent wet mire, fen & seepage (W31) is not included as a monitored interest feature. This SAT will be added as a monitored interest feature for this SSSI for inclusion within the MS and condition assessment criteria (timeframes to complete this will be dependent on Natural England resources). Further review is required to determine whether this site should also include the F001 Grassland & scrub matrix invertebrate assemblage interest feature.

The current designated features for this site also include another SAT within the invertebrate assemblages; W53 Saltmarsh, estuary and mudflat. This feature has the following attributes to assess against; presence/absence and vegetation heterogeneity diverse surface typography. On review, Natural England invertebrate specialists have agreed that this SAT is not appropriate for this SSSI and will therefore be removed within the MS and condition assessment criteria as it will no longer be a designated feature of the site (timeframes to complete this will be dependent on NE resources).

An overview of the SATs and attributes assessed and current condition status following the recent surveys is detailed in Table 6.2.

Table 6.2 - Condition status of Pulborough Brooks outstanding invertebrate assemblage following the 2021-23 review.

SAT	Meets CSMG target	New condition status	Confidence
Open water & mineral marsh (W21) Presence/Absence score	Fails	Unfavourable Declining	Medium [Note 1]
Permanent wet mire, fen & seepage (W31) Presence/Absence score	Pass	Favourable	Low [Note 2]
Attribute	**Meets CSMG target**	**New condition status**	**Confidence**
Habitat extent	Pass	Favourable	High
Vegetation heterogeneity Diverse surface topography (W21)	Unknown	Unassessed	Not applicable
Vegetation heterogeneity Diverse surface topography (W31)	Unknown	Unassessed	Not applicable

Note 1: A medium confidence rating has been assigned because there is no there is no baseline to assess against. Further information is provided in the narrative below.

Note 2: A low confidence rating has been assigned as the results from Pantheon are borderline and do not fully align with the observations made by the consultant.

The assessment of invertebrate assemblages has been undertaken by an expert consultant and the data analysed through Pantheon. The condition status has been based on the Pantheon results, however some observations from the consultant do partially differ to the results from Pantheon which is why confidence ratings in the table above vary. For example, for the Permanent wet mire, fen & seepage (W31) SAT as the appropriate species were present, this meets the target and therefore is in Favourable condition, however the scoring is borderline. Due to the low confidence in the data, this SAT requires further monitoring and potentially conservation action to be certain Favourable condition is maintained.

From the conclusions of both the consultant and Natural England invertebrate specialist, for the SAT where it failed to achieve Favourable condition, Open water & mineral marsh (W21), the scoring indicated that thresholds were not met by a large margin. This implies that significant effort would be required to bring this feature into Favourable condition, as previously classified. Whilst Natural England acknowledge that there is a lack of baseline data for this SAT on site, making it difficult to determine population characteristics (i.e., size), condition status guidance dictates that the feature must now be classified as being in unfavourable condition (rather than Favourable condition as it was previously) and as such an Unfavourable Declining condition was concluded.

There was insufficient time to undertake the necessary surveys to assess all of the attributes associated with these SATs. Therefore, there is not enough certainty or confidence to assess condition of all of the attributes listed in Table 6.2.

7. Floodplain sites – Ornithology

The three SSSIs that underpin the Arun Valley SAC, SPA, and Ramsar site (Amberley Wild Brooks, Pulborough Brooks, and Waltham Brooks) support a variety of over wintering and breeding bird species. The numbers of birds which over-winter are nationally significant.

The wet alluvial marsh is valuable for wintering birds including nationally significant numbers of teal and shoveler. Historically these sites recorded healthy numbers of Bewick's swan. In recent years several species have seen a significant decline including the over-wintering Bewick's swan and breeding Redshank, which have almost disappeared from these sites completely, whilst other species appear stable. Other breeding birds include ground nesting species such as snipe, fenland birds such as reed warbler and woodland birds like green woodpecker.

The findings and condition status for the bird features and their attributes are summarised in the below sections, relevant to each SSSI that underpins the Arun Valley SAC, SPA and Ramsar designations (Amberley Wild Brooks, Pulborough Brooks and Waltham Brooks).

Assessments of non-breeding bird features have been based predominately on the Wetland Bird Survey (WeBS) supplied by the British Trust for Ornithology (BTO). WeBS is a partnership, jointly funded by the BTO, RSPB, and JNCC, with fieldwork conducted by volunteers. For example, bird species analysis was based on the BTO WeBS data, with 5-year peak mean averages used to represent the species number and compared with targets set in Natural England's MS documents for each of these bird features across the three SSSIs. The 5-year peak mean from time of site designation has also been included where available.

Assessments for some attributes have also involved reviewing data from land managers for the sites (where it has been deemed CSMG compliant). Appendix 6 of this assessment provides the CSMG, Natural England standardised guidance and conservation objectives relevant to this feature.

Additionally, where the information was available, the report details whether the bird records are in line with national trends for the species. Unfortunately, there was not the records available to complete an assessment of all the bird assemblage features, those that were not possible to complete should be assessed as soon as possible.

Amberley Wild Brooks SSSI

Wintering bird features and condition

An overview of the features and attributes assessed and current condition status following the recent surveys is detailed in Table 7.1.

Table 7.1 - Condition status following 2021-23 review of the Amberley Wild Brooks SSSI aggregations of wintering birds' feature.

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Variety of wintering species	Habitat extent	Pass	Favourable	High
	Number of species	Pass	Favourable	High
Shoveler, *Spatula clypeata*	Population	Pass	Favourable	Low [note 1]
Teal, *Anas crecca*	Population	Pass	Favourable	High
Bewick's Swan, *Cygnus columbianus bewickii*	Population	Fails	Unfavourable Declining	High

Note 1: Low confidence has been assigned to this attribute as BTO advise caution with recent data, as records may have been negatively impacted by COVID-19.

In relation to the variety of wintering birds feature, the habitat extent attribute passes based on aerial images. The numbers of species attribute have a target of 76 species (in the MS for this site). The surveys between November 2020 to February 2021 recorded 85 species present and in November 2021 to February 2022 the surveys recorded 79 species present. As these numbers both meet the conservation target, it is concluded to be in Favourable condition.

For Shoveler, the number of birds recorded (the population attribute) is assessed against a target for this species as stated in the MS, which is 29. During this assessment, the MS target was met. The 5-year peak mean from surveys between 2014 and 2019 was 106, and from surveys between 2016 and 2021 it was 49 (Figure 7.1). As stated, (Note 1, Table 7.1), confidence in recent data is low, and continued monitoring is advised to ensure Favourable condition is maintained. WeBS alerts covering the period up to winter 17/18 state:

> "Numbers of Shoveler over-wintering on Amberley Wild Brooks SSSI have fluctuated throughout the period recorded by WeBS making interpretation of the underlying trend difficult. However, changes in numbers have been insufficient to

have triggered Alerts for this species. Numbers of this species over-wintering within Southern Region have been stable in the medium-term having previously increased. Numbers of this species over-wintering in Great Britain have been increasing long term. The stable proportion of regional numbers supported by this site suggest the environmental conditions remain relatively favourable for this species."

For Teal, the MS population target of 392 was met by a significant margin and therefore this species is in Favourable condition (the 5-year peak mean from surveys between 2014 and 2019 was 1042, and from surveys between 2016 and 2021 it was 932 (Figure 7.1)). WeBS alerts covering the period up to winter 17/18 state:

> *"Numbers of Teal over-wintering on Amberley Wild Brooks SSSI have been stable in the medium-term having previously increased. Consequently, no Alerts have been triggered for this species. Numbers of this species over-wintering within Southern Region have been decreasing in the short-term having previously peaked. Numbers of this species over-wintering in Great Britain have been stable in the medium-term having previously increased. The stable proportion of regional numbers supported by this site suggest the environmental conditions remain relatively favourable for this species."*

For Bewick's Swan, the MS population target of 50 was not met by a substantial margin, as recent records recorded only 5 swans present (Figure 7.1). This significant decline has resulted in the species being in Unfavourable Declining condition. However, this is in line with population declines observed nationally (WeBS Alert report). WeBS alerts covering the period up to winter 17/18 state:

> *"Numbers of Bewick's Swan over-wintering on Amberley Wild Brooks SSSI have been decreasing in the long-term having previously increased. Consequently, Alerts have been triggered for the long-, medium- and short-terms. Numbers of this species over-wintering within Southern Region have fluctuated throughout the period recorded by WeBS making interpretation of the underlying trend difficult. Numbers of this species over-wintering in Great Britain have been decreasing in the long-term having previously increased. The trend on the site appears to be tracking that of the region and British trends. The stable proportion of regional numbers supported by this site suggest the environmental conditions remain relatively favourable for this species. In conclusion, the similarity between the declining site trend and the regional and British trends suggests that the declining numbers underpinning these Alerts result from broad-scale population trends"*.

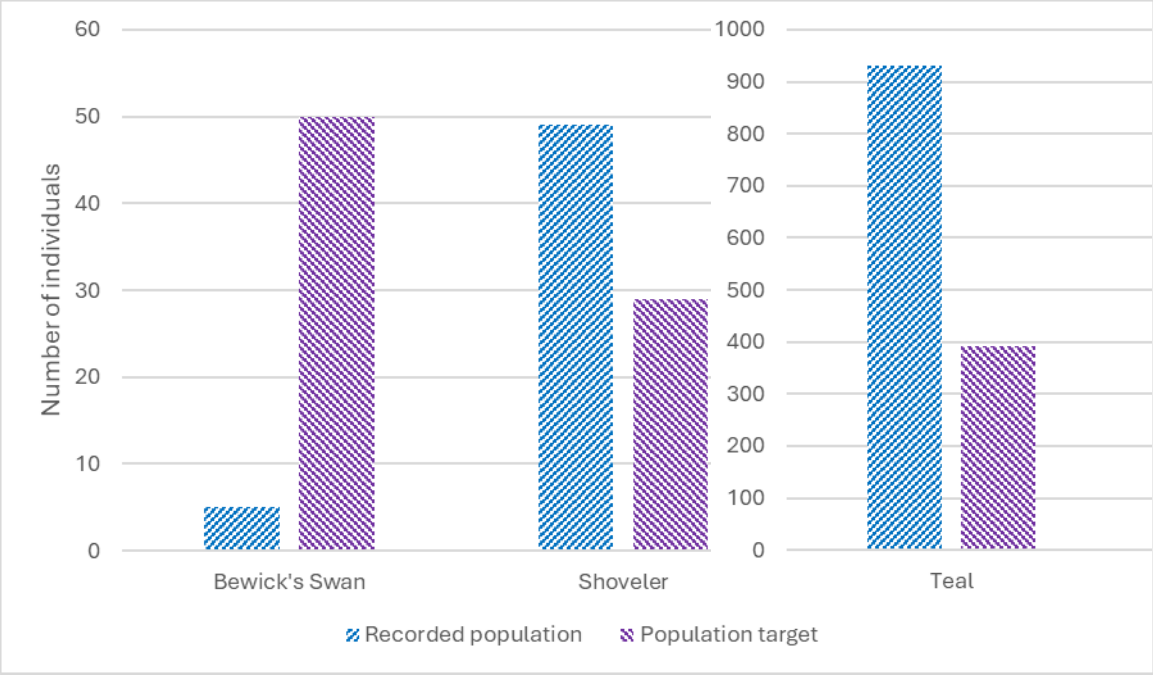


Figure 7.1 - Recorded number of individuals and population targets for the wintering bird features assessed at Amberley Wild Brooks SSSI.

Breeding bird features and condition

An overview of the features and attributes assessed and current condition status following the recent surveys is detailed in Table 7.2.

Table 7.2 - Condition status following 2021-23 review of the Amberley Wild Brooks breeding birds' features.

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Assemblages of breeding birds - Mixed: Lowland damp grassland, Woodland	Number of species	Unknown	Unassessed	Not applicable
Redshank, *Tringa totanus*	Habitat extent	Pass	Favourable	Low [note 1]
	Population	Fails	Unfavourable Declining	High

Note 1: Low confidence has been assigned as it is not fully understood how Redshank use this site, and it is also difficult to distinguish between different (but similar looking) habitat types using aerial imagery.

As the data to assess the number of species regarding the assemblages of breeding birds, mixed (Lowland damp grassland, Woodland) feature was not extensive, it is necessary to work with the RSPB and other partners to collect additional survey data before defining its condition status. From this, further data searches such as from iRecord or Sussex Biodiversity Records centre would offer confidence that the score is representative of the site. The score includes assessing evidence of breeding therefore a specialist survey in future assessments is also advised to enable greater certainty.

For Redshank, condition should be assessed against two attributes, which are supporting habitat extent and population. When comparing aerial imagery over time, the suggested wet open habitat does not appear to have changed significantly and is therefore in Favourable condition. This is in line with the MS, which states aerial imagery or field surveys should been used to ensure “no net loss greater than 5%” and “no increases in area of these open communities beyond 317 ha”. Confidence in the data used to assess this attribute is low however, and further investigation is necessary to ensure this condition is appropriate and is maintained.

From the RSPB data analysed for Redshank, the onsite population records from 2021 showed only one breeding pair (Figure 7.2). Natural England’s bird’s specialist advised that the breeding Redshank feature would be Unfavourable Declining if the population has declined by more than 25% since the last assessment, and if the decline has been less than 25%, then the feature would be classed as Unfavourable No Change. The target for this attribute in the MS is 16 pairs. In 2020, there were three pairs. Consequently, over the past two decades, the site and its Redshank population has consistently failed this target considerably. Due to this significant decline, resulting in only one pair left in 2021, the population and trend is not meeting the target by more than 25% and therefore the condition is Unfavourable Declining.

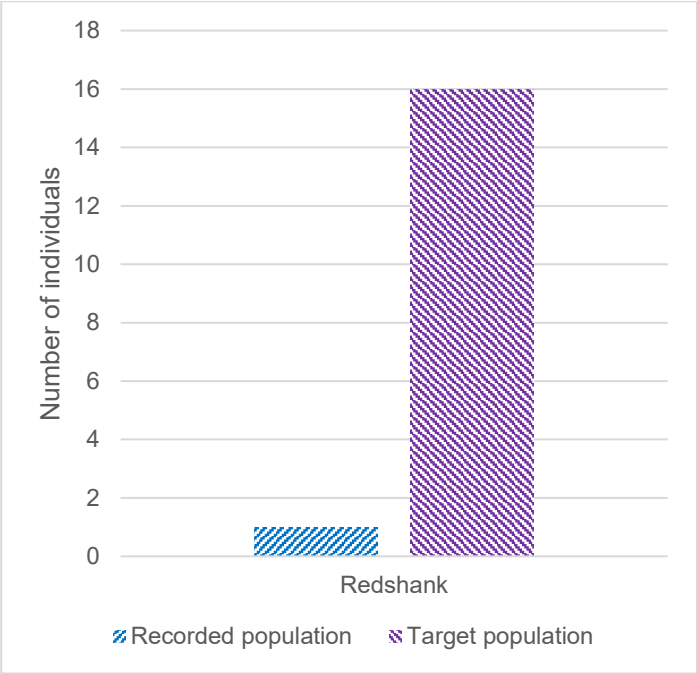


Figure 7.2 - Recorded number of individuals and population target for the Redshank breeding bird feature assessed at Amberley Wild Brooks SSSI.

Pulborough Brooks SSSI

Wintering bird features and condition

An overview of the features and attributes assessed and current condition status following the recent surveys is detailed in Table 7.3.

Table 7.3 - Condition status following 2021-23 review of the Pulborough Brooks aggregations of wintering bird's feature.

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Shoveler, *Spatula clypeata*	Population	Fails	Unfavourable Declining	Low [note 1]
Wigeon, *Mareca penelope*	Population	Fails	Unfavourable Declining	Low [note 1]
Teal, *Anas crecca*	Population	Pass	Favourable	High
Ruff, *Calidris pugnax*	Population	Fails	Unfavourable Declining	High

Pintail, *Anas acuta*	Population	Fails	Unfavourable Declining	Low [note 1]
Bewick's swan, *Cygnus columbianus bewickii*	Population	Fails	Unfavourable Declining	High

Note 1: Low confidence has been assigned for this attribute as BTO advise caution with recent data, as records may have been negatively impacted by COVID-19.

For Shoveler, the MS population target of 140 was not met, however this was borderline (Figure 7.3). A condition of unfavourable declining has been applied. There was a relatively stable trend between the 5-year peak mean during 2014-2019 surveys (127) and 2016-2021 surveys (124), however numbers have fluctuated over the years. Due to numbers fluctuating and the more recent declines, the confidence of the data is low, and it would be advised that the monitoring specifications are revied by specialists. Especially as the condition is contradictory to the opinions of the WeBS alerts covering the period up to winter 17/18, state*:*

> *"Numbers of Shoveler over-wintering on Pulborough Brooks SSSI have fluctuated over the long-term following a previous increase. However, changes in numbers have been insufficient to have triggered Alerts for this species. Numbers of this species over-wintering within Southern Region have been stable in the medium-term having previously increased. Numbers of this species over-wintering in Great Britain have been increasing long term. The stable proportion of regional numbers supported by this site suggest the environmental conditions remain relatively favourable for this species."*

For Wigeon, the MS population target of 2255 was not met, and in recent surveys the numbers are declining. A condition of unfavourable declining has been applied. The 5-year peak mean during the 2014-2019 surveys was 1868, and during the 2016-2021 surveys it was 1486 (Figure 7.3). Due to numbers fluctuating and the more recent declines, the confidence of the data is low, and it would be advised that the monitoring specifications are revied by specialists. Especially as the condition is contradictory to the opinions of the WeBS alerts covering the period up to winter 17/18, state:

> *"Numbers of Wigeon over-wintering on Pulborough Brooks SSSI have been stable in the medium-term having previously peaked. However, changes in numbers have been insufficient to have triggered Alerts for this species. Numbers of this species over-wintering within Southern Region have been stable in the medium-term having previously increased. Numbers of this species over-wintering in Great Britain have been stable in the medium-term having previously increased. The trend on the site appears to be tracking that of the region although not the British trend. The stable*

proportion of regional numbers supported by this site suggest the environmental conditions remain relatively favourable for this species."

For Teal, the MS population target of 452 was met. The 5-year peak mean from surveys between 2014 and 2019 was 1396, and from the surveys between 2016 and 2021 it was 1418 (Figure 7.3). The species is therefore in Favourable condition. WeBS alerts covering the period up to winter 17/18, state:

"Numbers of Teal over-wintering on Pulborough Brooks SSSI have fluctuated throughout the period recorded by WeBS making interpretation of the underlying trend difficult. Accordingly, although Alerts have been triggered for the long-term, they should be viewed with caution. Numbers of this species over-wintering within Southern Region have been decreasing in the short-term having previously peaked. Numbers of this species over-wintering in Great Britain have been stable in the medium-term having previously increased. The trend on the site does not appear to be tracking that of either the region or the British trend. The stable proportion of regional numbers supported by this site suggest the environmental conditions remain relatively favourable for this species. Although Alerts have been triggered, they are difficult to interpret and so it would be prudent to closely monitor numbers of this species on this site in coming winters to assess whether these Alerts are due to fluctuations or local pressures."

For Ruff, the MS population target of 39 was not met and in recent surveys the numbers are declining. The 5-year peak mean during the 2014-2019 surveys was 6**,** and during the 2016-2021 surveys it was 4 (Figure 7.3). The considerable decline observed has resulted in this feature being in Unfavourable Declining condition. This is in line with population trends within the South East and therefore is not seen as a site-specific decline. WeBS alerts covering the period up to winter 17/18, state:

"Numbers of Ruff over-wintering on Pulborough Brooks SSSI have been decreasing long term. Consequently, Alerts have been triggered for the long-, medium- and short-terms. Numbers of this species over-wintering within Southern Region have been decreasing long term. Numbers of this species over-wintering in Great Britain have fluctuated throughout the period recorded by WeBS making interpretation of the underlying trend difficult. The trend on the site appears to be tracking that of the region although not the British trend. The stable proportion of regional numbers supported by this site suggest the environmental conditions remain relatively favourable for this species. In conclusion, the similarity between the site trend and the regional trend suggests that the declining numbers underpinning these Alerts result from broad-scale population trends."

For Pintail, the MS population target of 166 was not met. A condition of unfavourable declining has been applied however; the average is borderline in terms of meeting the target where records were relatively stable. The 5-year peak mean during the 2014-2019 surveys was 103, and during the 2016-2021 surveys it was 160 (Figure 7.3). WeBS advise caution with recent data as records may have been negatively impacted by COVID-19.

Therefore, the confidence of the data is low; further continued monitoring is advised and for this reason. The trend on this site is in line with population trends within the South East and therefore is not seen as a site-specific decline. WeBS alerts covering the period up to winter 17/18, state:

> *"Numbers of Pintail over-wintering on Pulborough Brooks SSSI have been decreasing in the medium-term having previously peaked. Consequently, Alerts have been triggered for the medium- and long-terms. Numbers of this species over-wintering within Southern Region have been decreasing in the short-term having previously peaked. Numbers of this species over-wintering in Great Britain have been decreasing in the medium-term having previously peaked. The stable proportion of regional numbers supported by this site suggest the environmental conditions remain relatively favourable for this species. In conclusion, the similarity between the declining site trend and the regional and British trends suggests that the declining numbers underpinning these Alerts result from broad-scale population trends."*

For Bewick's Swan the population MS target of 52 has not been met by a significant margin; current records have only found one bird to be present (Figure 7.3). The considerable decline observed has resulted in this feature being in Unfavourable Declining condition. However, this is in line with population declines observed nationally (WeBS Alert report). WeBS alerts covering the period up to winter 17/18, state:

> *"Numbers of Bewick's Swan over-wintering on Pulborough Brooks SSSI have been decreasing in the long-term having previously increased. Consequently, Alerts have been triggered for the long-, medium- and short-terms. Numbers of this species over-wintering within Southern Region have fluctuated throughout the period recorded by WeBS making interpretation of the underlying trend difficult. Numbers of this species over-wintering in Great Britain have been decreasing in the long-term having previously increased. The trend on the site appears to be tracking that of the regional and British trends. In conclusion, the similarity between the declining site trend and the regional and British trends suggests that the declining numbers underpinning these Alerts result from broad-scale population trends."*

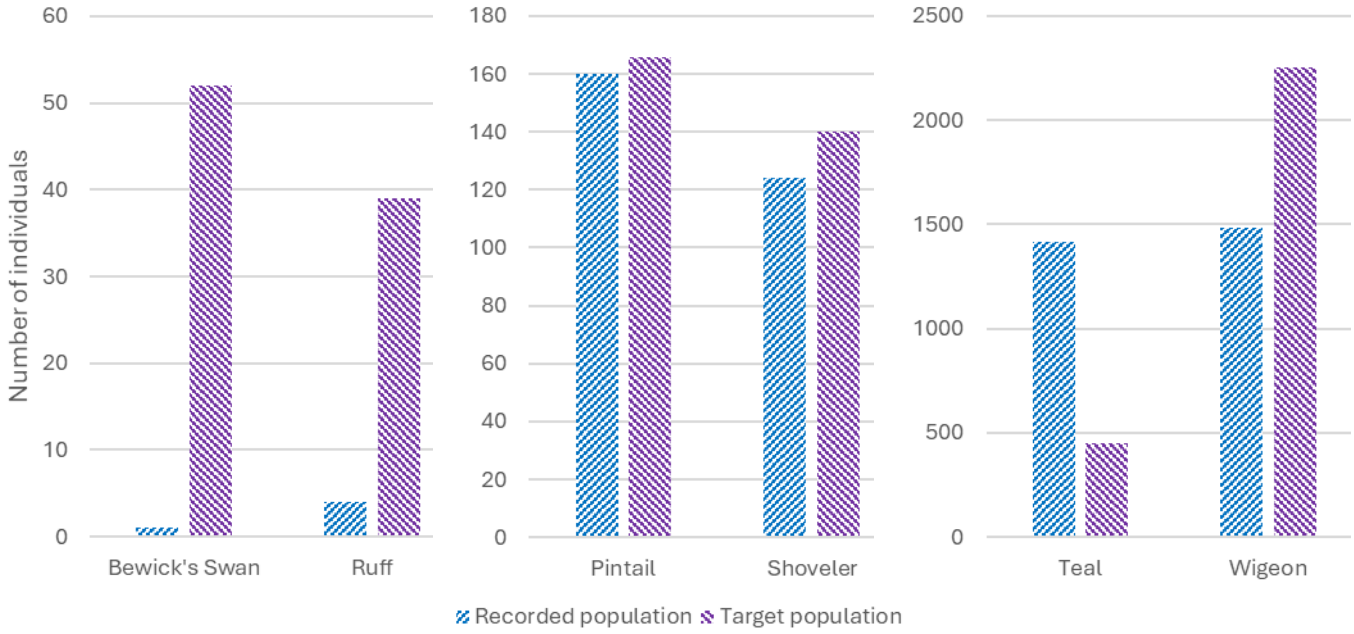


Figure 7.3 - Recorded number of individuals and population targets for wintering bird features assessed at Pulborough Brooks SSSI.

Breeding bird features and condition

An overview of the feature and attribute assessed and current condition status following the recent surveys is detailed in Table 7.4.

Table 7.4 - Condition status following 2021-23 review of the Pulborough Brooks aggregations of breeding bird's feature.

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Assemblages of breeding birds - Lowland damp grasslands	Presence/absence of breeding species	Pass	Favourable	High

The data to assess number of species regarding the assemblages of breeding birds, lowland damp grasslands feature, had a score of 31 where the Natural England target to assess condition against is 12 (the score at designation was 16). The score met the target by a significant margin and therefore is in Favourable condition. The data was based on 2021 records from the RSPB, this with the scoring has resulted in high confidence in the data.

Waltham Brooks SSSI

Wintering bird features and condition

An overview of the features and attributes assessed and current condition status following the recent surveys is detailed in Table 7.5.

Table 7.5 - Condition status following 2021-23 review of the Waltham Brooks aggregations of wintering bird features.

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Bewick's swan, *Cygnus columbianus bewickii*	Population	Fails	Unfavourable Declining	Medium [note 1]
Shoveler, *Spatula clypeata*	Population	Fails	Unfavourable Declining	Medium [note 2]
Teal, *Anas crecca*	Population	Fails	Unfavourable Declining	Medium [note 2]

Note 1: Medium confidence has been assigned for this attribute as the population trend cannot be ascertained from the small number of individuals present on site.

Note 2: Medium confidence has been assigned for these attributes as the number of individuals on this site has fluctuated in the past.

For Bewick's swan the population MS target of 119 (the numbers at designation) has not been met as there are no recent Bewick's Swan sightings recorded at this site (the number therefore being 0, Figure 7.4). The lack of presence of this species has resulted in this feature being in Unfavourable Declining condition. However, this is in line with population declines observed nationally (WeBS Alert report). WeBS alerts covering the period up to winter 17/18, state:

> *"Bewick's Swan occurs too infrequently on this site to make interpretation of the site trend meaningful. Alerts status has not been assessed for this species. This species now typically occurs in such low numbers that it is effectively extirpated from Waltham Brooks SSSI. Numbers of this species over-wintering within Southern Region have been decreasing in the long-term having previously increased. Numbers of this species over-wintering in Great Britain have been decreasing in the long-term having previously increased."*

For Shoveler, the MS population target of 42 was not met and recent surveys are showing further significant decline. The 5-year peak mean from the surveys between 2014 and 2019 was 24, and from surveys between 2016 and 2021 it was 19 (Figure 7.4). The considerable decline observed has resulted in this feature being in Unfavourable Declining condition, although the confidence in the data is medium. For this reason, further investigation is required to understand whether site specific pressures are influencing this decline. WeBS alerts covering the period up to winter 17/18, state:

> *"Numbers of Shoveler over-wintering on Waltham Brooks SSSI have fluctuated throughout the period recorded by WeBS making interpretation of the underlying trend difficult. Accordingly, although Alerts have been triggered for the short- and medium terms they should be viewed with caution. Numbers of this species over-wintering within Southern Region have been stable in the medium-term having previously increased. Numbers of this species over-wintering in Great Britain have been increasing long term. The trend on the site does not appear to be tracking that of the either the region or the British trend. The declining proportion of the regional numbers supported by this site suggest that site-specific pressures may be affecting this species. Although Alerts have been triggered, they are difficult to interpret and so it would be prudent to closely monitor numbers of this species on this site in coming winters to assess whether these Alerts are due to fluctuations or local pressures."*

For Teal, the MS population target of 247 was not met and recent surveys are showing further decline. The 5-year peak mean from the surveys between 2014 and 2019 was 220, and from surveys between 2016 and 2021 it was 208 (Figure 7.4). The considerable decline observed has resulted in this feature being in Unfavourable Declining condition, although the confidence in the data is medium. For this reason, further investigation is required to understand whether site specific pressures are influencing this decline. WeBS alerts covering the period up to winter 17/18, state:

> *"Numbers of Teal over-wintering on Waltham Brooks SSSI have remained relatively stable long term. Consequently, no Alerts have been triggered for this species. Numbers of this species over-wintering within Southern Region have been decreasing in the short-term having previously peaked. Numbers of this species over-wintering in Great Britain have been stable in the medium-term having previously increased. The trend on the site does not appear to be tracking that of either the region or the British trend. The stable proportion of regional numbers supported by this site suggest the environmental conditions remain relatively favourable for this species."*

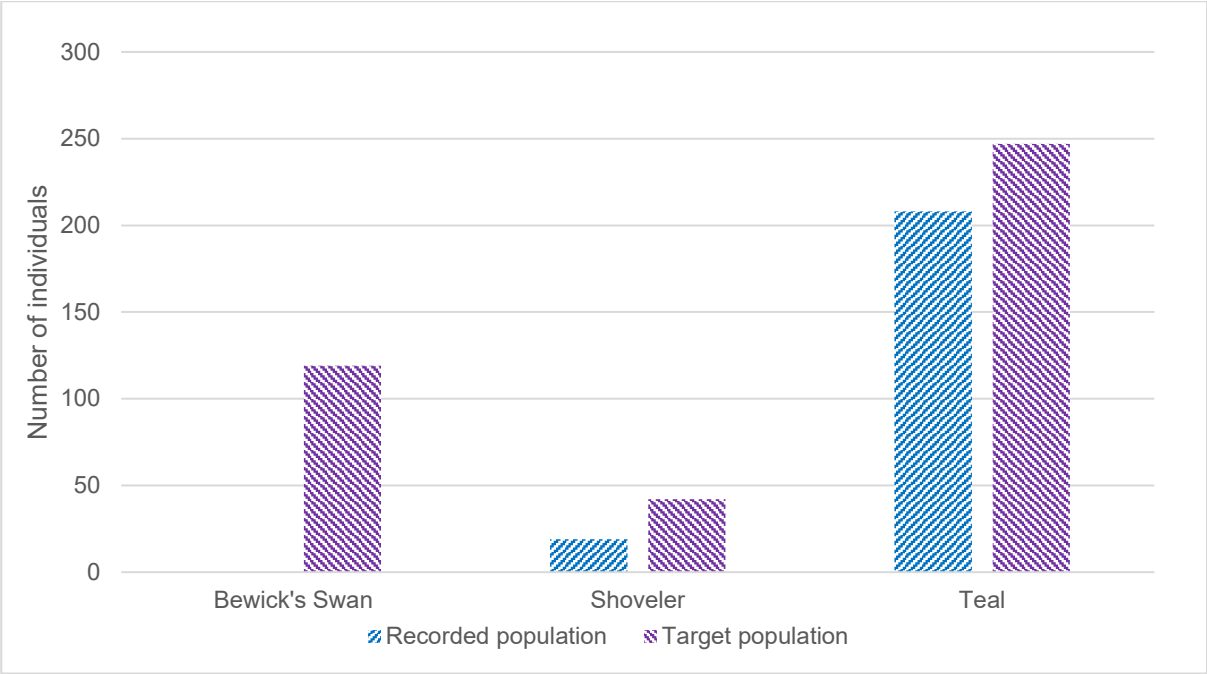


Figure 7.4 - Recorded number of individuals and population targets for wintering bird features assessed at Waltham Brooks SSSI.

Breeding bird features and condition

An overview of the feature and attribute assessed and current condition status following the recent surveys is detailed in Table 7.6.

Table 7.6 - Condition status following 2021-23 review of the Waltham Brooks aggregations of breeding birds feature.

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Assemblages of breeding birds - Lowland damp grasslands	Number of species	Unassessed	Unassessed	Not applicable

The data to assess number of species in regard to the assemblages of breeding birds, lowland damp grasslands feature, was unable to be assessed as there have been no recent surveys and/or no external data available to assess against. The last data suitable for assessment was in 2011, where the site scored 8, where the MS target score for this feature on this site was 17 (score at designation being 23). An up-to-date breeding bird assessment is required to confirm current score and condition.

8. Floodplain sites – Ditches

The variation in geology surrounding the three floodplain sites (Amberley Wild Brooks, Pulborough Brooks, and Waltham Brooks SSSIs) has resulted in notable differences within the chemical status of water present across the network of ditches. This has allowed for the development of a remarkable flora community which historically supported over 150 species of flowering plant, including several Nationally rare species. The sites are designated under Ramsar classification for the flora they support, which includes all five British duckweeds (*Spirodela polyrhiza, Wolffia arrhiza* and *Lemna* spp.), all three British water-milfoils (*Myriophyllum* spp.), all five British watercress including Yellow-cress species (*Rorippa)* and *Nasturtium* spp., all but one of the seven British water dropworts (*Oenanthe* spp.) and two-thirds of the British pondweeds (*Groenlandia densa* and *Potamogeton* spp., including the uncommon Sharp-leaved Pondweed *Potamogeton acutifolius*). Other notable plants include Greater Water-parsnip *Sium latifolium*, Small Water-pepper *Persicaria minor*, Bladderworts *Utricularia vulgaris* agg., Frogbit *Hydrocharis morsus-ranae*, and Flowering-rush *Butomus umbellatus*.

Further adding to the diversity of these floodplain sites and supported by the presence of ditch features is a wide array of both aquatic and water-dependent terrestrial fauna, including some notable invertebrate and bird species. Various attributes including habitat structure characteristics and the presence of notable species or communities, have historically been used in determining the condition status of these designated sites and their associated features, but the monitoring of certain parameters such as water quality and water chemistry had not been undertaken. Natural England acknowledge the absence of such monitoring as an important gap in supporting the determination of such features, and that without this supporting evidence the overall condition or health of such water-dependent features may be misrepresented. Therefore, Natural England, in partnership with the private landowners, RSPB, Sussex Wildlife Trust and Environment Agency, undertook water quality monitoring (between 2021 and 2022) of the Arun Valley floodplain sites as part of this review (the methodology used in this monitoring is provided in Appendix 10).

During Natural England's review process, it was also concluded that the previously prescribed water quality and water chemistry attributes (as detailed within the MS for each site) were limited, outdated, and not representative of emerging national guidance, particularly relating to the nutrient status of water-dependent habitats. Therefore, concerted effort was undertaken to assess the nutrient status at each floodplain site in conjunction with water quality monitoring. This looked specifically at Total Phosphorous (TP), a monitored attribute detailed within the MS, and Total Nitrogen (TN), a revised subsequent addition (agreed nationally in March 2023, by Natural England). To support Natural England's inclusion of further or more stringent water quality and water chemistry attributes, consideration of ditch habitat classification and relative natural state was required. For Amberley Wild Brooks SSSI and Pulborough Brooks SSSI, a Mesotrophic classification was determined, supported by the presence of biodiverse flora and fauna communities or species, and presence of low to moderate alkalinity. Whilst for Waltham

Brooks SSSI, with less diverse flora community and absence of the SAC feature *Anisus vorticulus*, a more naturally Eutrophic classification was determined. Water quality targets for these sites have been revised / added to reflect this conclusion and better represent and protect the interest features of these sites (as outlined in Table 8.1, timescales for completing these amendments are subject to Natural England resources).

Table 8.1 - Current and revised CSMG targets for total phosphorous and total nitrogen at the three floodplain sites (in relation to the water chemistry attributes to condition assess against for the ditch feature).

	Total Phosphorous (mg/l)		Total Nitrogen (mg/l)	
Floodplain Site	**(CSMG)**	**Revised**	**(CSMG)**	**Revised**
Amberley Wild Brooks SSSI	≤ 0.10	≤ 0.05	Not applicable	≤ 1.00
Pulborough Brooks SSSI	≤ 0.10	≤ 0.05	Not applicable	≤ 1.00
Waltham Brooks SSSI	≤ 0.10	Not applicable [no change]	Not applicable	≤ 1.50

The findings of the surveys undertaken by Natural England during this assessment are detailed under the relevant SSSI below. An overview of the CSMG, Natural England standardised guidance and conservation objectives relevant to these floodplain features is also presented in Appendix 7.

Amberley Wild Brooks SSSI

Interest features and condition

The ditches on this site support a diverse community of plants with several rarities. Natural England's assessment in 2021 was informed by previous botanical surveys carried out in 1998 (Abraham, 1998), with every effort made to re-survey as many of the same ditches to enable an accurate assessment of change over time. An overview of the attributes assessed and current condition status following the recent surveys is detailed in Table 8.2.

Table 8.2 - Condition status of Amberley Wild Brooks ditch system features following the 2021-23 review.

Attribute	Meets CSMG target	New condition status	Confidence
Habitat extent	Pass	Favourable	High
Habitat extent & structure: channel form	Fails	Unfavourable Declining	High
Habitat extent & structure: succession	Fails	Unfavourable Declining	Low [note 1]
Habitat extent & structure: shading	Pass	Favourable	High
Ditch Water Depth during assessment	Pass	Favourable	Low [note 2]
Water quality: water clarity	Fails	Unfavourable Declining	High
Water quality: extent of algal dominance	Pass	Favourable	Low [note 2]
Water quality: water chemistry	Fails	Unfavourable Declining	High
Number of species present: vegetation	Pass	Favourable	High (for new baseline target)
Indicators of negative change	Pass	Favourable	High
Indicators of local distinctiveness: rare species and quality indicators	Fails	Favourable	High

Note 1: A low confidence rating has been assigned for this attribute as management may have been carried out to reduce ditches in late succession since surveys were carried out.

Note 2: A low confidence rating has been assigned for these attributes due to an exceptionally high level of rainfall during this assessment. Natural England acknowledge that a more quantitative data set (collected over a prolonged period, i.e., > 12 months) would present a more detailed overview of ditch water depths and the associated parameters, enabling a higher confidence rating to be determined. Further information on this is provided in the narrative below.

The Habitat extent attribute was concluded to be in Favourable condition, and based on aerial imagery and on-site observations, no evidence of ditch infilling or change in ditch extent was observed. In terms of the channel form, determination of favourability was more problematic; the current target is for 75% of the ditches to have non-trapezoidal sides, however, where the Little Whirlpool Ramshorn Snail (the SAC feature) is or has been found present, there is a requirement for 80% of surveyed ditches to have a berm/margin with gentle gradient on one side or both. This update to the channel form target will be added when the MS is subsequently revised. However, on the ditches where this target applies, only 53% of those surveyed were found to provide this habitat (Figure 8.1, shows ditch with trapezoidal sides), resulting in the conclusion of Unfavourable Declining condition for the Channel Form attribute.

For the Succession attribute, the ditches were assessed in terms of whether each ditch was at an early, mid, or late stage (Figure 8.2). Early succession ditches are defined here as those that have been desilted or reprofiled in the same year as the monitoring visit. Whilst 10% of the ditches on site were found to be in an early stage with high levels of open water, this has been determined as being too low to support the diversity of plants requiring a more open habitat. Therefore, an Unfavourable Declining condition for this attribute was concluded. In addition to this, there was a noticeable preponderance of ditches recorded in the mid-successional stage (approximately 64%). This is thought to be unsuitable for the Little Whirlpool Ramshorn Snail, which requires a variety of successional stages for its life cycle. For the Shading attribute, just 5% of the ditches were recorded as being heavily shaded (Figure 8.3), meeting the targeted requirements and allowing Favourable condition to be determined.

Figure 8.1 - Ditch with trapezoidal sides and high algal cover in Amberley Wild Brooks SSSI. Photo by Natural England.

Figure 8.2 - Late stage succession ditch in Amberley Wild Brooks SSSI. Photo by Natural England.

Figure 8.3 - Ditch with high vegetation cover in Amberley Wild Brooks SSSI. Photo by Natural England.

Ditch water depth, water clarity and extent of algal dominance attributes were measured via visual observation, and where possible with water quality/turbidity equipment (following CSMG criteria). Both ditch water depth and extent of algal dominance passed the targeted requirements, achieving Favourable condition. However, an exceptionally high level of rainfall was noted during this assessment and has resulted in a low confidence rating being concluded for these attributes with a potential for the status to change, particularly when dry spells and/or drought conditions prevail (please see more information on pressures in Section 15). This uncertainty is further supported by external anecdotal and photographic evidence provided to Natural England (for example, by landowners of site and RSPB Reserve Manager, 2020-21, personal communication, Figures 8.4 – 8.8), and conflicting perceptions drawn from long-term vegetation studies such as Hicks and others (2019) which indicate that the minimum water level targets are not being met and on occasions ditches are drying out. Natural England will review the MS to determine whether a more appropriate target for this attribute that better reflects water availability can be included. Water clarity, as measured through turbidity (opaqueness of a fluid due to presence of suspended solids) showed a mean average of 30.3 Nephelometric Turbidity Units (NTU). This recording, supported by an inability for surveyors to clearly observe the ditch bottom (as per the JNCC CSMG for ditch systems) resulted in the conclusion of this attribute being in Unfavourable Declining condition.

Figure 8.4 - Low water levels in a ditch in Amberley Wild Brooks SSSI in May 2022. Photo by M. Willing.

Figure 8.5 - Oily film on the surface of a ditch in Amberley Wild Brooks SSSI in June 2022. Photo by Natural England.

Sequential water quality/chemistry laboratory analysis was undertaken in conjunction with visual observations during this assessment (between 2021-22), with sampling locations assigned to focus on key areas taking into consideration the presence of rare/notable

aquatic plant species and the SAC feature, the Little Whirlpool Ramshorn Snail (an overview of the assessed water quality parameters, sampling locations and justification behind those sites allocated is available in Appendix 10). Available access, existing monitoring locations, and hydrological connectivity from both surface water and groundwater were also considered.

As part of the MS, as well as there being targets for nutrient concentrations, three other parameters are to be maintained; dissolved oxygen (DO), biochemical oxygen demand (BOD) and total ammonia (recorded as ammoniacal Nitrogen, Ammonia N). Where, assessed the recorded mean concentrations for DO and Ammonia N are presented in Table 8.3 and were within, or below, targeted range at each of the monitoring locations. There was not the resource to assess BOD as part of this condition assessment.

Table 8.3 - The water quality data results recorded at each of the monitoring sites in Natural England's 2021-22 surveys at Amberley Wild Brooks SSSI, which includes data for DO, Ammonia N, mean annual TN and TP concentrations, and the ratio of TN to TP.

Determinant	Site A	Site B	Site C	Site D	Site 1	Site 2
DO (mg/l)	7.85	7.83	9.05	5.37	10.36	9.61
Ammonia N (mg/l)	0.103	0.251	0.076	0.098	**Unassessed**	**Unassessed**
TN (mg/l)	0.865	1.655	0.917	1.921	**Unassessed**	**Unassessed**
TP (mg/l)	0.106	0.220	0.149	0.186	**Unassessed**	**Unassessed**
TN/TP Ratio	9:1	8:1	9:1	10:1	**Unassessed**	**Unassessed**

Despite this, as both the recorded concentrations for mean annual TP and TN exceeded the current CSMG, or where applicable newly instated/revised target (Table 8.1), an Unfavourable Declining condition for the Water chemistry attribute was concluded. Interestingly, for TP, the data obtained from Natural England's monitoring program showed concentrations varied at each sampling site but showed similar climatic and temporal patterns, coinciding with periods of prolonged rainfall or dry spells (Figure 8.6). Thus, identifying the presence of increased hydrological connectivity with the wider river catchment (River Arun and River Rother and groundwater), and atmospheric changes from climate change as being areas of concern. The mean TP concentration calculated across all four monitoring sites at Amberley Wild Brooks SSSI was shown to be 0.17 mg/l.

A similar correlation was not so apparent in relation to TN, with a higher degree of variability being observed (Figure 8.7). This showed the mean annual TN concentration to be more consistent, with half of the monitoring sites (A and C) typically being within the

revised (agreed nationally in March 2023) target of ≤ 1.00 mg/l (Table 8.3). However, as the remaining sites (B and D) were consistently recorded in excess of this, an annual mean concentration for TN was calculated at 1.33 mg/l.

Analysis of TN composition across monitoring locations (Site A – Site D) indicate that organic nitrogen sources (60 – 78 %) form the primary component, with the calculated sum of Ammonia (Ammonia N), Nitrate and Nitrite ranging between 27 – 40 % of total Nitrogen content. The deposition of such, assumingly resulting from both on-site and catchment wide agricultural practices (run-off). Further transferal of organic nitrogen is likely attributed to the dispersal of nutrient bound particulate matter, with similarities observed between in-river and on-site ditch sediment composition samples. Analysis of TN/TP ratio (Figure 8.8) showed phosphorous to be the limiting nutrient and, whilst the TN/TP ratio of monitoring locations did not significantly exceed that associated with freshwater systems (approximately 7.3 / 1, TN/TP), the high values recorded for both TN and TP are of concern, with any deviation of this ratio “favouring the intensive growth of phytoplankton species” (Savic et al., 2022).

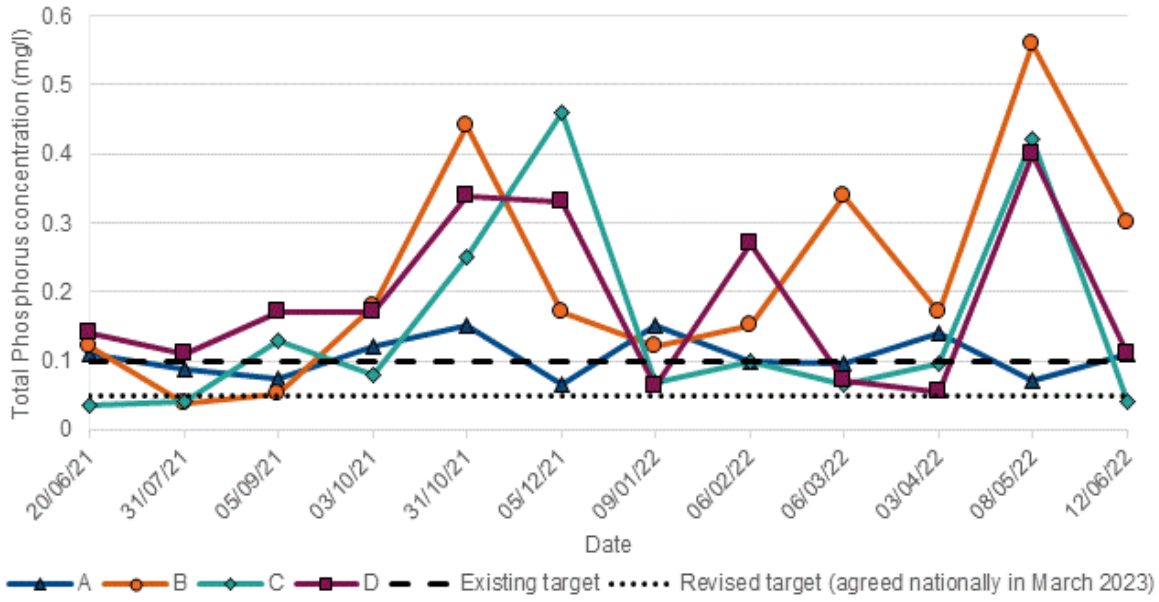


Figure 8.6 -1 Average concentration of Total Phosphorus (TP, mg/l) recorded over a 12-month period across the four sampling locations at Amberley Wild Brooks SSSI (Location A – Dark Blue, Location B – Orange, Location C – Turquoise, and Location D – Dark Pink), compared against the existing CSMG target of ≤0.1mg/l (Black dotted line).

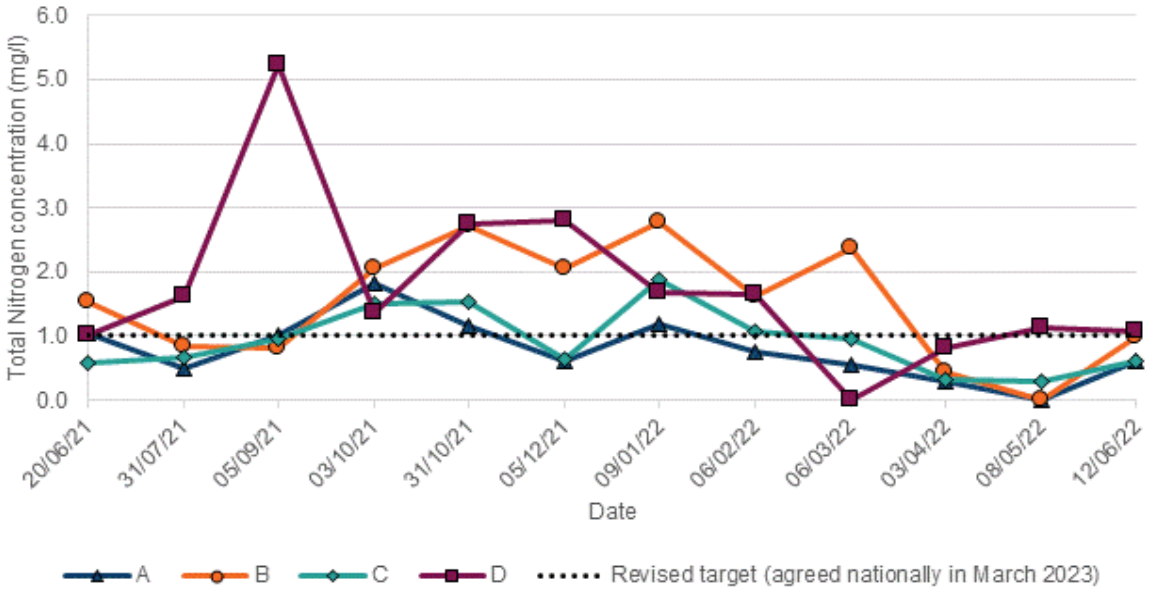


Figure 8.7 -2 Average concentration of Total Nitrogen (TN, mg/l) recorded over a 12-month period across the four sampling locations at Amberley Wild Brooks SSSI (Location A – Dark Blue, Location B – Orange, Location C – Turquoise, and Location D – Dark Pink), compared against the revised (agreed nationally in March 2023) CSMG target of ≤1.0mg/l (Black dotted line).N.B. Data entries on 06/03/22 (Site D) and 08/05/22 (Sites A and B) show TN at 0.0mg/L following sample collection errors.

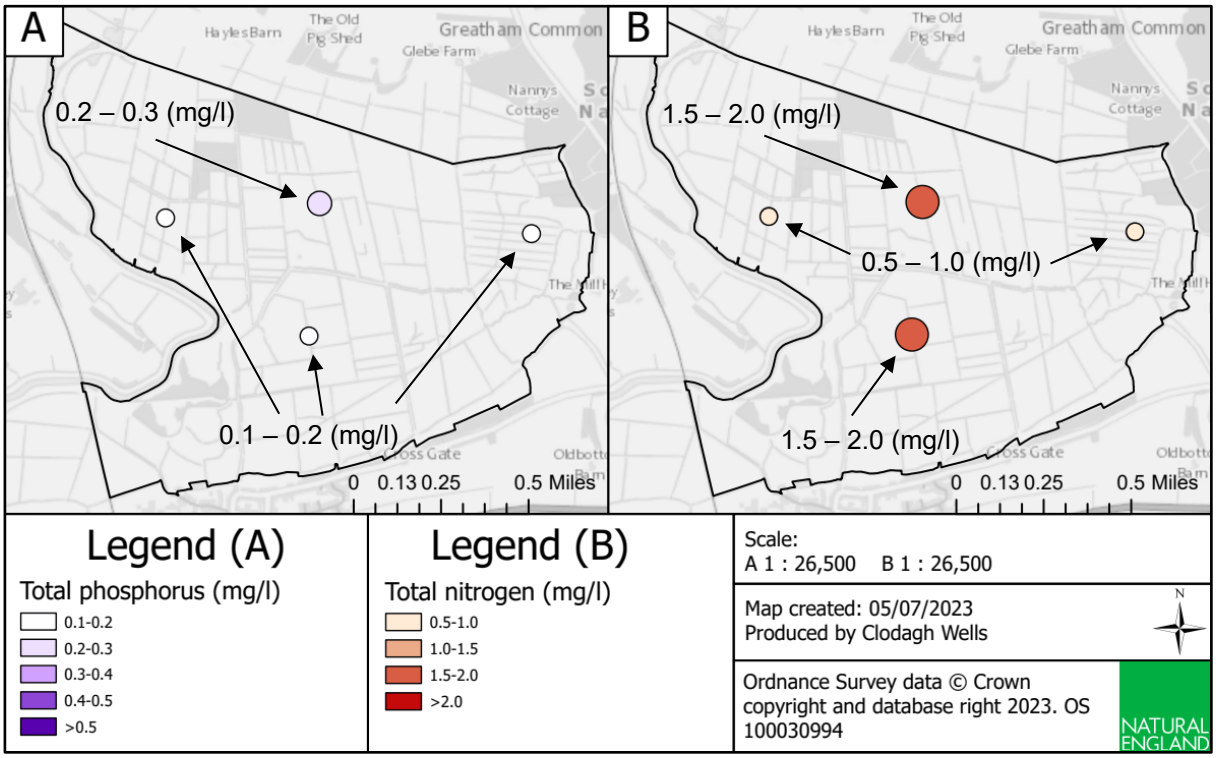


Figure 8.8 - Map of Amberley Wild Brooks SSSI showing the location and results of TP and TN sampling. Ordnance Survey data © Crown copyright and database right 2023.

Tidal cycles were also indicated to be an influencing factor on the water chemistry at Amberley Wild Brooks SSSI, with twice daily fluctuations in turbidity and conductivity being observed through sonde (multiparameter water quality monitoring device) analysis. A degree of variability was observed within these parameters (Table A10.2, Appendix 10) across all three sonde monitoring locations (Figure A10.2, Appendix 10). However, this was most apparent in the sampled location (site 2) in closest proximity to the River Arun. Whilst the results obtained from Natural England's monitoring programme showed that the calculated salinity did not exceed the expected range for freshwater (≤ 1 Practical Salinity Units, PSU) with typical concentrations of between 0.20 – 0.25 PSU being recorded, the observed fluctuations do indicate a potential inefficiency in mitigating tidal ingress through the sluices located between the river and site boundary. Continual monitoring of salinity or saline associated parameters (turbidity, and conductivity) would enable the effectiveness of these features to be determined and help to inform if, or when reformative works should be undertaken.

Despite previous high-quality botanical surveys, it was not possible to determine a clear baseline picture for plant species richness due to differences in surveying methodology. For instance, whilst the 1998 baseline survey was concluded to be a sufficient comparison for the ditches surveyed during Natural England's assessment and subsequently aided in identifying the target of no more than 20% decline in species number, no attempt to assess plant species abundance was undertaken (an important consideration for the plant species richness attribute). The current target as detailed within the MS is for the mean number of species to be at least 7 per 20m section. As an average of 28 species were recorded per 20m ditch section within Natural England's 2021 assessment, Favourable condition for the Number of species attribute was concluded. The MS will be updated with the new target (28) and include the no more than 20% reduction to the total species number when the specification is next revised.

Two ditches were found to have small discrete colonies of invasive species: New Zealand Pigmyweed *Crassula helmsii* and *Azolla* spp. However, as the recorded level was deemed to be within the threshold as detailed under the indicators of negative change attribute, Favourable condition was concluded. Natural England recommend that targeted management be explored to either control or eradicate the species. Finally, for the Indicators of local distinctiveness attribute, Favourable condition status was concluded with this site meeting the target based on the number of species indicative of high-quality ditch systems (as listed in Appendix 2 of the JNCC CSMG for ditch systems). A total of 64 species listed were present in the current surveys, compared to the 70 recorded on site in the 1998 baseline survey. Further information on the Vascular Plant Assemblage (VPA) and notified plant species is included in section 10.

Pulborough Brooks SSSI

Interest features and condition

The ditches of Pulborough Brooks were held to be of great botanical importance at designation due to the number of Nationally Rare and characteristic species found there. Four of these species have been incorporated into the Vascular Plant Assemblage (VPA) and have been assessed separately within this report (Section 10 – Vascular Plants). However, throughout the undertaking of this report, Natural England sought to establish the botanical richness of the ditches as a whole and to establish a baseline for future assessment work. An overview of the attributes assessed and current condition status following the recent surveys is detailed in Table 8.4.

Table 8.4 - Condition status of Pulborough Brooks ditch system features following the 2021-23 review.

Attribute	Meets CSMG target	New condition status	Confidence
Habitat extent	Pass	Favourable	High
Habitat extent & structure: channel form	Fails	Unfavourable Declining	High
Habitat extent & structure: succession	Fails	Unfavourable Declining	High
Habitat extent & structure: shading	Pass	Favourable	High
Ditch water depth during assessment	Pass	Favourable	Low [note 1]
Water quality: water clarity	Fails	Unfavourable Declining	High
Water quality: extent of algal dominance	Pass	Favourable	Low [note 1]
Water quality: water chemistry	Fails	Unfavourable Declining	High

Attribute	Meets CSMG target	New condition status	Confidence
Number of species present: vegetation	Pass	Favourable	Medium [note 2]
Indicators of negative change	Pass	Favourable	High
Indicators of local distinctiveness: rare species and quality indicators	Unknown	Unassessed	Not applicable

Note 1: A low confidence rating has been assigned for these attributes due to an exceptionally high level of rainfall during this assessment. Natural England acknowledge that a more quantitative data set (collected over a prolonged period, i.e., > 12 months) would present a more detailed overview of ditch water depth and the associated parameters, enabling a higher confidence rating to be determined. Further information on this is provided in the narrative below.

Note 2: A medium confidence rating has been assigned as the current target is not considered to be stringent enough for this site. Further information on this is again provided in the narrative below.

As with Amberley Wild Brooks SSSI, analysis of aerial imagery, supported by on-site observations indicate no evidence of ditch infilling or change in ditch extent at Pulborough Brooks SSSI, and as such Favourable condition for the Habitat extent attribute was concluded. However, for both the Channel form and Succession attributes, the required targets were not met and resulted in the determination of Unfavourable Declining condition. For Channel form, only 47 % of ditches surveyed met the targeted requirements in possessing a berm/margin with a gentle gradient on one-side or both (Figure 8.10 shows ditch with trapezoidal sides), significantly failing to meet the standardised 75 %, and more stringent 80 % target for ditches where the Little Whirlpool Ramshorn snail is or has been found (the SAC feature, applicable to all units on Pulborough Brooks). In relation to Succession, the key reason for not achieving Favourable condition was the observed low proportion of ditches in early succession (only 4 %, targeted range 15 – 25%) and abundance in mid successional stage (82% where the target is 35-75%, Figure 8.9 shows late stage succession). For the final Habitat extent attribute, Shading, Favourable condition status was concluded with only 2 % of the surveyed ditches being heavily impacted.

Figure 8.9 - Late-stage succession of a ditch in Pulborough Brooks SSSI. Photo by H. Frost (Natural England).

Figure 8.10 - Ditch with trapezoidal sides in Pulborough Brooks SSSI. Photo by Natural England.

Ditch water depth, clarity, and extent of algal dominance was measured via visual observation, and where possible with water quality/turbidity equipment (following CSMG criteria). Both ditch water depth and extent of algal dominance passed the targeted

requirements, achieving Favourable condition. However, an exceptionally high level of rainfall was noted during this ditch assessment and has resulted in a low confidence rating being concluded for these attributes with a potential for the status to change, particularly when dry spells and/or drought conditions prevail (please see more information on pressures in Section 15). This uncertainty is further supported by external anecdotal and photographic evidence provided to Natural England (for example, by landowners of site and RSPB Reserve Manager, 2020-21, personal communication) which indicate that the minimum water level targets are not being met and on occasions ditches are drying out. Natural England will review the MS to determine whether a more appropriate target for this attribute can be included. Water clarity, as measured through turbidity, showed a mean average of 27.8 NTU. This recording, supported by an inability for surveyors to clearly observe the ditch bottom (as per the JNCC CSMG for ditch systems) resulted in the conclusion of this attribute being in Unfavourable Declining condition.

Sequential water quality/chemistry laboratory analysis was undertaken in conjunction with visual observations during this assessment (between 2021-22), with sampling locations assigned to focus on key areas taking into consideration the presence of rare/notable aquatic plant species and the SAC feature *Anisus vorticulus* (an overview of the assessed water quality parameters, sampling locations and justification behind those sites allocated is available in Appendix 10). Available access, existing monitoring locations, and hydrological connectivity from both surface water and groundwater were also considered. (Pulborough Brooks SSSI is connected to Folkestone Beds aquifer and as such is a groundwater dependent site).

As part of the MS, as well as there being targets for nutrient concentrations three other parameters are to be maintained; DO, BOD and total ammonia (recorded as ammoniacal Nitrogen, Ammonia N). Where assessed, the recorded mean concentrations for DO and Ammonia N are presented in Table 8.5 and were within, or below, targeted range at each of the monitoring locations. There was not the resource to assess BOD as part of this condition assessment.

Table 8.5 - The water quality data results recorded at each of the monitoring sites in Natural England's 2021 – 22 surveys at Pulborough Brooks SSSI, which includes data for DO, Ammonia N, mean annual TN and TP concentrations, and the ratio of TN to TP.

Determinant	Site A	Site B	Site C	Site D	Site 1	Site 2
DO (mg/l)	5.24	6.52	7.65	6.36	5.98	7.78
Ammonia N (mg/l)	0.175	0.119	0.167	0.107	**Unassessed**	**Unassessed**
TN (mg/l)	1.789	1.848	2.120	1.497	**Unassessed**	**Unassessed**

Determinant	Site A	Site B	Site C	Site D	Site 1	Site 2
TP (mg/l)	0.415	0.388	0.220	0.245	**Unassessed**	**Unassessed**
TN/TP Ratio	4:1	6:1	11:1	7:1	**Unassessed**	**Unassessed**

Despite this, as both the recorded concentrations for mean annual TP and TN exceeded the current CSMG, or where applicable newly instated/revised target (Table 8.1), an Unfavourable Declining condition for the Water chemistry attribute was concluded. Like the observations made at Amberley Wild Brooks SSSI, the data obtained for TP at Pulborough Brooks SSSI showed concentrations varied at each sampling site but showed similar climatic and temporal patterns, coinciding with periods of prolonged rainfall or dry spells (Figures 8.14). Once again identifying the presence of increased hydrological connectivity with the wider river catchment (River Arun and River Rother, and River Stor along the northern boundary and groundwater), and atmospheric changes from climate change as being areas of concern. Interestingly, Site C, chosen for its proximity to the main river network (to assess overtopping) and conceived high residency time (situated at the outfall of the site), showed the lowest mean annual TP concentration of all monitored sites (Table 8.5). This could be indicative of potential issues surrounding drainage efficiency and legacy TP, impacting upon more centralised areas of the site which receive less water exchange. The mean TP concentration, calculated across all four monitoring sites at Pulborough Brooks was shown to be 0.32 mg/l.

A similar correlation was not so apparent in relation to TN (Figures 8.15), with the highest mean annual concentration being recorded at site C (closest to main river network, Table 8.5). This potentially shows an inefficiency in wetland nitrogen removal, or impact of water chemistry from increased hydrological connectivity. An annual mean concentration for TN was calculated at 1.82 mg/l.

Like Amberley Wild Brooks, Analysis of TN composition across monitoring locations at Pulborough Brooks (Site A – Site D) indicate that organic nitrogen sources (56 – 81 %) form the primary component, with the calculated sum of Ammonia (Ammonia N), Nitrate and Nitrite ranging between 19 – 44 % of total Nitrogen content. The deposition of such, assumingly resulting from both on-site and catchment wide agricultural practices (run-off). Further transferal of organic nitrogen is likely attributed to the dispersal of nutrient bound particulate matter, with similarities observed between in-river and on-site ditch sediment composition samples. Unsurprisingly, Site D, chosen as a representative sampling location of high floral diversity and marginal site conditions, showed the most equal concentration of nitrogen to phosphorous (Table 8.5, Figure 8.13), indicating close equilibrium. Whereas, Sites A and B were shown to be nitrogen limited, and Site C, Phosphorous limited.

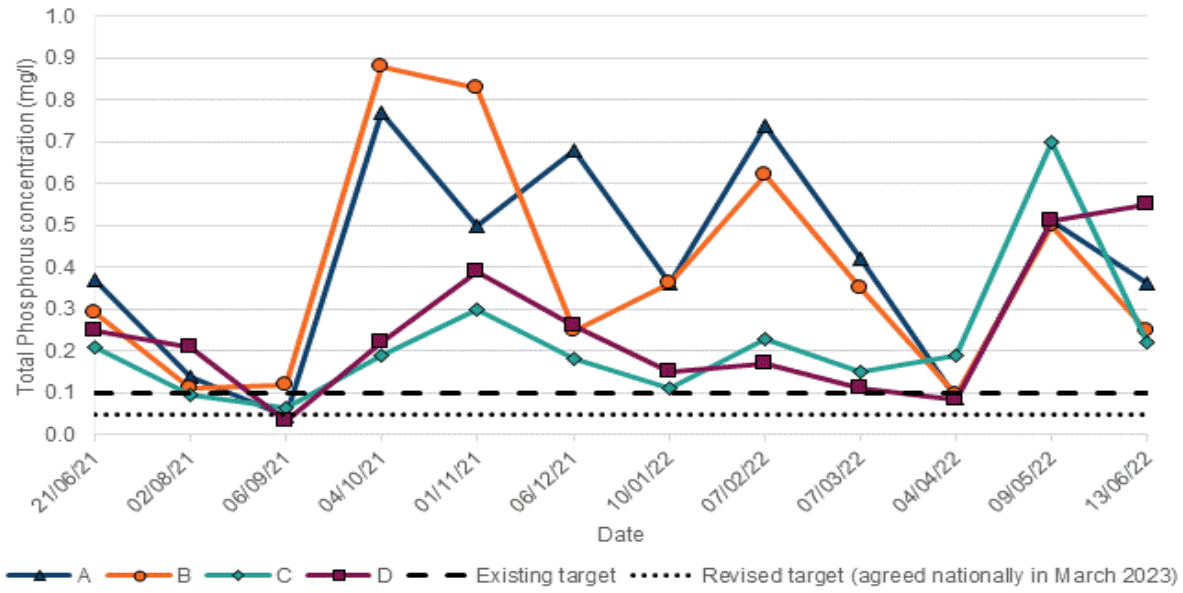


Figure 8.11 - A3verage concentration of Total Phosphorus (TP, mg/l) recorded over a 12-month period across the four sampling locations at Pulborough Brooks SSSI (Location A – Dark Blue, Location B – Orange, Location C – Turquoise, and Location D – Dark Pink), compared against the existing CSMG target of ≤0.1mg/l (Black dotted line).

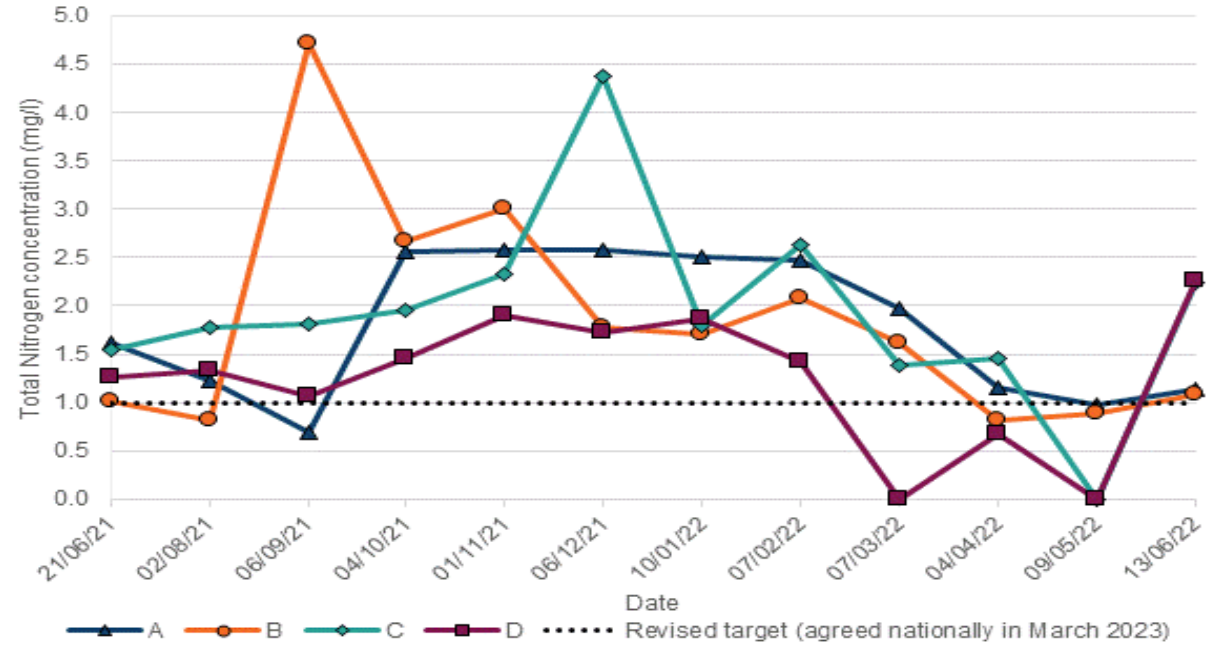


Figure 8.12 - Average concentration of Total Nitrogen (TN, mg/l) recorded over a 12-month period across the four sampling locations at Pulborough Brooks SSSI (Location A – Dark Blue, Location B – Orange, Location C – Turquoise, and Location D – Dark Pink), compared against the revised (agreed nationally in March 2023) CSMG target of ≤1.0mg/l (Black dotted line). N.B. Data entries on 07/03/2022 and 09/05/2022 (Site D) show TN at 0.00mg/L following sample collection errors.

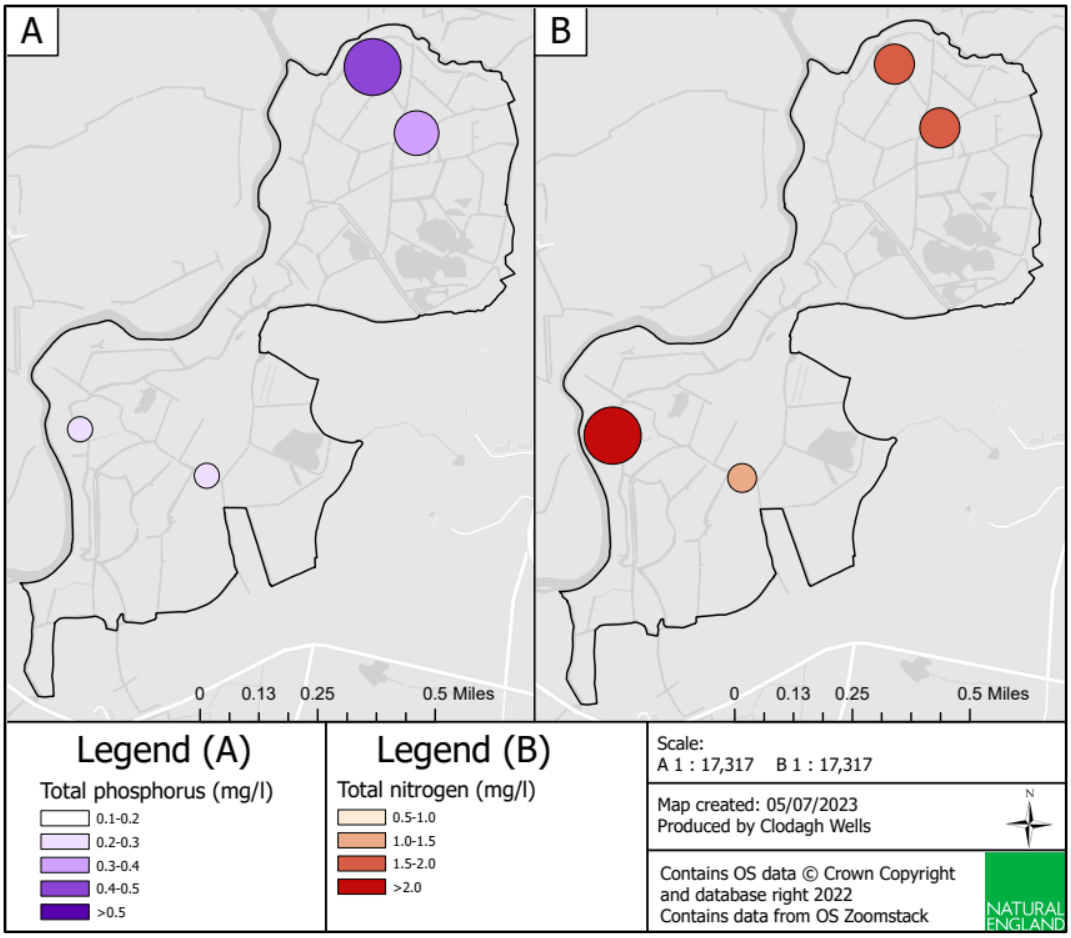


Figure 8.13 - Map of Pulborough Brooks SSSI showing the location and results of TP and TN sampling.

Tidal cycles were also indicated to be an influencing factor on the water chemistry at Pulborough Brooks, with twice daily fluctuations in turbidity and conductivity being observed through sonde (multiparameter water quality monitoring device) analysis. Only one sonde monitoring point was allocated on site (Figure A10.3, Appendix 10) and was located adjacent to the River Arun. Whilst the calculated salinity was shown to be within the freshwater range (≤ 1 PSU), with typical concentrations of between 0.15 - 0.20 PSU, the observed fluctuations do indicate a potential inefficiency in mitigating tidal ingress through the sluices located between the river and site boundary. Continual monitoring of salinity or saline associated parameters (turbidity, and conductivity) would enable the effectiveness of these features to be determined and help to inform if, or when reformative works should be undertaken.

For the botanical attributes of this feature, the lack of detailed baseline data relating to plant species richness (that follows CSMG) within the ditch systems meant that an accurate comparison between Natural England's recent surveys, and those previously undertaken could not be made. However, based on historical data and expert local knowledge (which heavily factored into the justification for the site's designation), this is a site of exceptionally high quality (Figure 8.14). As such, ditches may contain considerably more species per 20m length than in the target numbers, which is currently set at 7

species. For this reason, the Number of species attribute target has been revised to be 15 species per 20m of ditch (MS to be updated accordingly, timescale dependent on Natural England resources). Disregarding the negative indicator species recorded during the recent assessment, the average species number across the site was 28, exceeding the new target of 15 and resulting in Favourable condition status for this attribute being concluded. Natural England recommend that future assessments use the data obtained from their recent surveys as a point of comparison and analysis.

Figure 8.14 - Vegetation in a ditch in Pulborough Brooks SSSI. Photo by Natural England.

Non-native species were recorded present within a small number of ditches on site. This included Canadian Waterweed *Elodea canadensis,* Nuttall's Waterweed *E. nuttallii* and Common Carp *Cyprinus carpio*. As the average coverage/area of impact was within the threshold and deemed treatable with targeted management, the indicators of negative change attribute was concluded to be in Favourable condition. For the final botanical attribute, Indicators of local distinctiveness, a total of 60 rare species / species of local distinctiveness were recorded. Whilst this may indicate that the required targets were met, the forementioned lack of baseline data creates too many uncertainties for an accurate determination to be made. Therefore, this attribute remains currently unassessed (as detailed within Table 8.4). Further information on the VPA and notified plant species for this site is included in section 10.

Waltham Brooks SSSI

Interest features and condition

At designation, Waltham Brooks SSSI was notified chiefly for its grazing marsh, and wintering and breeding birds. The ditches formed an integral part of the habitat but were particularly noted for supporting populations of Cut-grass (*Leersia oryzoides),* with seven other species of aquatic macrophytes of interest noted as components of the ditches and as part of the mosaic grading into areas of fen and bankside communities. An overview of the attributes assessed and current condition status following the recent surveys is detailed in Table 8.6.

Table 8.6 - Condition status of Waltham Brooks ditch system features following the 2021-23 review.

Attribute	Meets CSMG target	New condition status	Confidence
Habitat extent	Pass	Favourable	High
Habitat extent & structure: channel form	Pass	Favourable	High
Habitat extent & structure: succession	Fails	Unfavourable Declining	High
Habitat extent & structure: shading	Fails	Unfavourable Declining	High
Ditch water depth during assessment	Fails	Unfavourable Declining	High
Water quality: water clarity	Pass	Favourable	Low [note 1]
Water quality: extent of algal dominance	Pass	Favourable	Low [note 1]
Water quality: water chemistry	Fails	Unfavourable Declining	High
Number of species present: vegetation	Pass	Favourable	Medium [note 2]

Attribute	Meets CSMG target	New condition status	Confidence
Indicators of negative change	Pass	Favourable	High
Indicators of local distinctiveness: rare species and quality indicators	Unknown	Unassessed	Not applicable

Note 1: A low confidence rating has been assigned for these attributes due to an exceptionally high level of rainfall during this assessment. Further information on this is provided in the narrative below.

Note 2: A medium confidence rating has been assigned as the current target is not considered to be stringent enough for this site. Further information on this is again provided in the narrative below.

For the ditch feature, the habitat extent attribute was concluded to be in Favourable condition with no evidence of ditch infilling or change in ditch extent observed on site, or through assessment of aerial imagery. With different targeted requirements compared to the other two floodplain sites (Amberley Wild Brooks and Pulborough Brooks), the channel form at Waltham Brooks was found to be in Favourable condition with 10 % of ditches having a trapezoidal cross-section. However, for both the Shading, and Succession attributes, the required targets were not met, and an Unfavourable Declining condition was subsequently concluded. Relative to shading, the impacted range was calculated to be equivalent to 17 %, the highest across all three sites (Figures 8.18 and 8.19). Whereas, for succession, there was not enough ditches in early succession (5%) and a significantly higher proportion of ditches in late succession (50%) observed.

Ditch water depth, clarity, and extent of algal dominance was measured via visual observation, and where possible with water quality/turbidity equipment (following CSMG criteria). Despite the exceptionally high rainfall noted during this assessment, ditch water depth failed to meet its targeted requirement and only 28% of ditches were shown to have a depth of 0.5 m or higher. Therefore, an Unfavourable Declining condition for this attribute was concluded. However, in the presence of low water levels, surveyors were able to clearly observe the ditch bottom (as per the JNCC CSMG for ditch systems) and as such resulted in the two attributes of water clarity and extent of algal dominance passing the targeted requirements and achieving Favourable condition. Although it should be noted that water clarity, as measured through turbidity, showed a mean average of 42.2 NTU. This was higher than the results recorded from both Amberley Wild Brooks and Pulborough Brooks SSSIs. Therefore, this could be seen as a false representation for these attributes on site and as such a low confidence rating has been assigned. This in conjunction with the low ditch water depth indicates that these attributes have the potential to change, particularly when dry spells and/or drought conditions prevail (please see more information on pressures in section 15).

Figure 8.15 - Overshaded ditch with low water levels in Waltham Brooks SSSI. Photo by Natural England.

Figure 8.16 - Overshaded ditch with low water levels in Waltham Brooks SSSI. Photo by H. Stanworth (Natural England).

Sequential water quality/chemistry laboratory analysis was undertaken in conjunction with visual observations during this assessment (between 2021-22), with sampling locations assigned to focus on key areas of aquatic plant species (an overview of the assessed water quality parameters, sampling locations and reason for allocation is available in Appendix 10). Available access, existing monitoring locations, and hydrological

connectivity from both surface water and groundwater were also considered. In addition, a further monitoring location (site B) was subsequently added during this assessment following high levels of nitrate recorded during in-field sampling (September 2021).

As part of the MS, as well as there being targets for nutrient concentrations, three other parameters are to be maintained; DO, BOD and total ammonia (recorded as ammoniacal Nitrogen, Ammonia N). Where assessed, the recorded mean concentrations for DO and Ammonia N are presented in Table 8.7. The mean concentration of DO was within, or below, targeted range. However, the mean Ammonia N concentration was shown to be consistently and significantly higher in site B, resulting in this parameter failing to meet its target (recorded concentration equivalent to class 5, or > 2.7 mg/l). There was not the resource to assess BOD as part of this condition assessment.

Table 8.7 - The water quality data results recorded at each of the monitoring sites in Natural England's 2021 – 22 surveys at Waltham Brooks SSSI, which includes data for DO, Ammonia N, mean annual TN and TP concentrations, and the ratio of TN to TP. To note, data recorded from Site B (added during this assessment following high nitrate levels) was between October 2021 – June 2022.

Determinant	Site A	Site B
DO (mg/l)	7.380	5.196
Ammonia N (mg/l)	0.117	3.807
TN (mg/l)	1.858	20.034
TP (mg/l)	0.132	5.722
TN/TP Ratio	19:1	4:1

In addition to this, and with both the mean annual TP and TN being shown to exceed the current CSMG, or where applicable newly instated/revised target (Table 8.1), an Unfavourable Declining condition for the Water chemistry attribute was concluded. Like the observations made at the other floodplain sites, TP concentrations were shown to vary greatly between sampling sites (Figures 8.20). For example, Site A (original sampling location) remained mostly consistent throughout the monitoring program (mean concentration of 0.13 mg/l), whereas Site B (added during the assessment following high nitrate recordings) which is located in a ditch just south of Coldwaltham wastewater treatment works (and which discharges into this ditch), showed significantly higher concentrations, reaching a peak of > 37 mg/l. This is significantly higher than the CSMG mean annual concentration targets for TP (Table 8.1) and shows a direct negative impact on the water quality parameters within this SSSI because of effluent discharge. This resulted in the mean TP concentration, as calculated across the site being 5.72 mg/l.

This is concurrently supported with the high TN levels also recorded during this assessment (Figures 8.21). Whereby, TN concentrations at site B were consistently and significantly higher than site A, reaching a peak of 35 mg/l with a mean concentration of 20.03 mg/l.

Unlike the data obtained from both Amberley Wild Brooks and Pulborough Brooks SSSI's, analysis of TN composition at Waltham Brooks SSSI suggest that inorganic sources of nitrogen form the primary component (70 – 99 %, as calculated by the total sum of Ammonia (Ammonia N), Nitrate and Nitrite). However, as previously detailed, this is unsurprising due to the close proximation of sampling locations to Coldwaltham WwTw's. The calculated TN/TP ratio (Figure 8.22) showed the limiting nutrient to be phosphorous at Site A, and nitrogen at Site B, with both values being excessively significant.

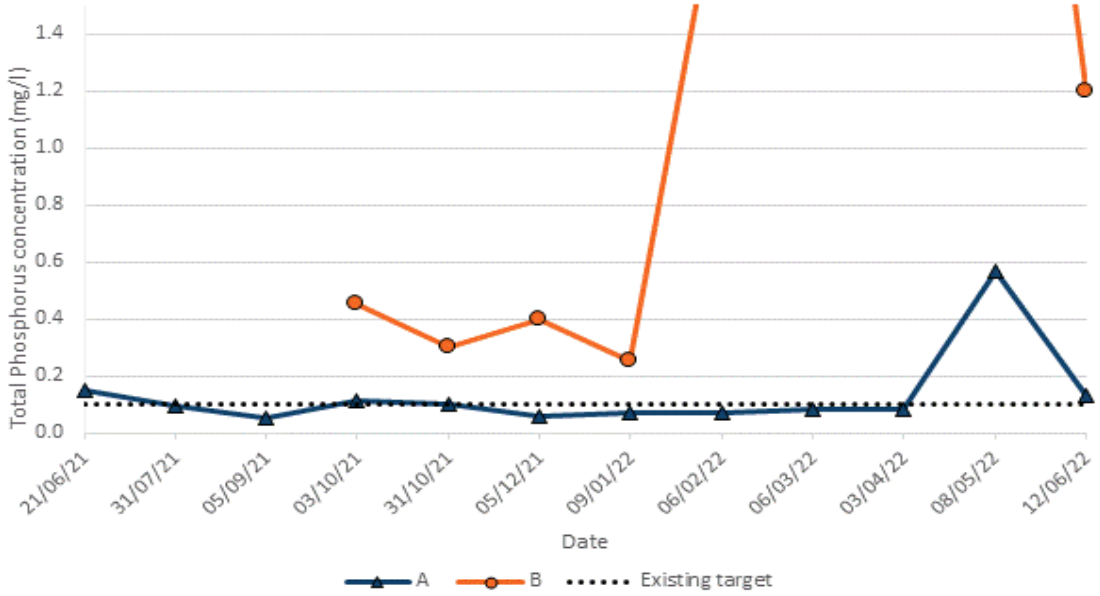


Figure 8.17 - Average concentration of Total Phosphorus (TP, mg/l) recorded over a 12-month period across the two sampling locations at Waltham Brooks SSSI (Location A – Dark Blue, and Location B – Orange), compared against the existing CSMG target of ≤0.1mg/l (Black dotted line). N.B. Three of the recorded data points from location B are not shown in the chart so the lower values can be seen. The missing TP values are as follows, 37 mg/l (06/03/2022), 6.2 mg/l (03/04/2022) and 3.7 mg/l (08/05/2022).

Figure 8.18 - Average concentration of Total Nitrogen (TN, mg/l) recorded over a 12-month period across the two sampling locations at Waltham Brooks SSSI (Location A – Dark Blue, Location B – Orange), compared against the revised (agreed nationally in March 2023) CSMG target of ≤1.5mg/l (Black dotted line).

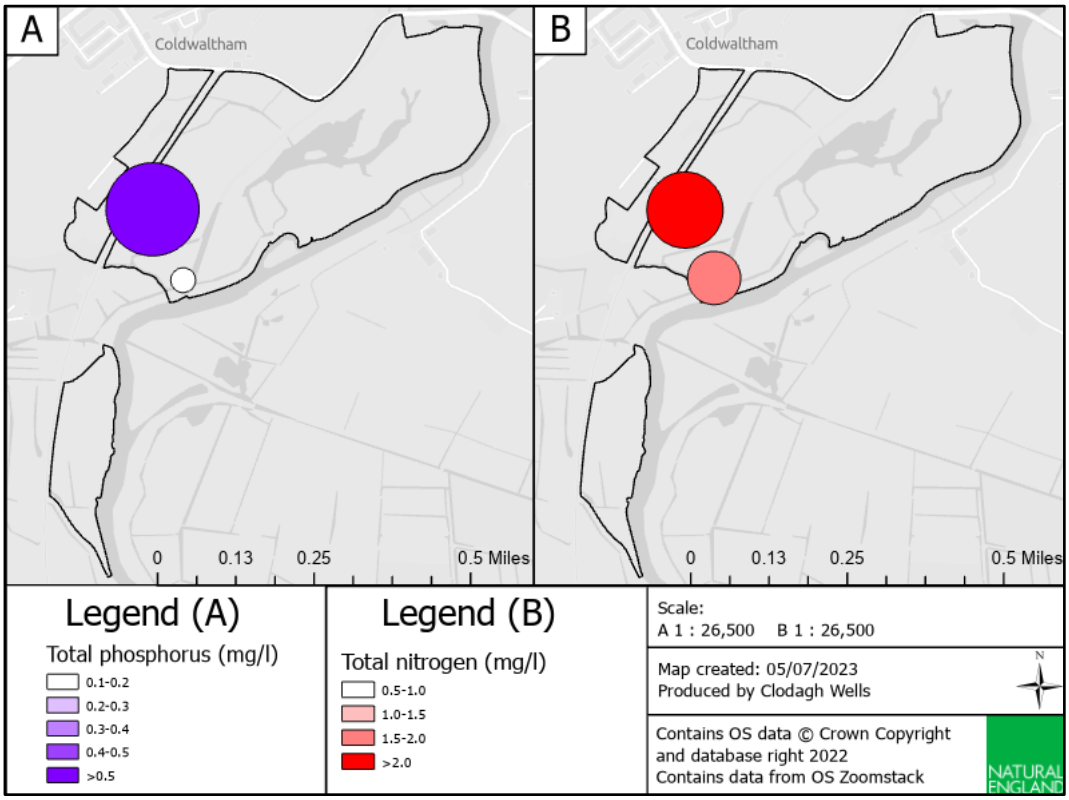


Figure 8.19 - Map of Waltham Brooks SSSI showing the location and results of TP and TN sampling.

Potential saline inundation was also identified at Waltham Brooks SSSI from the findings of the invertebrate surveys undertaken during this assessment period (explained in section 6), where numerous species associated with saltmarsh habitat, or tolerant of mildly brackish water were identified. No sonde (multi-parameter water quality monitoring device) analysis was undertaken on site during this assessment due to access and health and safety difficulties. However, intermittent testing of water quality parameters showed salinity concentrations within the freshwater range (≤ 1 PSU), with a mean calculated concentration of 0.20 PSU. Further clarification and investigations are needed to determine water quality parameters, fluctuations, and extent of tidal limits as continual, or increased saline ingression has the potential to impact both flora and fauna community structure.

As with that for Pulborough Brooks SSSI, it is not possible to compare current data with that previously obtained due to the lack of a detailed baseline for plant species richness that follows CSMG within the ditch system. However, based on historical data and expert local knowledge (which heavily factored into the justification for the site's designation), this is a site of exceptionally high quality. As such, ditches may contain considerably more species per 20m length than in the nationally derived target numbers, which is currently set at 7 species. For this reason, the Number of species attribute target has been revised to be 15 species per 20m of ditch (MS to be updated accordingly, timescale dependent on Natural England resources). Disregarding the negative indicator species recorded during the recent assessment, the average species number across the site was 22, exceeding the new target of 15 and resulting in Favourable condition status for this attribute being concluded. Natural England recommend that future assessments use the data obtained from their recent surveys as a point of comparison and analysis.

One invasive non-native species was identified in one ditch at Waltham Brooks SSSI: Himalayan Balsam *Impatiens glandulifera*. Despite this, across the site the average cover was calculated to be below the threshold, including for the combined cover of all non-natives, and therefore, Favourable condition for the indicator of negative change attribute was concluded. For the final botanical attribute, Indicators of local distinctiveness, a total of 44 rare species / species of local distinctiveness were recorded. Whilst this may indicate that the required targets were met, the forementioned lack of baseline data creates too many uncertainties for an accurate determination to be made. Therefore, this attribute remains currently unassessed (as detailed within Table 8.6). Further information on the monitored plant species associated with the ditch habitat feature for this site is included in section 10.

9. Floodplain sites - Wetlands

The three floodplain sites (Amberley Wild Brooks, Pulborough Brooks, and Waltham Brooks SSSIs) represent one of a few surviving areas of grazing marsh in West Sussex. At the time of designation, the wet alluvial grassland, fen, and marsh habitats on these sites contained a vast diversity of flora including many rare, internationally, and nationally important plant species, such as the Marsh Fern *Thelpteris thelypteroides,* True Fox-sedge *Carex vulpina,* and Cut-grass *Leersia oryzoi*des*.* These floodplain habitats are also highly valuable for fauna such as breeding and wintering birds. For example, at the time of designation for Amberley Wild Brooks SSSI (notified in 1985), there were 102 wintering bird species recorded including nationally significant numbers of Teal, Shoveler, and Bewick's swan. The sites were also in part protected due to being one of the most important wet meadow sites in the country for breeding Redshank.

On review, Natural England grassland specialists identified that the wet grassland/wetland interest features included on these sites within the MSs are incorrect and/or not appropriate for the sites. For example, currently the wet grassland feature across all three SSSIs is Lowland neutral grassland: MG13-related; Inland wet grassland. The following habitat types are more appropriate and have formed the basis of the surveys undertaken for this review: Lowland neutral grassland (M23, MG6, M25) and Alluvial grazing marshes with ditches, swamp (S4, S5, S6, S7, S11, S12, S19 related communities). These changes will be added when the MSs are next revised

Appendix 8 of this assessment provides the CSMG, Natural England standardised guidance and conservation objectives relevant to this feature.

Amberley Wild Brooks SSSI

Interest features and condition

At the time of producing this report, around 80% of the floodplain grasslands at Amberley Wild Brooks SSSI were generally supported through Countryside Stewardship grant agreements which outline and give consent for the appropriate management for the site. In particular, the grasslands are managed without application of fertiliser and with grazing animals suitable for the habitat. The objective of these agreements centre around maintaining a mosaic of conditions that are beneficial for notified bird and plant features. The wet grassland feature is not assessed as a monitored interest feature of this SSSI. However, is noted within the MS as supporting habitat for notified interest features and as such, has been assessed separately within this report.

An overview of the attributes assessed and current condition status following the recent surveys as detailed in Table 9.1.

Table 9.1 - Condition status following 2021-23 review of the Amberley Wild Brooks SSSI wet grassland feature.

Attribute	Meets CSMG target	New condition status	Confidence
Habitat extent	Pass	Favourable	Low [note 1]
Sward structure: bare ground	Pass	Favourable	High
Sward structure: average height	Fails	Unfavourable Declining	High
Sward composition	Fails	Unfavourable Declining	High
Sward composition: negative indicator species	Pass	Favourable	High
Water area/depth	Unknown	Unassessed	Not applicable

Note 1: A low confidence rating has been assigned to this attribute as the use of aerial photography alone makes it challenging to assess the habitat, as explained in the narrative below.

Assessment of aerial photography indicated that the grassland habitat extent has been maintained across the site against a target of no more than 5% net loss, allowing for a favourable condition assessment of this attribute. However, the existing mosaic of grassland, fen, and marsh habitats have not been mapped to determine how or where they grade into each other. Therefore, a low confidence rating for this attribute has been determined. Natural England acknowledge that undertaking a detailed National Vegetation Classification (NVC) survey would increase the understanding of type and quality of grassland, and that continuing assessments could be used to indicate environmental changes.

The target set for the bare ground attribute is no more than 10% in mid-June to July. As bare ground for Amberley wild brooks was assessed at 4% coverage, favourable condition has been achieved for this attribute. It is acknowledged that there is considerable variation in bare ground throughout the year due to the seasonal inundation of the site in winter, where water is often held on the land for many weeks. This wetter condition supports wintering bird populations.

Ideally, the grassland mosaic across this site should have a spread of height and structure which benefits a large variety of bird species, as well as supporting biodiverse plant communities (for further information please refer to section 10, Vascular plant feature

assessment). For example, Snipe require areas of taller vegetation (20-100cm, Figure 9.1) over wetter areas. Redshank, Shoveler and Teal prefer patches of medium to tall vegetation (20-50cm, Figure 9.2). Lapwings need shorter vegetation (between 5 and 15cm) and wigeon require grass height below <5cm throughout areas used for feeding. At Amberley Wild Brooks SSSI, almost no vegetation was recorded at the lowest height interval and 8% of the grass was recorded at over one metre in height, which is not valuable for any of the target species. Because of this predominance of taller vegetation across the site, the average height attribute has been assessed as being in unfavourable declining condition.

Figure 9.1 - Grassland site with a high cover of tussock sedge (*Carex stricta*) in Amberley Wild Brooks SSSI in June. Photo by Natural England.

Figure 9.2 - Grassland site with high cover of thistle and high sward height in Amberley Wild Brooks SSSI. Photo by Natural England.

The bird features that are supported by the floodplain wetland habitat require variable compositions of aquatic plants in their habitat. For example, Teal requires at least 25% cover of seed-bearing plants around freshwater (e.g. *Polygonum, Ranunculus, Eleocharis*). The sward composition target was not met on Amberley Wild Brooks, where there was an average of 23% cover of the target plant species resulting in the assessment of the attribute as unfavourable declining. This attribute was also assessed as such due to the overall dominance of *Juncus* spp. (Figure 9.3). This dominance indicates a shift from a wet grassland community into a wetland community, which is unsuitable for this habitat type and the bird species it supports. Average cover of negative indicator species was at 2%, remaining below the 5% target. As such this attribute was assessed as being in favourable condition

Figure 9.3 - Grassland with high cover of rush *(Juncus* spp.) in Amberley Wild Brooks SSSI. Photo by Natural England.

Pulborough Brooks SSSI

Interest features and condition

This site consists of a series of wet meadows on the floodplain of the River Arun between Pulborough and Greatham. The fields (Figure 9.4) are subject to winter and occasional summer flooding, which supports wintering wildfowl and breeding waders. Historically the site has been managed as flood meadows, which are cattle grazed and cut for hay during the summer. Much of the grassland is semi-improved, with most fields consisting of species-poor rough damp pasture. The majority of the site consists of plants which form a wet grassland community: Yorkshire-fog *Holcus lanatus*, tufted hair-grass *Deschampsia flexuosa*, coarse grassland and Creeping Bent *Agrostis stolonifera* and Marsh Foxtail *Alopecurus geniculatus* wet pasture. The fields support such typical plants as Soft Rush *Juncus effusus*, Hard Rush *Juncus inflexus*, Hairy Sedge *Carex hirta* and Marsh Ragwort *Jacobaea aquatica*.

The site has recently entered a new Countryside Stewardship agreement which aims to outline and give consent for the appropriate management for the site. In particular, the grasslands are managed without application of fertiliser and with grazing animals suitable

for the habitat (Figure 9.5). The objective of the agreements centre around maintaining a mosaic of conditions that are beneficial for notified bird and plant features. The wet grassland feature is not assessed as a monitored interest feature of this SSSI. However, is noted within the MS as supporting habitat for notified interest features and as such, has been assessed separately within this report.

Figure 9.4 - Grassland in Pulborough Brooks SSSI. Photo by Natural England.

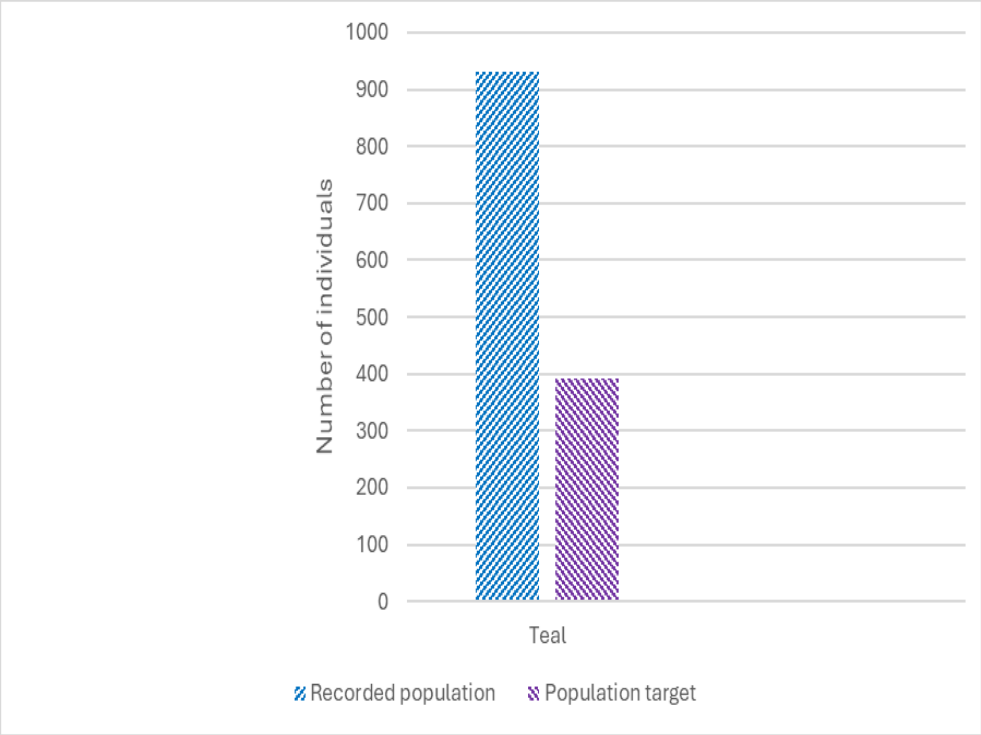


Figure 9.5 - Highland cattle grazing a grassland at Pulborough Brooks SSSI. Photo by H. Stanworth (Natural England).

An overview of the attributes assessed and current condition status following the recent surveys is detailed in Table 9.2.

Table 9.2 - Condition status following 2021-23 review of the Pulborough Brooks SSSI wet grassland feature.

Attribute	Meets CSMG target	New condition status	Confidence
Habitat extent	Pass	Favourable	Low [note 1]
Sward structure: bare ground	Pass	Favourable	High
Sward structure: average height	Fails	Unfavourable Declining	High
Sward composition	Fails	Unfavourable Declining	High
Sward composition: negative indicator species	Fails	Favourable	High

Attribute	Meets CSMG target	New condition status	Confidence
Water area/depth	Unknown	Unassessed	Not applicable

Note 1: A low confidence rating has been assigned to this attribute as the use of aerial photography alone makes it challenging to assess the habitat, as explained in the narrative below.

Aerial photography was used to assess this target and it has been determined that grassland habitat extent has been maintained on the site against a target of no net habitat loss, allowing for a favourable condition assessment. However, the mosaic of grassland, fen, and marsh habitats and how or where they grade into each other has not been mapped at this time. Therefore, confidence in the data and analysis is low as it is difficult to ascertain from aerial photos alone if the type or quality of grassland has changed. An NVC survey is recommended in the future to facilitate better understanding of the site.

The target for bare ground coverage at Pulborough Brooks SSSI is no more than 10% in summer. As bare ground was assessed at 1% across the site, this attribute was assessed as being in favourable condition. As with Amberley Wild Brooks SSSI, it is acknowledged that there is considerable variation in bare ground throughout the year due to the seasonal inundation of the site in winter, when high rainfall is often stored on the land for many weeks. This wetter condition will support wintering bird populations on site.

Ideally, the grassland mosaic across this site should have a range of heights and structure which benefits a large variety of bird species, as well as supporting biodiverse plant communities (for further information please refer to section 10, Vascular plant feature assessment). Snipes require areas of taller vegetation (20-100cm) over wetter areas. Redshank, Pintail, Shoveler, and Teal prefer patches medium to tall vegetation (20-50cm). Lapwings need shorter vegetation (between 5 and 15cm) and Wigeon require grass height below <5cm throughout areas used for feeding. At Pulborough Brooks SSSI, all survey locations were found to have a medium sward height, with no record of swards at both less than 5cm and more than 75cm. Therefore, the target for a range of sward heights between 5 -100 cm was not reached and unfavourable declining condition for this attribute was determined.

The bird features that are supported by the floodplain wetland habitat require variable compositions of aquatic plants in their habitat. Wigeon, require an average cover of 25% of one or more of the following soft-leaved plants: *Glyceria, Agrostis* and / or *Alopecurus*. Pintail require 25% of one or more of soft-leaved plants including *Glyceria, Agrostis, Potamogeton*). Teal requires at least 25% cover of seed-bearing plants around freshwater (e.g. *Polygonum, Ranunculus, Eleocharis*). Wigeon and Teal targets were met, but for Pintail, there was only 14% average cover of the target plant species. This attribute was also marked as unfavourable declining due to the overall dominance of *D. cespitosa,* which is a negative indicator species when above 10% cover. Average cover of negative

indicator species was at 4%, remaining below the 5% target. As such this attribute was assessed as being in favourable condition.

Waltham Brooks SSSI

Interest features and condition

This site supports an area of alluvial grazing marsh, which is adjacent to the River Arun. The lush grasslands and expanses of open water provide important feeding and roosting areas for a nationally important assemblage of wintering birds, and several species of breeding birds.

At the time of producing this report, the majority of this SSSI had recently been transferred from a Higher-Level Stewardship agreement into a Countryside Stewardship agreement. Both agreements were designed to outline and give consent for the appropriate management for the site. In particular, the grasslands are managed without application of fertiliser and with grazing animals suitable for the habitat. The objective of the agreements centre around maintaining a mosaic of conditions that are beneficial for notified bird and plant features. Currently, the wet grassland feature is not a monitored feature within the MS for this SSSI and will be added when the specification is next revised.

An overview of the attributes assessed and current condition status following the recent surveys is detailed in Table 9.3.

Table 9.3 - Condition status following 2021-23 review of the Waltham Brooks SSSI wet grassland feature. All sites were within unit 2.

Attribute	Meets CSMG target	New condition status	Confidence
Habitat extent	Pass	Favourable	Low [note 1]
Sward structure: bare ground	Pass	Favourable	High
Sward structure: average height	Fails	Unfavourable Declining	High
Sward composition	Fails	Unfavourable Declining	Low [note 2]
Sward composition: negative indicator species	Pass	Favourable	High

Attribute	Meets CSMG target	New condition status	Confidence
Water area/depth	Unknown	Unassessed	Not applicable

Note 1: A low confidence rating has been assigned to this attribute as the use of aerial photography alone makes it challenging to assess the habitat, as explained in the narrative below.

Note 2: A low confidence rating has been assigned to this attribute as it is not certain that the current targets are appropriate, as discussed in the narrative below.

Aerial photography was used to assess this target and it has been determined that grassland habitat extent has been maintained against a target of no net loss greater than 5%, allowing for a favourable condition assessment. However, the mosaic of grassland, fen, and marsh habitats and how or where they grade into each other has not been mapped at this time. Therefore, confidence in the data and analysis is low as it is difficult to ascertain from aerial photos alone if the type or quality of grassland has changed. An NVC survey is recommended in the future to facilitate better understanding of the site. Currently, the habitat extent attribute is not assessed within the MS for this SSSI, and it will be added when the specification is next revised.

The target for bare ground coverage at Waltham Brooks SSSI is no more than 10% in mid-June to July. As bare ground was assessed at 3% across the site, this attribute was assessed as being in favourable condition. As with the other floodplain sites, it is acknowledged that there is considerable variation in bare ground throughout the year due to the seasonal inundation of the site in winter, when high rainfall is often stored on the land for many weeks. This wetter condition will support wintering bird populations on site.

Ideally, the grassland mosaic across this site should have a spread of height and structure which benefits a large variety of bird species, as well as supporting biodiverse plant communities (for further information please refer to section 10, Vascular plant feature assessment). Waltham Brooks SSSI is notified for Shoveler and Teal which have preferences for patches of medium to tall vegetation (20-50cm). Sward height at Waltham Brooks SSSI was found to support targets for a range of vegetation heights. However, there was a predominance of taller vegetation, where 17% was recorded at over 1 metre in height, which is not valuable for any of the target bird species. Additionally, expert observations on site have shown that much of the sward height is above 2 metres. Because of this predominance towards taller sward heights, this attribute has been assessed as being in unfavourable declining condition.

The bird features that are supported by the floodplain wetland habitat require variable compositions of aquatic plants in their habitat. Teal requires at least 25% cover of seed-bearing plants around freshwater (e.g. *Polygonum, Ranunculus, Eleocharis*). This target was not met on Waltham Brooks SSSI, where there was an average of 21% cover of the target plant species. As such, the sward composition attribute was assessed as being in unfavourable declining condition. This attribute was also marked as unfavourable declining

due to the overall dominance of *Juncus* spp. and *D. cespitosa*, which are considered undesirable species for this habitat type and the bird's species it supports. However, the confidence rating of this attribute is low: Further surveys and discussion with Natural England national specialists are required to ensure the targets for this site within the MS are appropriate and amended when MSs are next revised.

For the negative indicator species attribute, there was an average 2% cover of negative indicator species against a target of no more than 5% cover (See Appendix 8 for full negative indicator species list). Therefore, this feature was assessed as being in favourable condition.

10. Floodplain sites – Vascular Plants

The Arun Valley floodplain sites (Amberley Wild Brooks, Pulborough Brooks, Waltham Brooks) are of great importance for their vascular plants. There are many species of conservation concern (an overview of the most notable plant species, their rarity, and conservation status is outlined within Appendix 8). This includes species which have been assessed as Endangered on the England and Great Britain Red Lists:

Cut-grass *Leersia oryzoides* – A Nationally Rare, Schedule 8 (Wildlife and Countryside Act 1981 (as amended)) and S.41 of Natural Environment and Rural Communities Act (NERC) species, classified as Endangered on both the England and Great Britain Red Lists (PlantAtlas 2020, BSBI). Cut-grass requires disturbance and seasonal inundation in its favoured spots to provide areas of bare mud that aids in the establishment, spread, and persistence of the species. It is detrimentally affected by shading, competitive vegetation, and over-grazing.

Greater Water-parsnip *Sium latifolium* – A Nationally Scarce, S.41 NERC species, classified as Endangered on both the England and Great Britain Red Lists (PlantAtlas 2020, BSBI). Greater Water-parsnip is a perennial herb that was once typical of very wet, species-rich, tall-herb fen, often developing as floating mats within the margins of lakes and large rivers. However, is now more typically found in ditches, growing amongst other emergent species.

Sharp-leaved Pondweed *Potamogeton acutifolius* – A Nationally Rare, S.41 NERC species, classified as Endangered on both the England and Great Britain Red Lists (PlantAtlas 2020, BSBI). *Potamogeton acutifolius* as a species appears to be in gradual, long-term decline within the UK, decreasing significantly in or disappearing completely from parts of its natural range. However, several vigorous populations are still apparent within Sussex, of which the population at Pulborough Brooks SSSI is one.

For each site, all species which are individually designated features or are members of a Vascular Plant Assemblage (VPA) have been assessed. Each species is assessed on the attributes indicated within the Monitoring Specifications (MS), including Presence/Absence, Population Size, Habitat Extent, Successful regeneration, and change over time. Within the report, this assessment for each species includes analyses of changes in distribution, where sufficient data exists.

Natural England's internal guidance on Common Standards Monitoring for Vascular Plants suggests that the most ecologically sound assessment approach is to gather data that leads to an understanding of population sustainability. Where a population is found to be in a healthy condition, Favourable status is assigned based on the assessor's knowledge of ongoing site management and confidence that the appropriate management is in place and is likely to continue until the next assessment cycle.

Appendix 7 and 8 of this assessment provides the CSMG, Natural England standardised guidance, and conservation objectives relevant to vascular plants as features. The findings and condition status for the feature's attributes are summarised in the below sections, relevant to each SSSI.

Amberley Wild Brooks SSSI

Interest features and condition

Amberley Wild Brooks SSSI has been described within *The Flora of Sussex* as remarkable for hosting a "wonderful freshwater aquatic flora" (Abraham et al. 2018). The VPA comprises: Cut-grass *Leersia oryzoides,* True Fox-sedge *Carex vulpina*, Sharp-leaved Pondweed *Potamogeton acutifolius,* Narrow-leaved Water-dropwort *Oenanthe silaifolia,* Greater Water-parsnip *Sium latifolium* and Small Water-pepper *Persicaria minor.* The first two species (Cut-grass *Leersia oryzoides,* and True Fox-sedge *Carex vulpina*) are also individual features in their own right.

The Presence/Absence and Population size of the VPA species are used to determine the overall favourability of the VPA feature, and as such have been assessed separately within this report.

An overview of the features and attributes assessed and current condition status following the recent surveys is detailed in Table 10.1.

Table 10.1 - Condition status following 2021-23 review of the Amberley Wild Brooks SSSI Vascular Plant Assemblage (VPA).

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Vascular Plant Assemblage	Population	Fails	Unfavourable Declining	High
Vascular Plant Assemblage	Presence/absence	Fails	Unfavourable Declining	High
Vascular Plant Assemblage	Successful regeneration - population	Fails	Unfavourable Declining	High

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Leersia oryzoides	Population	Fails	Unfavourable Declining	High
Leersia oryzoides	Presence/absence	Pass	Favourable	High
Carex vulpina	Population	Pass	Unfavourable Declining	Medium [note 2]
Carex vulpina	Presence/absence	Pass	Favourable	High
Potamogeton acutifolius **[note 1]**	Population	Fails	Unfavourable Declining	High
Potamogeton acutifolius **[note 1]**	Presence/absence	Pass	Favourable	High
Oenanthe silaifolia **[note 1]**	Population	Unknown	Unassessed	Not Applicable
Oenanthe silaifolia **[note 1]**	Presence/absence	Unknown	Unassessed	Not Applicable
Sium latifolium **[note 1]**	Population	Fails	Unfavourable Declining	High
Sium latifolium **[note 1]**	Presence/absence	Pass	Unfavourable Declining	High [note 3]

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Persicaria minor **[note 1]**	Population	Fails	Unfavourable Declining	High
Persicaria minor **[note 1]**	Presence/absence	Pass	Favourable	High

Note 1: This species is not an individual designated feature of the site. However, it is noted as a monitored species within the VPA feature and as such has been assessed separately within this report. The inclusion of this species within Table 10.1 is for reference purposes only.

Note 2: A low confidence rating has been assigned to these attributes as the timing of surveys for this species was not ideal. Further information on this is provided in the narrative below.

Note 3: A high confidence rating and Unfavourable Declining condition have been determined for this attribute despite passing the Presence/Absence target. Further information on this is provided in the narrative below.

The VPA feature is assessed against three attributes, the first two of which are used to assess individual species: Population (the count of functional individuals), Presence/Absence (positive identification of the species), and Successful regeneration (proportionate presence of multi age class specimens, possessing either full seed heads or flowers). Unlike other features, the VPA at Amberley Wild Brooks is not assigned to any specific unit/s of the SSSI, as at designation it was determined that this feature was found in abundance across the site according to habitat type.

During Natural England's assessment, many of the constituent species of the VPA were recorded and as a result met the requirements under the Presence/Absence attribute (on a species level). However, the majority were shown to be in low abundance, displaying declining populations or unviable longevity. This resulted not only in the Population attribute for the VPA failing to meet the required targets but also impacted upon the condition status of the Presence/Absence attribute. Furthermore, the data obtained also indicates that the targets of the Successful Regeneration attribute was also not being met and as such, all three attributes, and VPA feature were concluded to be in Unfavourable Declining condition. An overview of each of constituent species is detailed below.

Whilst it was encouraging to find healthy populations of Cut-grass in the central and northern section of the SSSI, the species was found to have declined from its previous range and extent. Cut-grass was recorded in 9 out of the 30 ditches surveyed (30%) and in an additional six ditches when a rare species search was conducted, however this still represents a decline of 17% when compared to surveys carried out in 1998 (referred to

here on after as the 1998 baseline survey) of the same ditches (Figure 10.1, A). The MS states that a decline of up to 10% may be tolerated as part of natural fluctuations, but the decline noted in 2021 is of a significant nature. In some parts of the site Cut-grass was seen to be thriving, but it has been almost lost from the western part of the site and as such, the Population attribute was determined to be in Unfavourable Declining condition. A review of management and external pressures across the site is required to ensure the population reverts to previous levels, to restore the species back to Favourable condition.

True fox-sedge was absent from all previously recorded locations and only a single specimen was found at a new location (Figure 10.1, E). Whilst this constitutes a Pass under the Presence/Absence attributes, this does not represent a healthy population. The feature, therefore, fails under the Population attributes and is assessed as Unfavourable Declining. Whilst Natural England are confident that the data received from the surveying team is accurate, with lead surveyors experienced in botanical identification undertaking the assessments, it is acknowledged that this species can be difficult to detect or discern amongst other elongate leaved emergent plant species. Therefore, a medium confidence rating has been assigned to this feature.

Sharp-leaved Pondweed passed the requirements for Favourable condition under the Presence/Absence attribute, with the species being recorded in 18 out of the 30 ditches surveyed across the site (60%). Whilst this could be perceived to be indicative of a healthy population (relative to the features population attribute), subsequent assessment and comparative analysis against historical data obtained from the 1998 baseline survey have shown that the species has experienced a significant decline (20%) in on-site coverage (Figure 10.1, C). This substantially exceeds the no more than 10% loss to population extent target (as detailed within the MS). Therefore, an Unfavourable Declining condition for the Population attribute and feature was concluded.

Narrow-leaved Water-dropwort was found in one location (Figure 10.1, D). Whilst this feature could have been concluded to be in Unfavourable Declining condition, the lack of available baseline data for the species (not previously recorded during the 1998 baseline survey) has prevented an accurate determination of species presence over time. In addition to this, it was also acknowledged that Natural England’s surveying period for Narrow-leaved Water-dropwort was potentially undertaken too late in the year for the species to be identified with absolute certainty. Therefore, it was concluded that this feature should remain unassessed (as detailed within Table 10.1) with the acknowledgement that further assessment is required.

Greater Water-parsnip was recorded in just two places in the SSSI (Figure 10.1, B) and although this does technically pass the requirements for the Presence/Absence attribute, comparative analysis against the 1998 baseline survey show that the species has displayed a 7% loss in the proportion of ditches hosting the species. Whilst this recorded decline falls within the tolerated range as detailed under the Population attribute targets within the MS (i.e., no more than 10% loss to population extent), the previously noted population range (1998 baseline survey) was already considered too low (present in only 10% of ditches) and following the results of Natural England’s 2021 assessment, Greater

Water-parsnip is now considered to be at an unsustainable level to maintain the population or enable recovery across the SSSI. Therefore, it was concluded that both attributes should be classified as being in Unfavourable Declining condition.

Small Water-pepper was present on site and as such Favourable condition status for the Presence/Absence attribute was concluded. However, the species was only found in 10 % of the ditches surveyed (3 out of 30), which when compared to records obtained from the 1998 baseline survey, represents an on-site decline of approximately 37%. As this was shown to be significantly higher than the prescribed, no loss greater than 10 % target as detailed within the MS, an Unfavourable Declining condition was concluded for the Population attribute, and the species.

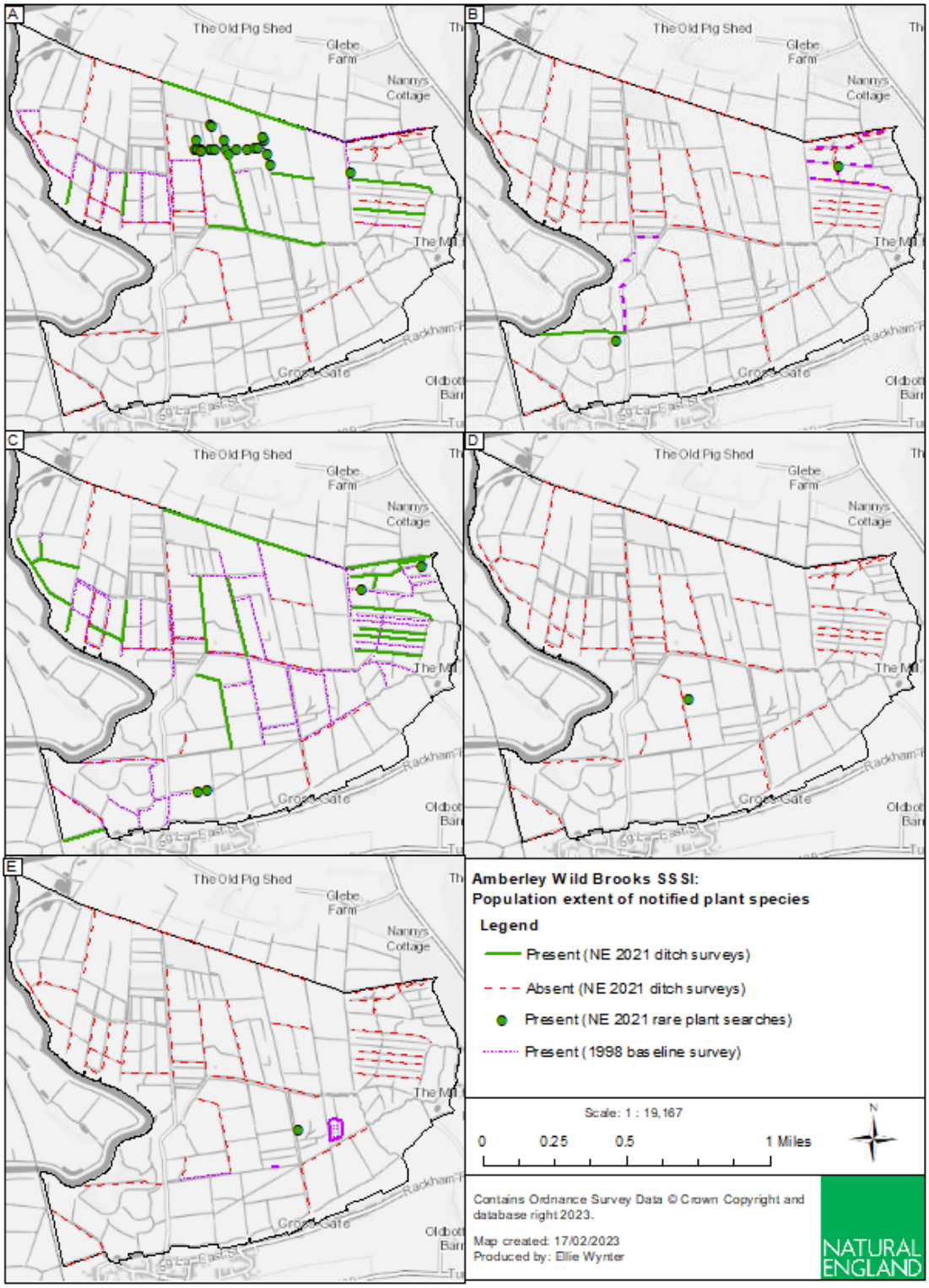


Figure 10.1 - Map of Amberley Wild Brooks SSSI, detailing the previous extent (Purple dotted line, 1998 Baseline survey), recorded presence (green solid line) and recorded absence (red dashed line) of notified plant species as identified from the Natural England 2021 surveys. This included *Leersia oryzoides* (A), *Sium latifolium* (B), *Potamogeton acutifolius* (C), *Oenanthe silaifolia* (D), and *Carex vulpina* (E). N.B. Only ditches assessed in both the 1998 Baseline survey and the Natural England 2021 surveys were used for comparison. Contains Ordnance Survey Data © Crown Copyright and data right 2023.

With one species Unfavourable Declining for both attributes, four species Unfavourable Declining for one attribute, and one species unassessed, the VPA is assessed as Unfavourable Declining for Presence/Absence and Population attributes.

Future Monitoring Specification revision

It is acknowledged that the representation of vascular plants within the SSSI documentation could be improved as only a small proportion of the total suite of plants of conservation importance and local distinctiveness that have been recorded at Amberley Wild Brooks are mentioned.

There are only six species in the VPA, two of which are notified as features in their own right. There are 13 additional species included in the MS to be monitored, either as attributes of other features, or listed in Local Distinctiveness.

By applying the criteria within the Guidelines for the Selection of Biological SSSIs, Chapter 11 Vascular Plants (Taylor et al, 2021), for example if a SSSI renotification were to take place, new notified plant species may be found to be qualifying as features. Meanwhile, in the absence of this, the list of monitored plants of Local Distinctiveness in the MS, should be reviewed to include a more representative range of species of conservation concern. This would provide a more complete characterisation of the importance of the wetland flora at Amberley Wild Brooks and a better means of monitoring trends and condition of the site.

Pulborough Brooks SSSI

Interest features and condition

Pulborough Brooks' VPA feature comprises four species: Greater Water-parsnip *Sium latifolium,* Sharp-leaved Pondweed *Potamogeton acutifolius,* and Narrow-leaved Water-dropwort *Oenanthe silaifolia*. In addition to this, the MS also identifies Cut-grass *Leersia oryzoides* as a species for consideration when assessing the VPA feature for this SSSI. However, there remains uncertainty around the origin and status (native or introduced) of Cut-grass on the site. The species was not known to be present on Pulborough Brooks at the time of designation (1998), with the earliest records dating from 2011 (data from Botanical Society of Britain and Ireland, accessed online, 2023). Because of this, Cut-grass has not been included within the VPA for this assessment.

An overview of the features and attributes assessed and current condition status following the recent surveys is detailed in Table 10.2.

Table 10.2 - Condition status following 2021-23 review of the Pulborough Brooks SSSI Vascular Plant Assemblage.

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Vascular Plant Assemblage	Habitat Extent	Pass	Favourable	Low [note 2]
Vascular Plant Assemblage	Presence/absence	Fails	Unfavourable Declining	High
Vascular Plant Assemblage	Population	Fails	Unfavourable Declining	High
***Sium latifolium* [note 1]**	Population	Fails	Unfavourable Declining	Medium [note 3]
***Sium latifolium* [note 1]**	Presence/absence	Fails	Unfavourable Declining	High
***Potamogeton acutifolius* [note 1]**	Population	Pass	Favourable	Low [note 4]
***Potamogeton acutifolius* [note 1]**	Presence/absence	Pass	Favourable	High
***Oenanthe silaifolia* [note 1]**	Population	Fails	Unfavourable Declining	Low [notes 4 - 5]
***Oenanthe silaifolia* [note 1]**	Presence/absence	Pass	Favourable	High

Note 1: This species is not an individual designated feature of the site. However, it is noted as a monitored species within the VPA feature and as such has been assessed separately within this report. The inclusion of this species within Table 10.2 is for reference purposes only.

Note 2: A low confidence rating has been assigned to this attribute as it is acknowledged that determination of condition should not solely rely on the physical presence of the feature (the ditches) and environmental considerations should also be considered.

Note 3: A medium confidence rating has been assigned to this attribute as there are limited baseline records to compare the current population against.

Note 4: A low confidence rating has been assigned to this attribute as there are disparities between historic and current population distribution creating uncertainty on overall population size. Further information on this is provided in the narrative below.

Note 4: A low confidence rating has been assigned to this attribute as the timing of surveys for this species were sub-optimal. Further information on this is again provided in the narrative below.

For the VPA at Pulborough Brooks SSSI, the MS states that three attributes should be assessed: Habitat extent (the ditch habitat feature of the site), Population (the count of functional individuals), and Presence/Absence (positive identification of the species). As detailed within Section 8 of this report, analysis of aerial imagery and on-site observations showed no apparent loss of habitat extent or ditch infilling, and as such the Habitat extent attribute was concluded to be in Favourable condition status. It is, however acknowledged, that determining the condition status of this attribute solely through the physical presence of the feature does not fully determine the overall suitability of the habitat, and several environmental factors, such as suitable hydrochemistry should also be considered. For this reason, a low confidence rating has been determined for this attribute. For the other two attributes, Population, and Presence/Absence, the determination of condition status was based on survey results for each species. An overview is provided below.

Greater Water-parsnip was not recorded during Natural England's 2021 botanical surveys or assessment of the ditch habitat feature, and the species was also absent from all previously recorded locations during a subsequent rare plant search (Figure 10.2A), suggesting that it has been lost from site. As such, an Unfavourable Declining condition was concluded for both the Presence/Absence, and Population attribute. Natural England determine the data obtained from their assessment as sufficient in supporting the condition status of this feature. However, it is acknowledged that there is limited baseline data for this species on site and as a result have a assigned a medium confidence rating to the Population attribute of this feature.

For Sharp-leaved Pondweed, the species was present in 14 of the 19 ditches surveyed (74%, Figure 10.2B) and as such, both the Population and Presence/Absence attribute were concluded to be in Favourable condition. It was, however, difficult to determine any changes in population size. Therefore, a low confidence rating was determined for the Population attribute. The current distribution of Sharp-leaved Pondweed has been mapped more fully to allow future monitoring to include meaningful comparisons.

Narrow-leaved Water-dropwort was not present in any of the previously recorded locations. However, several seed producing specimens were found in a new but localised area of the SSSI (Figure 10.2C) and as such, the Presence/Absence attribute was concluded to be in Favourable condition. With the noted disparities in plant distribution indicating a decreasing presence of the species on site, the Population attribute was determined to be in Unfavourable Declining condition. Natural England, however, acknowledge that their surveying period for this species was sub-optimal and for this reason a low confidence rating for this attribute was concluded. As with Sharp-leaved

Pondweed, the current distribution of this species has been mapped to assist in future monitoring.

With two of the three constituent species being assessed as Unfavourable Declining, the VPA is also concluded to be in Unfavourable Declining condition.

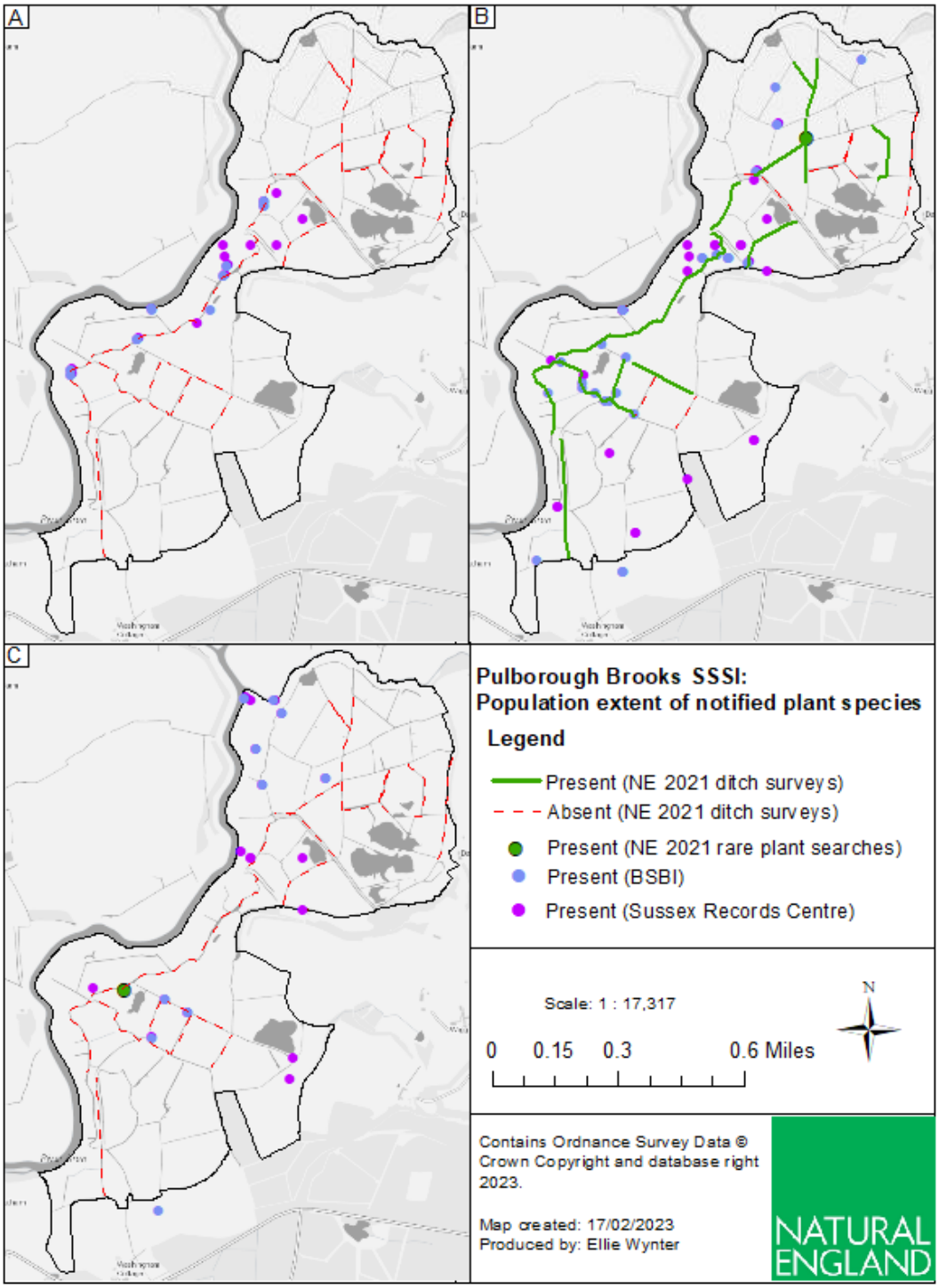


Figure 10.2 - Map of Pulborough Brooks SSSI, detailing the previous extent (Mauve dots, Botanical Society of Britain & Ireland, and Purple dots, Sussex Biodiversity records

centre), recorded presence (Green solid line) and recorded absence (Red dashed line) of notified plant species as identified from the Natural England 2021 surveys. This included *Sium latifolium* (A), *Potamogeton acutifolius* (B), and *Oenanthe silaifolia* (C). Includes occurrence data from the Botanical Society of Britain and Ireland (BSBI), accessed online (2023)

Future Monitoring Specification revision

It is acknowledged that the representation of vascular plants within the SSSI documentation could be improved as only a small proportion of the total suite of plants of conservation importance and local distinctiveness that have been recorded at Pulborough Brooks are mentioned.

There are only three species currently detailed within the VPA of the MS, with another noted for consideration (*Leersia oryzoides*). However, records indicate several other species of conservation importance and characteristic of the habitats which could usefully be considered for monitoring either as attributes of other features or listed in Local Distinctiveness.

By applying the criteria within the Guidelines for the Selection of Biological SSSIs, Chapter 11 Vascular Plants (Taylor et al, 2021), for example if a SSSI renotification were to take place, new notified plant species may be found to be qualifying as features. Meanwhile, in the absence of this, the list of monitored plants of Local Distinctiveness in the MS, should be reviewed to include a more representative range of species of conservation concern. This would provide more complete characterisation of the importance of the wetland flora at Pulborough Brooks and a better means of monitoring trends and condition of the site.

Waltham Brooks SSSI

Interest features and condition

Waltham Brooks does not have a VPA as a designated feature, however the MS does recognise that there is a VPA associated with the overarching Ramsar designation and is a monitored attribute under the SSSI's ditch habitat feature. Therefore, assessment of a VPA should be taken into consideration when assessing overall condition of the site, and for this reason it has been included within this report. The VPA's constituent species are: Cut-grass *Leersia oryzoides,* Marsh Fern *Thelypteris palustris*, Narrow-leaved Water-dropwort *Oenanthe silaifolia*, Greater Water-parsnip *Sium latifolium*, Hairlike pondweed *Potamogeton trichoides,* Small Water-pepper *Persicaria minor*, and Sharp-leaved Pondweed *Potamogeton acutifolius.* In addition to this, Cut-grass *Leersia oryzoides* is also an individually designated feature. Following the MS, these species are assessed under two attributes: Population (the count of functional individuals), and Presence/Absence (positive identification of the species).

For the VPA, the MS states that three attributes should be assessed: Habitat extent (the ditch habitat feature of the site), Population (the count of functional individuals), and Presence/Absence (positive identification of the species). As detailed within Section 8 of this report, analysis of aerial imagery and on-site observations showed no apparent loss of habitat extent or ditch infilling, and so Habitat extent was concluded to be in Favourable condition status. It is, however acknowledged, that determining the condition status of this attribute solely through the physical presence of the feature does not fully determine the overall suitability of the habitat, and several environmental factors, such as appropriate hydrochemistry should also be considered. For this reason, a low confidence rating has been determined for this attribute. For the other two attributes, Population, and Presence/Absence, the determination of condition status was based on the survey results for each species.

An overview of the features and attributes assessed and current condition status following the recent surveys is detailed in Table 10.3.

Table 10.3 - Condition status following 2021-23 review of the Waltham Brooks SSSI Vascular Plant Assemblage.

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Leersia oryzoides	Population	Fails	Unfavourable Declining	High
Leersia oryzoides	Presence/absence	Fails	Unfavourable Declining	High
Vascular Plant Assemblage [note 1]	Habitat extent	Pass	Favourable	Low [note 2]
Vascular Plant Assemblage [note 1]	Presence/absence	Fails	Unfavourable Declining	High
Vascular Plant Assemblage [note 1]	Population	Fails	Unfavourable Declining	High

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Thelypteris palustris **[note 1]**	Population	Fails	Unfavourable Declining	Medium [note 3]
Thelypteris palustris **[note 1]**	Presence/absence	Fails	Unfavourable Declining	High
Oenanthe silaifolia **[note 1]**	Population	Fails	Unfavourable Declining	High
Oenanthe silaifolia **[note 1]**	Presence/absence	Pass	Favourable	Low [note 4]
Sium latifolium **[note 1]**	Population	Fails	Unfavourable Declining	Medium [note 3]
Sium latifolium **[note 1]**	Presence/absence	Fails	Unfavourable Declining	High
Potamogeton trichoides **[note 1]**	Population	Fails	Unfavourable Declining	Medium [note 3]
Potamogeton trichoides **[note 1]**	Presence/absence	Fails	Unfavourable Declining	High
Persicaria minor [**note 1]**	Population	Fails	Unfavourable Declining	Medium [note 3]
Persicaria minor [**note 1]**	Presence/absence	Pass	Favourable	High

Feature	Attribute	Meets CSMG target	New condition status	Confidence
Potamogeton acutifolius **[note 1]**	Population	Fails	Unfavourable Declining	Medium [note 3]
Potamogeton acutifolius **[note 1]**	Presence/absence	Pass	Favourable	High

Note 1: This feature/species is not an individual designated feature of the site. However, it is noted as a monitored feature within the VPA of the overarching Ramsar and is included as a monitored attribute under the SSSI's ditch habitat feature, and as such has been assessed separately within this report. The inclusion of the feature/species within Table 10.3 is for reference purposes only.

Note 2: A low confidence rating has been assigned to this attribute as it is acknowledged that determination of condition should not solely rely on the physical presence of the feature (the ditches) and environmental considerations should also be considered.

Note 3: A medium confidence rating has been assigned to this attribute as there is limited baseline data, as further detailed in the narrative below.

Note 4: A low confidence rating has been assigned to these attributes as the timing and extent of the surveys for this species was not ideal. Further information can be found in the narrative below.

Cut-grass is the only vascular plant species at Waltham Brooks SSSI that is designated as a feature in its own right and historical records (Figure 10.3A) have shown its presence on site in many locations surrounding the main lake. Despite examining similar locations, Cut-grass was not found in any of the surveys undertaken during 2021, including Natural England's assessment of ditch habitat and wet grassland features, with the species also being absent during subsequent rare plant searches. Therefore, both attributes of this feature, Population and Presence/Absence were concluded to be in Unfavourable Declining condition.

Three of the six species noted within the MS were not recorded during Natural England's assessment: Marsh Fern, Greater Water-parsnip, and Hairlike Pondweed. As a result of this, an Unfavourable Declining condition was concluded on both attributes (Population and Presence/Absence) for these species. Natural England are satisfied that the surveys undertaken were adequate to assess the presence/condition of these species. However, it is recognised that the lack of baseline data means it is difficult to determine the degree of change from the historic position, so a medium confidence rating has been determined for the Population attributes of these species.

Both Sharp-leaved Pondweed and Small Water-pepper were recorded during Natural England's assessment, and as such the Presence/Absence attribute for these species was concluded to be in Favourable condition. However, subsequent analysis of survey data

indicates both species are displaying unviable population sizes and, therefore, an Unfavourable Declining condition was concluded for the Population attribute. As previously stated, Natural England acknowledge that the determination of degree of change, if any, is impacted by the limited amount of baseline data for these species on site and for this reason, a medium confidence rating has been determined.

The Presence/Absence attribute for Narrow-leaved Water-dropwort was concluded to be in Favourable condition, despite no observations of the species during Natural England's assessment of ditch or wet-grassland habitat feature, and only a single specimen recorded during a subsequent rare plant search. Rare plant searches were focused in areas where a species has been historically recorded (Figure 10.3B), however these were limited due to capacity, restricted access, and time constraints. Natural England also acknowledge that the surveys undertaken for this species may have been too late in the year to maximise chances of detection due to die back of the plant and, therefore, a low confidence rating has been determined for the Population attribute. Nevertheless, the data obtained is sufficient to support a decision of Unfavourable Declining condition.

With all constituent species being Unfavourable Declining, the VPA is also concluded to be in Unfavourable Declining condition.

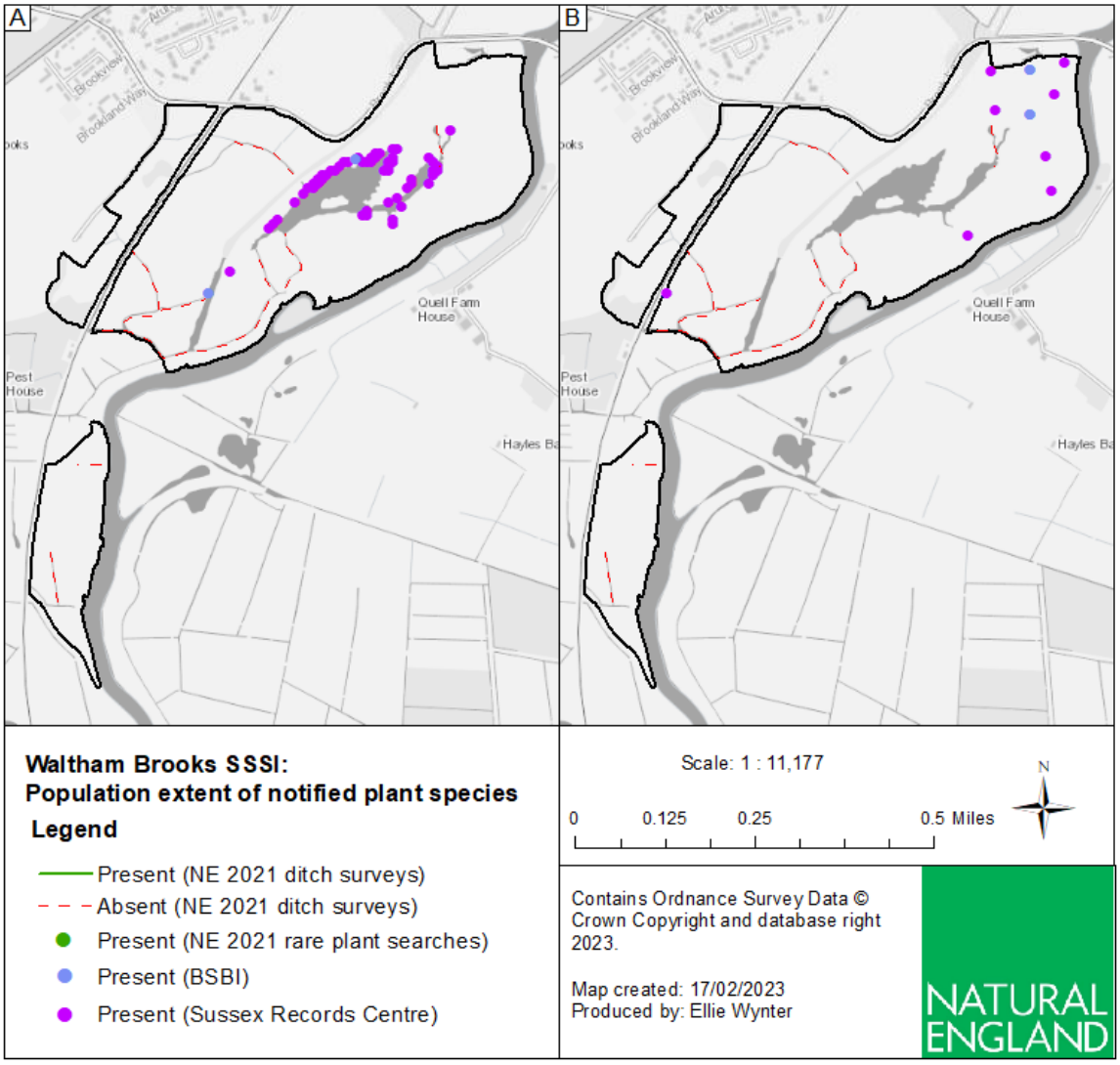


Figure 10.3 - Map of Waltham Brooks SSSI, detailing the previous extent (Mauve dots, Botanical Society of Britain & Ireland, and Purple dots, Sussex Biodiversity records centre), recorded presence (Green solid line) and recorded absence (Red dashed line) of notified plant species as identified from the Natural England 2021 surveys. This included *Leersia oryzoides* (A), and *Oenanthe silaifolia* (B). Includes occurrence data from the Botanical Society of Britain and Ireland (BSBI), accessed online (2023)

Future Monitoring Specification revision

It is noted that the representation of vascular plants within the SSSI documentation could be improved as only a small proportion of the total suite of plants of conservation importance and local distinctiveness that have been recorded at Waltham Brooks are mentioned.

Whilst there is no VPA designated for this SSSI, there are 7 species included in the MS to be monitored as a VPA associated with the ditch habitat feature. Further, records indicate several other species which could be considered for monitoring either as attributes of other features or listed in Local Distinctiveness.

By applying the criteria within the Guidelines for the Selection of Biological SSSIs, Chapter 11 Vascular Plants (Taylor et al, 2021), for example if a SSSI renotification were to take place, new notified plant species may be found to be qualifying as features. Meanwhile, in the absence of this, the list of monitored plants of Local Distinctiveness in the MS, should be reviewed to include a more representative range of species of conservation concern, this would provide a more complete characterisation of the importance of the wetland flora at Waltham Brooks and a better means of monitoring trends and condition of the site.

11. SAC interest feature – *Anisus vorticulus*

The Little Whirlpool Ramshorn Snail *Anisus vorticulus*, identifiable through its flattened spiral shell (≤ 5 mm, diameter) is a small, localised, aquatic species of mollusc with a geographic range that typically extends between central and Southern Europe (JNCC, n.d). This species, which formerly occurred at around 15 sites in the South and East of England, inhabits the clean, unpolluted, usually calcareous water of well vegetated marsh drains or ditches and can be found in association with a rich assemblage of other aquatic flora and fauna. This can include important invertebrate communities and often other rare molluscs, such as the Shining Ramshorn Snail *Segmentina nitida*, Large Mouthed Valve Snail *Valvata macrostomo,* and *Euglesa pseudosphaerium* (as it does in the Arun Valley).

The historical decline observed in *Anisus vorticulus* populations throughout the species' natural range has subsequently led to *A. vorticulus* and its associated habitats becoming protected under legislative policy, including the European Union Habitats and Species Directive (Council Directive 92/43/EEC). Although the reasons attributed to this decline are not fully understood, an ensuing impact on UK populations of *A. vorticulus* is apparent, with the species now restricted to local communities within areas of Norfolk, Suffolk, and Sussex. To mitigate against further loss, the sites in which *A. vorticulus* remain have subsequently been designated as Special Areas of Conservation (SAC). One of these remaining locations is the Arun Valley SAC, which encompasses both Amberley Wild Brooks SSSI and Pulborough Brooks SSSI.

There have been concentrated efforts made to better understand and monitor the SAC species on both Amberley Wild Brooks and Pulborough Brooks, including but not limited to several historic and more recent surveys conducted by expert malacologists (specialists in molluscan identification and study). The results of these studies have indicated significant levels of concern relating to the population status of this species, and prior to this review it was thought that *A. vorticulus* had disappeared from Amberley Wild Brooks and was declining on Pulborough Brooks, despite the deployment of extensive conservation efforts including "Back From The Brink" project funding. This collection of information has been reviewed for use in this condition assessment where appropriate and involves data from specific surveys undertaken between 2020-2022 (unpublished Natural England commissioned survey report by expert mollusc consultant Dr. Martin Willing, available on request, and unpublished data from RSPB).

Appendix 9 of this assessment provides the CSMG, Natural England standardised guidance, and conservation objectives relevant to this feature. The findings and condition status for the feature's attributes are summarised in the below sections, relevant to each SSSI.

Amberley Wild Brooks SSSI

Interest feature and condition

Prior to this condition assessment, periodic surveys conducted on site showed growing evidence that the population and extent of *A. vorticulus* had severely declined at Amberley Wild Brooks SSSI (an overview of the historic *A. vorticulus* surveys is available in Appendix 9). Markable concern relating to the status of this species on site had been highlighted on several occasions, with survey results noting a "total loss" of *A. vorticulus* within pre-inhabited areas of the site (western end of the SSSI, from 2005 onwards) and the perceived on-site extinction of the species following a hiatus in recorded presence (applicable to all previously inhabited areas within the SSSI between 2009–2015).

To clarify whether *A. vorticulus* had officially been lost from Amberley Wild Brooks, an inclusive molluscan survey of all 142 ditches was undertaken in 2015. Although *A. vorticulus* was found to be present at the time of this survey, only a few live specimens were recorded within a confined area of this SSSI (part of the SAC). Therefore, for the purpose of this assessment and to better understand the status of *A. vorticulus* at Amberley Wild Brooks, Natural England commissioned an additional survey of all *A. vorticulus* pre-inhabited ditches on site (unpublished Natural England commissioned survey report by expert mollusc consultant Dr. Martin Willing, available on request). An overview of the attributes assessed and current condition status following the most recent surveys are detailed in Table 11.1, with a summary of the findings detailed below.

Table 11.1 - Condition status following 2021-23 review of the Amberley Wild Brooks SSSI *Anisus vorticulus* SAC interest feature.

Attribute	Meets CSMG target	New condition status	Confidence
Population	Fails	Unfavourable Declining	High
Presence/Absence	Pass	Favourable	High
Population extent	Fails	Unfavourable Declining	High
Successful regeneration	Fails	Unfavourable Declining	High

The most recent surveys conducted at Amberley Wild Brooks showed that *A. vorticulus* populations were present in low numbers, enabling the Presence/Absence attribute to

achieve Favourable condition status. However, as only a minimal number of specimens were recorded during this survey, it was concluded that the current estimated population had significantly exceeded the target of no more than 20% loss to baseline population density, resulting in the determination of Unfavourable Declining condition for the Population attribute.

For the population extent attribute to achieve Favourable condition status, at least 10% of the surveyed ditches must show a positive presence of *Anisus vorticulus*, and no decrease of more than 20% to the baseline extent (previously inhabited areas) is to be observed. As *A. vorticulus* was not found to be present in any of the 16 previously occupied ditches, and only observed in small numbers in a close-by adjacent ditch, this attribute failed to meet its targeted requirement and has been concluded to be in Unfavourable Declining condition. This conclusion was subsequently supported by the results of additional surveys undertaken on behalf of Southern Water (unpublished survey in May 2022, undertaken as part of their Hardham Basin Environmental Sustainability investigation, see section 13 for more details). This 2022 Southern Water survey showed the presence of *A. vorticulus* within one previously identified positive site (from the Willing (2022) survey commissioned by Natural England) and three separate sections within the adjoining ditch network, made up of two ditches. This indicates that only four separate, compartmental sections are currently inhabited by the species. Therefore, still failing to meet the no decrease of more than 20% to baseline extent (as previously the species occupied 16 ditches).

Due to the low volume of *A. vorticulus* and absence of multiple age class specimens recorded during the 2021 survey (Willing, 2022), successful regeneration could not be determined and therefore, this attribute also failed to meet its target and has been concluded to be in Unfavourable Declining condition. Whilst the results of Natural England's commissioned survey may give an indication into the population presence and extent of *A. vorticulus* at Amberley Wild Brooks, a true representation remains inconclusive with surveys only offering a "snapshot" of the situation faced by the species. As the conclusion for this feature has shown an Unfavourable declining condition across three of the four attributes, there is plausible concern surrounding the future longevity of the species on site. This sentiment is echoed in supporting documentation, and the data obtained from Natural England's condition assessment which indicate the species has seen a significant decline on site. Whilst it is not possible to say with certainty the overarching cause of such decline, the available data and anecdotal evidence suggest that a variety of impeding factors, working alone or in conjunction could be having a detrimental impact on the population presence and extent of *A. vorticulus* at Amberley Wild Brooks (an overview of which is detailed below).

As concluded in this assessment, the ditches which form the supporting habitat for *A. vorticulus* have been classified as being in Unfavourable Declining condition (Further details provided in Sections 8 and 15). Relative to this feature, the following issues have been highlighted:

Inappropriate ditch structure, or ditch management.

As it stands, appropriate ditch management can be characterised by two key elements: staggered clearance (a series of cleared and un-cleared sections so refuges are provided), and rotational clearance (management carried out over a long rotation to allow time to recover).

- Only 53% of ditches surveyed, known to previously support *A. vorticulus* were shown to have a berm/margin with gentle gradient on one side or both (target as per MS being 80%).
- 64% of the ditches surveyed (across the whole site) were in a mid-successional stage, with a noted absence of ditch structure heterogeneity. This is thought to be insufficient to adequately support the various life cycle stages of *A. vorticulus* which require a broader range of habitat homogeneity.

Water quality/chemistry, ditch water depth and water retainment

- Poor water quality attributes, including high levels of total phosphorous (TP) and total nitrogen (TN). This could pose a significant risk in promoting the growth of competitive light inhibiting species, or lead to a state of eutrophication to occur, resulting in hypoxic conditions (depletion of dissolved oxygen, DO) and subsequent loss in biodiversity.
- During the survey period of this assessment (2021-22), ditches across this site, including those where this species was and is present, were recorded to have significantly low levels of water at times, and in some cases, ditches had dried out completely.
- Potentially ineffective water retainment structures (sluices) and tidal ingress. Alteration to water chemistry parameters may impact *A. vorticulus,* for example the species is known to have no tolerance to increased salinity.

Invasive Non-Native Species (INNS)

- New Zealand Pigmyweed *Crassula helmsii,* and *Azolla* spp*.* identified on site. insufficient management could result in detrimental impacts to the population presence, or level of extent of *A. vorticulus* through:
    - impediment of natural hydrological function (altering the connectivity of ditch networks, flow of water and dispersal of pollutants).
    - outcompeting of native plant species (used by *A. vorticulus* throughout the species various life cycle stages).
    - obstruction of light through excessive growth/coverage, leading to the prevailing of hypoxic conditions (depletion of DO), and subsequent decline in biodiversity (fish, invertebrates, aquatic flora, etc.).
- Anecdotal evidence (RSPB Reserve Manager, 2022, personal communication) identifying the presence of Common Carp *Cyprinus carpio*. This potentially poses both a direct (predation, Carp being omnivorous) and indirect (decrease in supporting habitat and water quality parameters) risk to *A. vorticulus.*

Pulborough Brooks SSSI

Interest feature and condition

Pulborough Brooks SSSI is owned and managed by the RSPB, and as a site is believed to possess the second largest population of *A. vorticulus* within the UK (RSPB Senior Ecologist, 2016, personal communication). However, as forementioned within this report, the extent and subsequent population of the species at Pulborough Brooks has been predicted to be declining. This was supported within the results and following an on-site, full ditch network survey and population assessment of *A. vorticulus* (Willing, 2015a). The findings of which showed *A. vorticulus* as being present in 17 ditches (North), but additionally reported that the species had been lost from both the central and southern parts of the reserve, including the ditches in which *A. vorticulus* had previously inhabited.

The important role that Pulborough Brooks SSSI plays in ensuring that the UK retains a "strong hold" population of *A. vorticulus* has subsequently increased and is particularly attributed to the observed significant decline of the species recorded at Amberley Wild Brooks SSSI (Willing, 2015b, confirmed in Willing, 2021). The highlighted potential for the loss of *A. vorticulus* throughout the Arun Valley helped to identify a requirement for conservation efforts to be made. This resulted in the RSPB securing "Back From The Brink" (BFTB) funding from 2016 which was used to improve the understanding of habitat conditions and how they can be optimised to promote protection of the species (an overview of the findings from the BFTB trial and subsequent quality assurance survey is available in Appendix 9).

As part of the data collection process for the BFTB trial, an annual assessment of *A. vorticulus* populations was undertaken (for a total of three years, 2018 - 2020), with the records obtained from the final assessment (year 3) being supported by an additional quality assurance survey. A Natural England review of this data concluded that it provided the sufficient information to determine the condition of all reasonably assessable attributes without the need for additional surveys to be undertaken.

An overview of the attributes assessed and current condition status following the analysis of the BFTB trial data are detailed in Table 11.2, with a summary of the findings detailed below.

Table 11.2 - Condition status following 2021-23 review of the Pulborough Brooks SSSI *Anisus vorticulus* interest feature.

Attribute	Meets CSMG target	New condition status	Confidence
Presence/Absence	Pass	Favourable	High

Attribute	Meets CSMG target	New condition status	Confidence
Population	Unknown	Unassessed	Not applicable
Population extent	Fails	Unfavourable Declining	High
Successful regeneration	Unknown	Unfavourable Declining	High

In summary, the data obtained from the BFTB trial showed an annual positive presence of *A.vorticulus* within the monitored area of the reserve (Northern part of the SSSI), and as such the Presence/Absence attribute was concluded to be in Favourable condition. During annual assessment, a significant increase was shown in the number of specimens recorded (equivalent to 83% between 2018 – 2020) and whilst this growth could be indicative of achieving Favourable condition status under the population attribute, uncertainties surrounding the original population volume (prior to undertaking the trial) meant there was no clear baseline data to accurately assess this attribute. Therefore, at this stage it remains Unassessed, as detailed within Table 11.2. To increase confidence and make it possible to conclude condition of this attribute, consistency with future surveys should be maintained, with the records obtained from the BFTB trial used as a point of comparison and analysis.

The creation of new BFTB trial ditch sections within the northern area of the reserve during 2016 - 17 was shown to be effective and colonisation of the species in these areas was successful. This resulted in the population expanse (Population extent attribute) of *A. vorticulus* increasing within this area by 8.85% (between 2018–2020), indicating Favourable condition for this attribute and taking the total length of inhabited ditches from 2,317 to 2,522 metres. However, as there was a recorded inability to establish *A. vorticulus* populations within previously inhabited areas of the reserve (central and southern), at a SSSI scale, this attribute was concluded to be in Unfavourable Declining, further investigation would be advised.

The apparent restriction of *A. vorticulus* to the northern area of the reserve, and absence of the species from areas previously inhabited (central and southern) has subsequently impacted the successful regeneration attribute and has also resulted in an Unfavourable Declining status being concluded. Whilst it is apparent that successful regeneration of the species is occurring within the northern area of the site, with a significant increase in population size, and recording of multiple size class specimens being noted throughout the trial, it is apparent that there are issues impacting *A. vorticulus* presence within the wider reserve. Continual monitoring of the habitat characteristics (water quality, water chemistry, hydrological connectivity, ditch structure, etc.) within the impacted areas of the reserve

(central and southern) would enable a better understanding of the causes of decline and help to inform if, or how reformative works should be undertaken.

The data obtained and used during Natural England's recent condition assessment, and anecdotal evidence supplied to Natural England suggest there are a variety of impeding factors, working alone or in conjunction which could be having a detrimental impact on the population presence and extent of *A. vorticulus* at Pulborough Brooks. For example, the ditches which form the supporting habitat for *A. vorticulus* have been classified as being in Unfavourable Declining condition (Further details provided in Sections 8 and 15). Relative to this feature, the following issues have been highlighted:

Inappropriate ditch structure, or ditch management.

As it stands, appropriate ditch management can be characterised by two key elements: staggered clearance (a series of cleared and un-cleared sections so refuges are provided), and rotational clearance (management carried out over a long rotation to allow time to recover).

- Only 47% of ditches surveyed were shown to have a berm/margin with gentle gradient on one side or both (target as per MS being 80%).
- 83% of the ditches surveyed (across the whole site) were in a mid-successional stage, with a noted absence of ditch structure heterogeneity. This is thought to be insufficient to adequately support the various life cycle stages of *A. vorticulus* which require a broader range of habitat homogeneity.

Water quality/chemistry, availability and water retainment

- Poor water quality attributes, including high levels of total phosphorous (TP) and total nitrogen (TN). This could pose a significant risk in promoting the growth of competitive light inhibiting species, or lead to a state of eutrophication to occur, resulting in hypoxic conditions (depletion of dissolved oxygen, DO) and subsequent loss in biodiversity.
- Before the survey period of this assessment (2021-22), concerns have been raised of low levels of water within ditches (RSPB Reserve Manager, 2021, personal communication).
- Potentially ineffective water retainment structures (sluices) and tidal ingress. Alteration to water chemistry parameters may impact *A. vorticulus,* for example the species is known to have no tolerance to increased salinity.

Invasive Non-Native Species (INNS)

Canadian Waterweed *Elodea canadensis,* and Nutall's Waterweed *E. nuttallii* identified on site. insufficient management could result in detrimental impacts to the population presence, or level of extent of *A. vorticulus* through:

- impediment of natural hydrological function (altering the connectivity of ditch networks, flow of water and dispersal of pollutants).

- outcompeting of native plant species (used by *A. vorticulus* throughout the species various life cycle stages).
- obstruction of light through excessive growth/coverage, leading to the prevailing of hypoxic conditions (depletion of DO), and subsequent decline in biodiversity (fish, invertebrates, aquatic flora, etc.).

Anecdotal evidence (RSPB Reserve Manager, 2022, personal communication) identifying the presence of Common Carp *Cyprinus carpio*. This potentially poses both a direct (predation, Carp being omnivorous) and indirect (decrease in supporting habitat and water quality parameters) risk to *A. vorticulus.*

This feature is primarily in Unfavourable condition however, the BFTB trial has been beneficial in increasing the knowledge surrounding both the species in general, and the reliance that *A. vorticulus* has on habitat conditions. This project highlighted that the undertaking of sufficient, albeit different, habitat management techniques can be implemented without causing loss to *A. vorticulus* and is supported through the observation of “good recruiting populations” in all variations of managed ditches. This indicates that the undertaking of species targeted management techniques could be beneficial in promoting the population presence and extent of the species further at Pulborough Brooks SSSI and Amberley Wild Brooks SSSI (as well as wider sites where *A. vorticulus* is present). Therefore, Natural England commend the work carried out by all those involved in the BFTB trial and hope that the findings of these reports can aid in further recovery of the species.

12. Ramsar site criteria and SPA interest features

The Arun Valley SPA and Ramsar site encompasses the three floodplain sites assessed in this report: Amberley Wild Brooks, Pulborough Brooks, and Waltham Brooks SSSIs. As detailed in section 1, the SPA interest features are as follows:

- A037 Bewick's swan, *Cygnus columbianus bewickii* non-breeding
- Water bird assemblage, non-breeding.

And the Ramsar designated criteria are as follows:

- Criterion 2: Site holds 7 wetland invertebrates listed on British RDB as threatened and 1 of these is endangered. Site holds 4 Nationally Rare and 4 Nationally Scarce plant species.
- Criterion 3: Ditches hold outstanding aquatic native flora in addition to the rare and threatened species.
- Criterion 5: Internationally important assemblage of waterfowl.

In relation to the SPA and Ramsar designated wintering bird assemblage feature and / or criterion, Natural England's MSs for Amberley Wild Brooks, Pulborough Brooks, and Waltham Brooks SSSIs all list a target for the SPA/Ramsar that they are 'Used regularly by more than 20,000 wintering waterfowl'. The assessment target describes that this is only to be assessed at the level of the SPA/Ramsar site, not at SSSI level. The numbers are to be based on the known natural fluctuations of the population at this site, maintaining the population at the 5-year mean figure recorded immediately prior to designation and not using the lowest annual figure as the baseline (due to large fluctuations in short time scale). The feature will be considered Unfavourable if the population falls below 50% of that at designation. The SPA and Ramsar target are to maintain the population above 13,621 individuals across the SPA and Ramsar site (50% of that at designation).

From the WeBS data taken from surveys between 1992-97, the peak mean was 27,241 individuals across the SPA and Ramsar site. The most recent WeBS data available, surveys undertaken between 2015/16 to 2019/20, recorded a peak mean of 12,365 individuals. This represents a significant reduction in records since 1992 where the population appears to have declined more than 50%. For this reason, the associated SPA feature and Ramsar criterion is in Unfavourable Declining condition. However, further investigation is required to assess whether this decline is in line with, or outside of, expected national decline patterns.

For the SPA Bewick's swan, *Cygnus columbianus bewickii* interest feature, based on the assessment of this species across the three SSSIs (as outlined in section 7) this is also in Unfavourable Declining condition. However, similar to the wintering bird assemblage feature conclusions, further investigation is required to establish if the extent of decline across all three SSSIs is greater than expected from national decline, this will determine

whether this interest feature is still appropriate (taking into consideration the likelihood of this species being able to return to site in future).

A summary of the condition status of the other Ramsar criteria listed above (criterion 2 and 3), outside of the waterfowl assemblage (criterion 5) is provided in Tables 12.1 and 12.2. This is based on the assessment of these features from sections: 5 (*Odonata),* 6 (invertebrates), 8 (ditches), 10 (vascular plants) and 11 (*Anisus vorticulus*). Taking the same approach as what has been currently agreed across Natural England for condition assessing SSSIs (which takes the precautionary approach: if one attribute/feature is in an Unfavourable condition, the feature/unit condition is based on that), overall the condition status for criterion 2 and 3 would also be in Unfavourable Declining condition.

Ramsar criterion 2:

As described under The Ramsar Sites Criteria guidance, and based on species and ecological communities, "A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities".

Table 12.1 - Condition status of SSSI features relating to Ramsar criterion 2.

Related SSSI Feature	Amberley Wild Brooks	Pulborough Brooks	Waltham Brooks
Outstanding invertebrate assemblage	Unfavourable No Change	Unfavourable No Change	Not applicable [note 1]
Outstanding Odonata assemblage	Favourable	Favourable	Not applicable
Rare Odonota: *Libellula fulva*, Scarce chaser	Not applicable	Favourable	Not applicable
Rare Odonota: *Gomphus vulgatissimus,* Club-tailed dragonfly	Not applicable	Unfavourable No Change	Not applicable
Vascular Plant Assemblage	Unfavourable Declining	Not applicable	Unfavourable No Change

Population of Schedule 8 plant - *Leersia oryzoides,* Cut-grass	Unfavourable Declining	Not applicable	Unfavourable Declining
Population of RDB plant - *Carex vulpina,* True Fox-sedge	Unfavourable Declining	Not applicable	Not applicable
Population of RDB mollusc - *Anisus vorticulus*, Little Whirlpool Ramshorn Snail	Unfavourable Declining	Unfavourable No Change	Not applicable
Lowland neutral grassland (M23, MG6, M25) (note 2)	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Alluvial grazing marshes with ditches, swamp (S4, S5, S6, S7, S11, S12, S19 related communities) (note 2)	Unfavourable Declining	Not applicable	Unfavourable Declining

Note 1: Outstanding invertebrate assemblage not a designated feature at Waltham Brooks on a SSSI level. However, The False Orb Pea Mussel *Euglesa pseudosphaerium* (formerly *Psidium pseudo-sphaerium*, IUCN) is an invertebrate designated under the Ramsar classification and is a monitored feature on this site. Surveys undertaken in 2021 identified *Pisidium* genus (of which *E. pseudosphaerium* is part) present on site, however, the consultant was unable to identify the specimens to species level during surveys. For this reason, this species could not be assessed, therefore future investigations should include a species-specific survey to confirm the presence of *Euglesa pseudosphaerium.*

Note 2: Alluvial grazing marshes, and lowland neutral grassland are not designated features of Amberley Wild Brooks and Pulborough Brooks SSSI's. However, are noted within the MS as an attribute of supporting habitat for notified features. Therefore, they have been included within this report.

Ramsar criterion 3:

As described under The Ramsar Sites Criteria guidance, and based on species and ecological communities, “A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region”.

Table 12.2 - Condition status of SSSI features/attributes relating to Ramsar criterion 3.

Related SSSI Feature	Amberley Wild Brooks	Pulborough Brooks	Waltham Brooks
Ditch Systems	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Number of species present: vegetation [Note 1]	Favourable	Favourable	Favourable
Indicators of local distinctiveness: rare species and quality indicators [Note 2]	Favourable	Uncertain [note 2]	Uncertain [note 2]

Note 1: “Number of species present: vegetation” and “Indicators of local distinctiveness: rare species and quality indicators” are attributes of the greater “Ditch systems” feature that are particularly relevant to Ramsar criterion 3.

Note 2: See section 8 (Floodplain sites: Ditches) for more information, condition was uncertain as there was not baseline data to compare against, required to fully assess against the relevant targets.

13. Floodplain sites – Further evidence

The hydrogeology and water chemistry of these designated sites is complex and, as demonstrated throughout this report and particularly within the Pressures Section (Section 15), there are numerous issues relating to both water resources and water quality that are affecting the floodplain designated sites and their interest features, these three SSSIs overlapping with the Arun Valley SAC, SPA and Ramsar sites. It is possible these pressures are affecting the Upper Arun and Arun Banks SSSIs too, however there is not enough current evidence at this stage and further investigation is required for more certainty (as detailed in the corresponding sections for these two sites: sections 3 and 4).

Across the three floodplain designated sites, the underpinning geology varies spatially and is overlain by a range of drift deposits that vary in their permeability. The sites are underlain by the Folkestone beds, the Lower Greensand aquifer, and potentially permeable superficial deposits that provide potential additional pathways for groundwater discharge to the edges of the designated sites. The variation in geology around the sites has resulted in differences in the chemical status of the water across the ditches. This has allowed for the development of a remarkable and wide array of both aquatic and water-dependent terrestrial fauna and flora community. The biodiverse communities of flora and fauna species (including *Anisus vorticulus*) and the fact that there is a presence of low to moderate alkalinity indicates that all three floodplain sites are indicative of mesotrophic environments.

These designated sites within the Arun Valley are also influenced by various surface water bodies/catchments: Rivers Arun, Rother, and Stor. These waterbodies flow and pass-through farmland and populated urban areas. The more southern sites are tidally influenced and where these site's border rivers, they are managed by flood embankments. Due to this, many water retainment structures (sluices) have been installed and water level management is both required within the sites and at the borders where they are situated next to a river.

Since the last condition assessments for these sites, evidence has continued to support that water resource pressures are still impacting upon the sites. For example, a recent study (Hicks *et al.,* 2019) assessed the plant community composition across Amberley Wild Brooks SSSI from historic and recent (2017) surveys. This paper showed statistically significant changes in the vegetation community, including those that form part of the Ramsar features and SSSI features, in the north of Amberley Wild Brooks SSSI, indicative of slowly drying conditions. The area that shows the significant community change is consistent with the area that is thought to be connected to the Folkestone beds, Lower Greensand aquifer.

Though in part the drying identified in the Hicks *et al.,* (2019) study may be climatic, other anthropogenic pressures are likely to be contributing or working in conjunction, such as abstraction which cannot be ruled out as a contributing factor (this is one of the pressures outlined in the SIP and previous condition assessments).

Since 2019, Natural England has been reviewing environmental assessments undertaken by the local water company, Southern Water, in relation to applying for changes to their groundwater abstraction licence (which is in close proximity to the floodplain sites that underpin the Arun Valley Habitats and Ramsar sites). This existing public water supply groundwater abstraction takes water from the same aquifer that is situated underneath these floodplain designated sites, the Folkestone beds.

Adverse effects on site integrity from the existing groundwater abstraction cannot be ruled out with certainty, as currently it is unknown how significant the groundwater supply from the Folkestone beds would be to the designated sites without abstraction and with the hydrology of the supporting aquifer fully recovered from the abstraction. It has, however, now been proven by objective evidence (from recent Southern Water hydrology unpublished data from 2022-23 and via the findings of the Natural England commissioned Eco-hydrology and Peat Assessment Reports) that there is a connection between the aquifer (Folkestone beds), the water company groundwater abstraction, and these floodplain designated sites (Brotherton *et al.,* 2025; Whiteley *et al.*, 2025, more information further in this section). However, specific connectivity between the Folkestone beds and Waltham Brooks SSSI is not likely as previous data has indicated the presence of Marehill clay extends further than shown on British Geological Society maps (from Southern Water's 2008-09 Arun Valley sustainability study (AVSS) and accompanying Environment Agency Review of Consents, (2009)).

The water company that holds the licence for the groundwater abstraction, Southern Water, are undertaking a current investigation (Hardham Basin Environmental Studies investigation, due for completion in 2025) to understand the full impacts of their abstraction and validate previous conclusions such as there being no connectivity between the aquifer and Waltham Brooks SSSI. This investigation includes a comprehensive monitoring program to ensure an evidence-based approach informs (and validates) modelling and resolutions that will remove any significant adverse effects caused by the abstraction. Natural England are members of the project steering group, along with the Environment Agency and other land managers, to ensure this investigation continues to promote nature recovery and prevent further deterioration of the sites in the interim whilst the investigation is being completed.

As above, it is already thought that there are water quality and water resource pressures affecting these sites, as concluded from the previous condition assessments of the SSSIs and in the Site Improvement Plan (SIP). The surveys undertaken during this assessment and discussions during the review period (between 2021-23) has also highlighted and/or provided further validation that water quality and resource pressures are still impacting upon the sites and that condition in general has declined. This includes but is not restricted to the following (summarised from previous section assessments such as the invertebrate surveys (section 6), the review of bird features (section 7), targeted *Anisus vorticulus* surveys (section 11) as well as further external anecdotal and photographic evidence provided to Natural England in relation to ditch features (see section 8):

- Ongoing maintenance of ditch water levels relative to the target for Favourable condition, with anecdotal evidence showing water levels to be unrepresentative of seasonal conditions, i.e., the targeted minimum water levels are not being met within the ditches across the three sites and on occasions are shown to be drying out, even in the absence of prolonged periods of dry / 'drought' conditions. Outdated or absent water level management plans and ineffective coordination and implementation of water levels across the sites is another likely contributing factor impacting ditch water levels.
- Water levels and movement of water on site are likely to be affected by ineffective coordination and implementation of water level management where there is either outdated or no water level management plans for the site, however further assessment would be required in order to confirm this. Natural England is engaging with the Environment Agency (who act as the local Internal Drainage Board) in order to ascertain how improvements to water level management across the sites can be achieved.
- Existing and recently agreed revised (and added) water quality nutrient CSMG targets for ditches (TP and TN) are not being met across all three sites.
- There are wider water chemistry concerns on site such as turbidity, sedimentation, and salinity which appear to be linked to land and ditch management such as issues with flood embankment maintenance and management / maintenance of water retainment (sluice) structures, and INNS.
- Bird features have declined and there are potential issues relating to water resources in relation to their feeding and foraging supporting habitat (which includes standing water within wet grassland and ditches).

The purpose of undertaking this condition assessment is to better understand pressures, the requirements of interest features, and to revise conservation targets for the sites where appropriate. This is ongoing work (subject to Natural England resources) where the aspiration is to ensure that the interest features, including those that are SAC, SPA and Ramsar features/criteria, are better protected and that this review can help inform effective restoration and more appropriate management being applied. Due to the level of concern regarding water quality and resources and the fact that these sites are deteriorating in condition, Natural England has commissioned further studies to improve the evidence base in relation to these issues. The following additional projects detailed below have been commissioned and will be published or made available upon request alongside this condition assessment.

Arun Valley Designated sites: Water Quality Nature Recovery Plan - Phase 1

A study was commissioned by Natural England to provide supplementary evidence to support this condition assessment by investigating the hydrological, nutrient, and sediment inputs into the three floodplain SSSIs that make up the Arun Valley Habitats sites (Amberley Wild Brooks SSSI, Pulborough Brooks SSSI and Waltham Brooks SSSI). This

study used outputs from previous investigations, historical data and various tools and models. The impact of agricultural measures was also assessed using the Farmscoper model.

The study is the first stage of collating all the existing evidence, understanding the gaps that require further investigation and providing an action plan to inform targeted work to address evidence gaps. During this study, it has been concluded that the primary source of the nutrients to the Arun Valley designated sites is diffuse pollution (from local inputs; drainage and runoff from the local catchment) and inputs from the Rivers Rother and Stor, and Upper Arun under flood events. The study also identified a significant input of sewage into Waltham Brooks SSSI from Southern Water's Coldwaltham Wastewater treatment works, as the effluent discharges directly onto this site. However, there are some significant data/evidence gaps around the source apportionment and percentages between diffuse and point source. For example, this study has not attempted to understand the impacts from storming from combined sewerage overflows, this is a gap that requires further investigation as there is data available on this.

It was also determined that the primary source of sediment onto the designated sites is likely to result from overtopping from the Rivers Arun and Stor during floods when the river carries a high sediment load, with approximately 70% of the sediment load derived from agricultural land and 30% from bank erosion. This is both an issue directly in terms of deterioration of water chemistry on these sites but also is directly affecting condition of other interest features such as aquatic plants species and peatland habitat.

As diffuse sources were the primary input of nutrients, measures outlined from Farmscoper model analysis, focussing on the livestock and arable sources of TN and TP, are therefore expected to be primary means to improve the sites and their condition in relation to water quality. Additional key measures were also identified to address evidence gaps that may be affecting source apportionment; including the legacy inputs to the systems as remobilisation of total phosphorus was indicated, especially on Pulborough Brooks SSSI, and the need to investigate the potential input via leakage through the sluices on the sites as this is uncertain at this stage. There was also a focus on Coldwaltham wastewater treatment works as high concentrations of nutrients were identified in the ditches connected to this discharge at Waltham Brooks SSSI.

The Farmscoper model analysis indicated that introduction of cover crops would be the most effective measure, followed by creation of riparian buffer strips. Different bundles were determined for dairy and grazing farms, and arable farms. When applied in combination, the calculated reductions in diffuse pollution were approximately 10-15% for TN, 20-35% for TP, and 25-45% for sediment. It was noted that achieving the CSMG targets at all three sites would be challenging with these measures alone. These percentages are also subject to change as they were assessed against what were provisional CSMG water quality targets for the SSSIs associated, and there are still evidence gaps that may affect the source apportionment. At Waltham Brooks SSSI, the most significant progress towards meeting the target would occur if inputs from the wastewater treatment works could be reduced primarily.

The study recommended a range of additional actions including:

- Review of existing agri-environment measures uptake to identify farms where communication and implementation can be improved.
- Establish cover crops in the autumn, and riparian buffer strips in the catchment.
- Adopt reduced cultivation systems.
- Reduce the TP permit at Coldwaltham wastewater treatment works and investigate potential to have a more stringent TP permit and add a TN permit in order to adhere to the recently agreed revised CSMG water quality targets for the site.
- Develop woodland conservation in catchment.
- Investigate possible erosion from higher land south of Amberley Wild Brooks SSSI.
- Investigation of legacy phosphorus in drain sediments and explore potential to manage the issue through site management or restoration plans.
- Investigate interactions at river sluices to assess the ingress of nutrients to sites via this pathway.
- Investigation into the sources, numbers, and feasibility of removing INNS fish species.
- Investigation of local point sources in catchment (i.e. septic tanks).
- Gather further information on flood bank condition and investigation of flood bank removal and how that would affect the nutrient input to the sites.
- Investigation of sediment deposition during/following floods to estimate inputs and retention of TP onto sites.

Water quality sonde analysis (multiparameter water quality monitoring device) identified a potential influence of tidal cycles on Amberley Wild Brooks SSSI and Pulborough Brooks SSSI. During high tides, an increase in turbidity and conductivity (indicative of increasing salinity) was observed at both sites. The twice-daily patterns do not by themselves indicate inflow from the River Arun into the sites via the sluices not working correctly, but could, in some locations, relate to tidal locking causing a reduction in ditch flow and back up of stream or wetland-derived water. However, the presence of increased conductivity indicates at least some water from the river is entering the sites. It is uncertain which specific processes are controlling these trends. Further analysis is recommended to record conductivity/salinity, turbidity and dissolved oxygen, and visual observation.

Eco-hydrology and peat assessment report (Amberley Wild Brooks and Pulborough Brooks SSSIs)

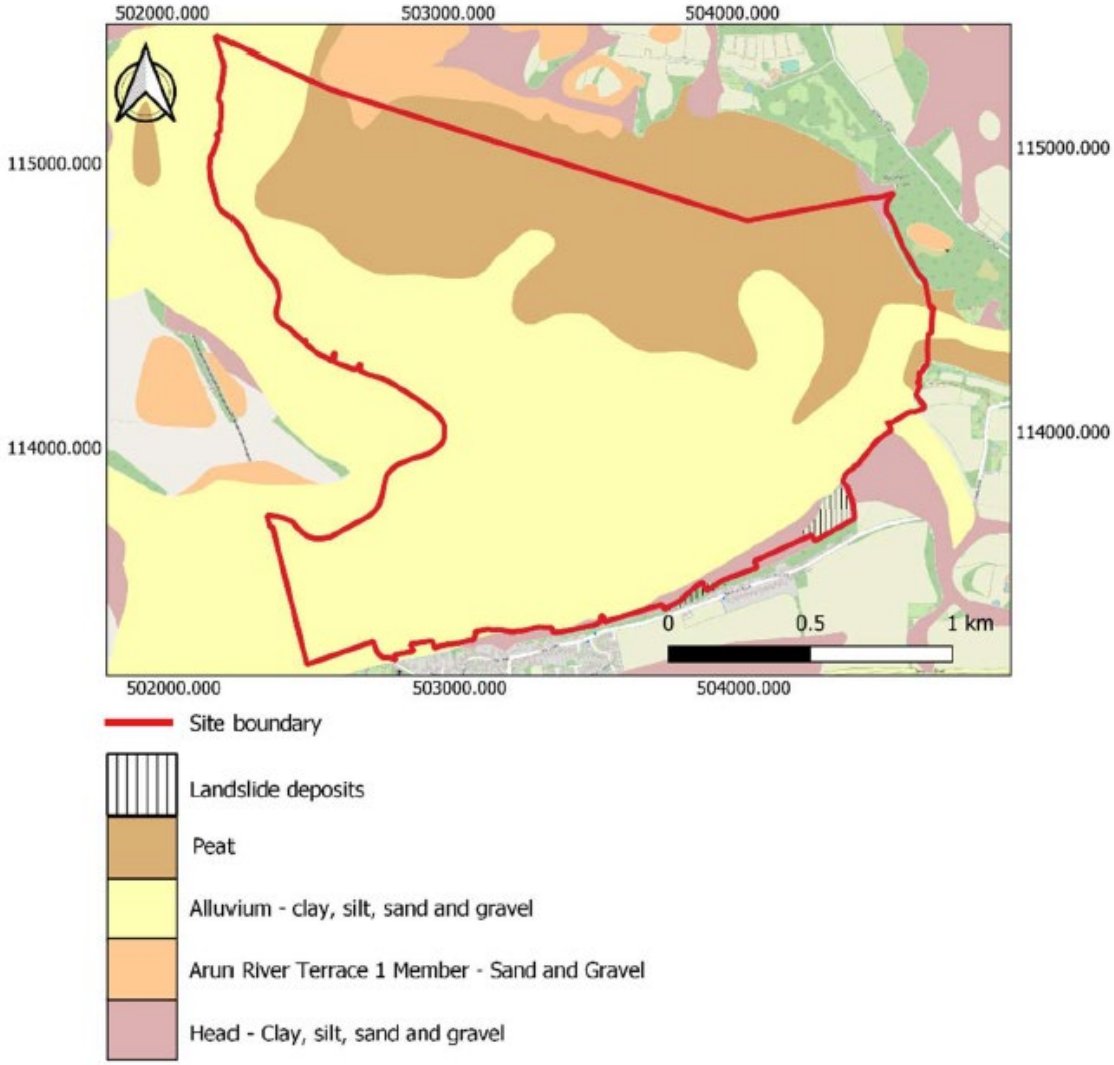
Peatland is a habitat of principal importance for conservation, termed ‘Priority Habitats’ under the Natural Environment and Rural Communities Act 2006 (NERC Act). The British Geological Survey maps and the Natural England tools (which includes national peat mapping) show that there are significant areas of peat on the northern area of Amberley Wild Brooks SSSI, as well as on the south-eastern area and north-eastern margin of Pulborough Brooks SSSI. These areas of peat are also reflected by the Amberley Wild Brooks SSSI citation and by local knowledge. The areas of peat are coincident with areas

of the sites thought to be underlain by the Folkestone beds, the Lower Greensand aquifer, and potentially permeable superficial deposits that potentially provide a pathway for groundwater discharge to the edges of the designated sites.

A study was commissioned by Natural England to provide further supporting evidence and understanding of the eco-hydrology and peatland condition at Amberley Wild Brooks and Pulborough Brooks SSSIs as part of improving understanding for this wider condition assessment review. The study involved a desk study, intrusive fieldwork, and groundwater monitoring to investigate peat and hydrology condition beneath both of these designated sites (Whiteley et al., 2025; Brotherton et al., 2025).

The study identified that the ground conditions comprised a dominant alluvial clay over River Terrace Deposits, over a bedrock of Folkestone Beds for both designated sites. These designated sites within the Arun Valley are influenced by various surface water bodies/catchments. The rivers that influence the sites are the Arun, Rother, and Stor. In addition to the Arun itself, the majority of the catchments feeding into the Arun are of moderate ecological status (in relation to the WFD assessments, regulated by the Environment Agency). This is attributed to poor or moderate levels of phosphates arising from poor land management or agricultural practices and the discharge of treated water from wastewater treatment works.

At Amberley Wild Brooks SSSI, peat deposits were found in discrete areas along the northern and eastern edges, and in an area in the central portion of the site (Figure 13.1). The peat distribution at Amberley Wild Brooks SSSI appears to be controlled by the presence of a relic meander of the river Arun which crosses the site. The peat deposits at Pulborough Brooks SSSI were found in discrete areas along the eastern and southern edges of the site, adjacent to the scarp slope that lies immediately outside of the site (Figure 13.2). The springs and seeps from the scarp slopes surrounding the site are considered to have been important in the peat generation, as well as groundwater feeding in the subsurface. At both sites, the groundwater monitoring analysis in the ecohydrology study indicated that the peat is fed partly by groundwater seeping from and through the scarp slope, and by rainfall.



1Figure 13.1 - Map of Amberley Wild Brooks SSSI, detailing the superficial geology (Yellow – Aluvium, Orange – Arun River Terrace 1 Member, and Pink – Head), mass movement (White/Black vertical lines) and location of peat (Brown). Figure image from Natural England commissioned Amberley Wild Brooks SSSI Eco-hydrology and Peat assessment (Whiteley and others, 2025).

The peat was typically found to be wet in lower portions and dry in upper portions. Many of the deposits had standing water at the surface, above a dry upper peat layer, and then a wetter peat layer. This indicates it is displaying hydrophobic behaviour on both sites, which is associated with peat desiccation. The historical drainage channels on the two SSSIs have probably accelerated water outflow from peatland in magnitude and speed, which has been increased further over time as more ditches have been added to the sites. It is this drainage of peat which leads to drying. Additionally, the analysis showed that the pH of the peat ranged from the more typical low values (6.2 at Amberley Wild Brooks SSSI and 6.7 at Pulborough Brooks SSSI) to higher (6.9 and 7) values on both sites. These values are towards the upper end of what is typically encountered in a healthy peat body and may therefore indicate poor health of the peat deposits.

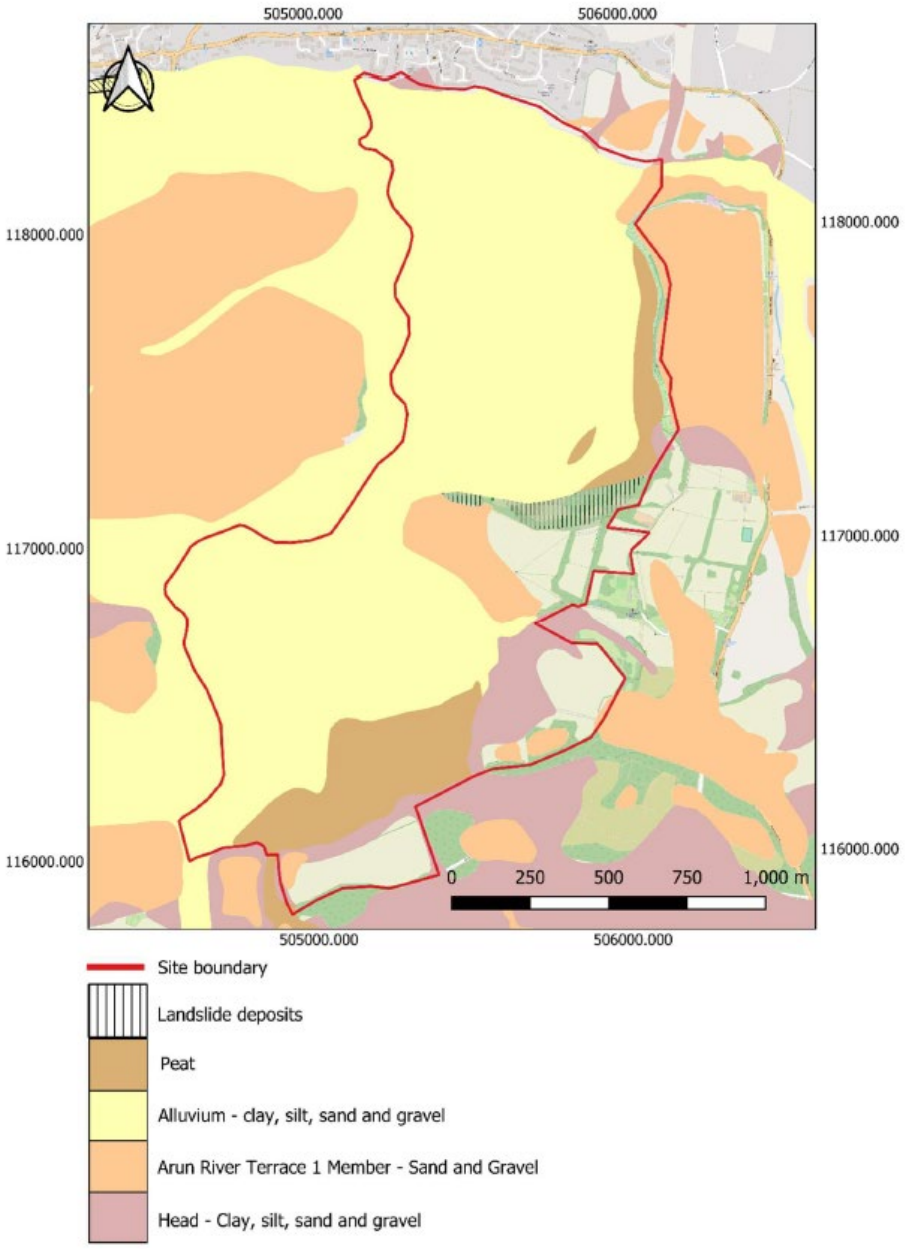


Figure 13.2 - Map of Pulborough Brooks SSSI, detailing the superficial geology (Yellow – Aluvium, Orange – Arun River Terrace 1 Member, and Pink – Head), mass movement (White/Black vertical lines) and location of peat (Brown). Figure image from NECR Pulborough Peat & Hydro assessment (Brotherton et al., 2025).

Dry peatlands bogs are net emitters of carbon dioxide and other greenhouse gases. This occurs when carbon within the deposits is degraded aerobically, releasing carbon in the form of carbon dioxide. Based on the dry nature of the peats upper layers as observed in the study it was concluded that the peat on both Amberley Wild Brooks and Pulborough Brooks SSSIs are likely to be emitting, rather than storing carbon.

The water company, abstracts both from the Rivers Rother and Arun, and from the Folkestone Beds groundwater aquifer. As the groundwater likely impacts the hydrology of the peat on both Amberley Wild Brooks and Pulborough Brooks SSSIs, this study

concludes that the groundwater abstraction is likely to have some effect on peat health and hydro-ecology. The potential for this impact at Amberley Wild Brooks SSSI is less certain as it is further from the abstraction point than Pulborough Brooks SSSI.

The study outlined a range of potential solutions which are focussed on increasing the retention time of both meteoric and spring or seep fed water inputs when crossing the designated sites, to raise water levels in areas of the site across all seasons. This is particularly important in light of climatic drying. All solutions would require joint discussion with regulators, stakeholders, landowners, and land managers to identify the most suitable measures, interventions, and locations for these, with specific consideration of the sensitive flora and fauna found on the sites (of which many are interest features of the designated sites). A non-exhaustive list of potential solutions includes the following:

- Ditch maintenance (reduction in maintenance schedule, reduction in depth of maintenance or no maintenance to allow certain ditches critical to peat health to naturally infill where applicable).
- Some ditch modification (targeted dams, ditch infilling).
- Modifying marginal seeps (from low to high intervention, such as piping, cutting off trenches, and trench infilling).
- Reassessing water level management of ditches such as the operation of sluice structures and investigating removal of sluices in places.
- Removal of flood defences (requires detailed further investigation as removal would have considerable consequences for hydrology, water chemistry and ecology of the designated sites, especially with current water quality issues of the associated rivers).

In addition to the potential solutions, the study identified some recommended next steps to improve knowledge and understanding of the designated sites, and the hydrology and peatland habitat, such as:

- Identification of the impact of restoring the peatland on the other interest features and identification of restoration options that will maximise both wildlife and peatland restoration.
- Further water quality analysis over a prolonged time period to enable differentiation between sources of water from precipitation (meteoric) and from water that has had some contact with mineral ground (telluric).
- Additional topographical and sediment geological transects across perimeter ditches to identify to what degree do permitter ditches intercept groundwater and/or seeps.
- Continue with groundwater monitoring for at least one year to determine what happens in different environmental conditions (such as wet winter periods or dry summer periods).
- Gather permeability data and construct a water balance model to aid in modelling of the degree to which groundwater, rainwater or evapotranspiration dominate.

- Detailed impact assessment using LiDAR/Digital Terrain Model to model degree of surface inundation and possible impact on depth to groundwater.
- Selected peat augering to confirm presence or absence of peat in selected areas outside of the areas investigated in the study.
- Further peat depth probing.
- Review of historical modelling undertaken by Southern Water in relation to the information concluded in this study to determine to what degree their groundwater abstraction may be impacting on the groundwater feed into the peat.
- Review of climate projections and building a water balance model to model climate change scenarios.
- Desk based research in peat carbon balance to show how is peat behaving with respect to carbon cycle, i.e. if it is a net sink or emitter of carbon.

Peatland habitat has been shown to be present at both Pulborough Brooks SSSI and Amberley Wild Brooks SSSI through this study. However, it is not currently an interest feature at either site. As Peatland habitat is clearly mentioned within the citation of Amberley Wild Brooks SSSI, this feature will be added (timescale dependent on NE resources). Collaborative discussions should be undertaken to consider the above measures, and requirement of further investigations to address knowledge gaps which could help to maintain and restore the peatland habitat at these sites.

SSSI future reforms case study – climate change vulnerability

Amberley Wild Brooks SSSI is one of the site case studies in the national climate change pilot project by Natural England. This project aims to assess the effectiveness of the current legal framework for SSSIs in reducing climate vulnerability on protected sites, and how this can help to achieve Favourable condition during a time of increasing ecological dynamism in response to climate change. The policy driver underpinning this national project is the Government's 25 Year Environment Plan, with a target of achieving Favourable condition in 75% of protected sites by 2042. The project outcome is to provide a framework for site managers to apply Resist-Accept-Direct (RAD) change to conservation objectives and site management to maintain/restore Favourable condition during a time of rapid ecological change. As one of the pilot case studies is Amberley Wild Brooks SSSI, the outputs and outcomes of this project will directly help to assist in the evidence base to inform better management decisions, in relation to climate change issues, impacting upon this SSSI, but also the two other floodplain sites assessed in this report that together underpin the Arun Valley Habitats and Ramsar sites.

The first phase of the project has already been completed and was published in October 2023. The report aims to build on evidence of climate change impacts on SSSI condition by undertaking an in-depth analysis of projected climate change impacts on designated features in habitats of increased climatic vulnerability at Amberley Wild Brooks SSSI

(freshwater and wetlands habitats) to predict the likely future change and takes into consideration:

- The future projections, with the impact assessment considering both direct and indirect impacts of climate change on the site, focusing on a 2ºC warming scenario and timescale up to 2060, but also assessing risks for 4ºC.
- What conservation objectives (favourable conservation status) could look like under above scenarios.

The next phase of the project aims to determine if and what future adaptation responses are required for sites to achieve Favourable condition using the RAD framework by identifying adaptation responses for both current and potential future conservation objectives, as well as those that operate both within the SSSI and in the surrounding landscape (where appropriate). This will enable a review of whether the existing SSSI legal framework enables protected sites to implement effective and appropriate responses to climate change and enhance wider landscape resilience, providing recommendations for legislative and policy change to support implementation of the RAD framework.

14. SSSI condition review

Natural England have attempted to assess as many of the designated features and their attributes as possible across the five SSSIs assessed in this report. Any conclusions of condition assessment for those features and attributes that were not assessed during this review are classed as ‘unassessed’ in the following tables. For justification behind confidence levels please refer to the relevant site and/or interest feature sections of this report for more details. Figure 14.1 below provides up-to-date maps with the current site condition following the findings of this 2021-23 review. Please see Appendix 1 for condition status across the features of each SSSI and for feature to unit breakdown.

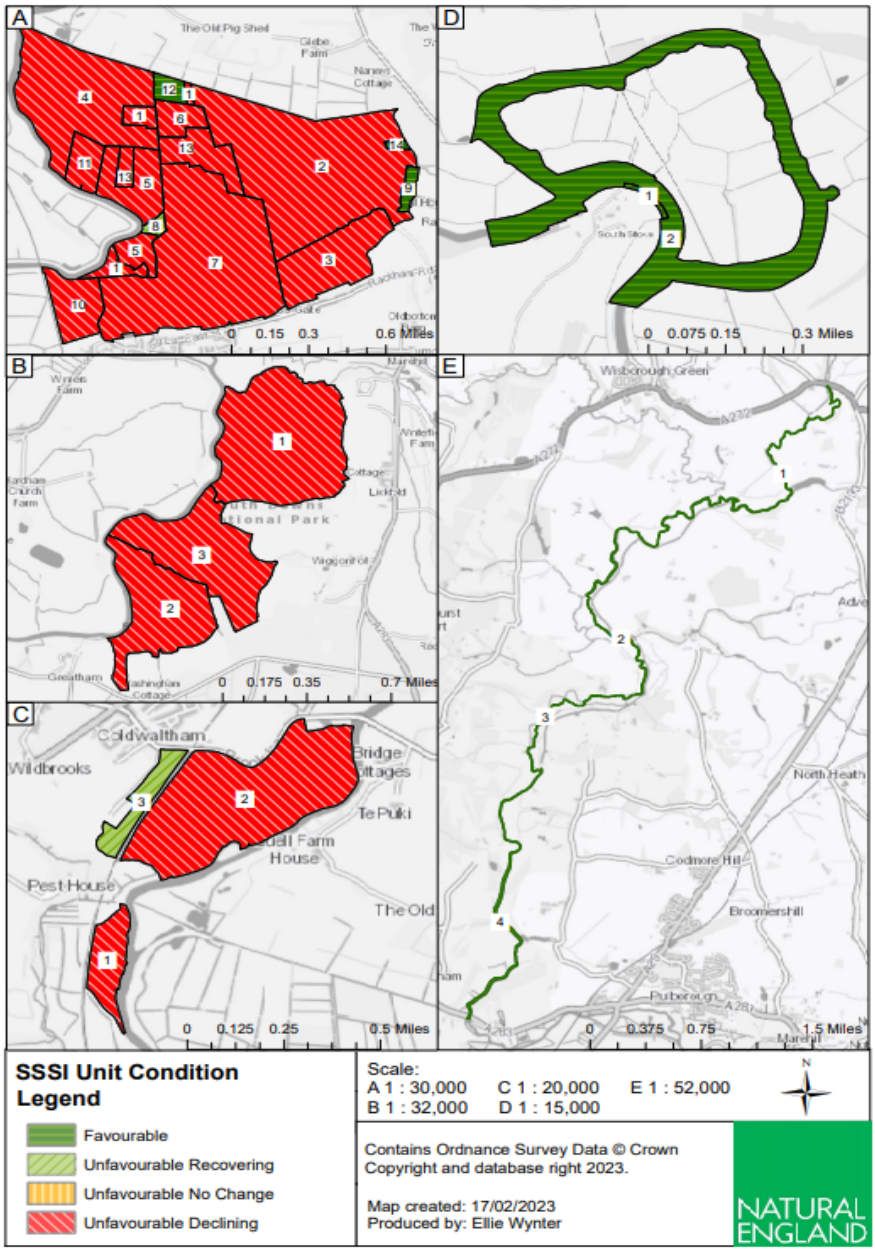


Figure 14.1 - Map of Arun Valley designated sites (A: Amberley Wild Brooks SSSI, B: Pulborough Brooks SSSI; C: Waltham Brooks SSSI; D: Arun Banks SSSI; E: Upper Arun

SSSI.), detailing the SSSI unit numbers and respective condition of designated features following this 2021–23 review (Dark Green/Horizontal lines – Favourable, Light Green/Diagonal lines – Unfavourable Recovering, Orange/Vertical Lines – Unfavourable No Change, and Red/Opposing diagonal lines – Unfavourable Declining). N.B. The condition of units 8, 9, 12 and 14 on Amberley Wild Brooks (A), and unit 3 of Waltham Brooks (C) are based on previously reported condition, resulting from a lack of assessable data or absence of relevant feature surveys. Contains Ordnance Survey Data © Crown Copyright and database right 2023.

Arun Banks SSSI

Table 14.1 - Condition status following the 2021-23 review of Arun Banks SSSI and its monitored notified features.

Feature	Condition Status	Confidence
Floodplain fen (lowland)	Unassessed	Not applicable - was not surveyed during the 2021 condition assessment
Population of *Schoenoplectus x kuekenthalianus*	Favourable	High
Wet woodland	Unassessed	Not applicable - was not surveyed during the 2021 condition assessment

Upper Arun SSSI

Table 14.2 - Condition status following the 2021-23 review of Upper Arun SSSI and its monitored notified features.

Feature	Condition Status	Confidence
Outstanding Odonata assemblage	Favourable	Medium

Amberley Wild Brooks SSSI

Table 14.3 - Condition status following the 2021-23 review of Amberley Wild Brooks SSSI and its monitored notified features.

Feature	Condition Status	Confidence
Outstanding Odonata assemblage	Favourable	Medium
Outstanding diverse Invertebrate assemblages (W21 mineral marsh and open water, W31 permanent wet mire, F21 grassland scrub matrix)	Unfavourable No Change	Medium
Aggregations of breeding birds - Redshank, *Tringa totanus*	Unfavourable Declining	High
Aggregations of non-breeding birds - Bewick's swan, *Cygnus columbianus bewickii*	Unfavourable Declining	High
Aggregations of non-breeding birds - Shoveler, *Spatula clypeata*	Favourable	Low
Aggregations of non-breeding birds - Teal, *Anas crecca*	Favourable	High
Aggregations of non-breeding birds - variety of wintering species	Favourable	Medium
Assemblages of breeding birds - Mixed: Lowland damp grassland, woodland	Not Assessed	Low
Ditch systems	Unfavourable Declining	High
Lowland neutral grassland (M23, MG6, M25) (note 1)	Unfavourable Declining	High
Vascular Plant Assemblage	Unfavourable Declining	Medium

Feature	Condition Status	Confidence
Population of Schedule 8 plant - *Leersia oryzoides*, Cut-grass	Unfavourable Declining	High
Population of RDB plant - *Carex vulpina*, True Fox-sedge	Unfavourable Declining	Low
Population of RDB mollusc - *Anisus vorticulus*, Little Whirlpool Ramshorn Snail	Unfavourable Declining	High
Alluvial grazing marshes with ditches, swamp (S4, S5 S6, S7, S11, S12, S19 related communities) (note 1)	Unfavourable Declining	High
Wet Woodland (W1 *Salix cinerea-Galium palustre* woodland, W5c *Alnus glutinosa-Carex paniculata* woodland, *Chrysosplenium oppositifolium* sub-community, W6b *Alnus glutinosa-Urtica dioica* woodland, *Salix fragilis* and *Salix viminalis/triandra* sub-communities, W10c *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland, *Holcus lanatus* sub-community)	Unassessed	Not applicable - was not surveyed during the 2021 condition assessment

Note 1: Alluvial grazing marshes, and lowland neutral grassland are not designated features of Amberley Wild Brooks SSSI. However, are noted within the MS as an attribute of supporting habitat for notified features. Therefore, have been included within this report.

Pulborough Brooks SSSI

Table 14.4 - Condition status following the 2021-23 review of Pulborough Brooks SSSI and its monitored notified features.

Feature	Condition Status	Confidence
Outstanding Odonata assemblage	Favourable	Medium

Feature	Condition Status	Confidence
Rare Odonota*: Libellula fulva*, Scarce chaser	Favourable	Low
Rare Odonota: *Gomphus vulgatissimus*, Club-tailed dragonfly	Unfavourable No Change	Low
Outstanding diverse Invertebrate assemblages (W21 mineral marsh and open water, W31 permanent wet mire)	Unfavourable No Change [note 1]	Medium
Aggregations of non-breeding birds - Bewick's swan, *Cygnus columbianus bewickii*	Unfavourable Declining	High
Aggregations of non-breeding birds - Pintail, *Anas acuta*	Unfavourable Declining	Low
Aggregations of non-breeding birds - Shoveler, *Spatula clypeata*	Unfavourable Declining	Low
Aggregations of non-breeding birds - Teal, *Anas crecca*	Favourable	High
Aggregations of non-breeding birds - Wigeon, *Mareca penelope*	Unfavourable Declining	Low
Aggregations of non-breeding birds - Ruff, *Calidris pugnax*	Unfavourable Declining	High
Assemblages of breeding birds - Lowland damp grasslands	Favourable	High
Ditch systems	Unfavourable Declining	High
Lowland neutral grassland (M23, MG6, M25) (note 2)		

Feature	Condition Status	Confidence
Vascular Plant Assemblage	Unfavourable Declining	Medium
Population of RDB mollusc - *Anisus vorticulus*, Little Whirlpool Ramshorn Snail	Unfavourable No Change	High
Alluvial grazing marshes with ditches, swamp (S4, S5 S6, S7, S11, S12, S19 related communities) (note 2)	Unfavourable Declining	High

Note 1: Unfavourable Declining condition concluded as SAT W21 failed to meet Favourable condition by a significant margin.

Note 2: Alluvial grazing marshes, and lowland neutral grassland are not designated features of Pulborough Brooks SSSI. However, are noted within the MS as an attribute of supporting habitat for notified features. Therefore, have been included within this report.

Waltham Brooks SSSI

Table 14.5 - Condition status following the 2021-23 review of Waltham Brooks SSSI and its monitored notified features.

Feature	Condition Status	Confidence
Aggregations of non-breeding birds - Bewick's swan, *Cygnus columbianus bewickii*	Unfavourable Declining	Medium
Aggregations of non-breeding birds - Shoveler, *Spatula clypeata*	Unfavourable Declining	Medium
Aggregations of non-breeding birds - Teal, *Anas crecca*	Unfavourable Declining	Medium
Assemblages of breeding birds - Lowland damp grasslands	Unassessed	Not applicable - was not surveyed during the 2021 condition assessment

Ditches	Unfavourable Declining	High
Lowland neutral grassland (M23, MG6, M25)	Unfavourable Declining	High
Vascular Plant Assemblage (associated with the monitored ditch habitat feature)	Unfavourable Declining	Low
Population of Schedule 8 plant - *Leersia oryzoides*, Cut-grass	Unfavourable Declining	High
Alluvial grazing marshes with ditches, swamp (S4, S5 S6, S7, S11, S12, S19 related communities)	Unfavourable Declining	High

15. Pressures

Freshwater Impacts

Inland flood defence works and physical modification.

As is the case with most UK waterways, the historic modification of natural riverine and flood plain systems, either for the purpose of navigation, or flood defence has resulted in alterations to the natural hydrological function within the Arun Valley. The presence of physical modification has been identified as a “current challenge” faced by the Arun and Western Streams Catchment Partnership and has been highlighted as a pressure potentially impacting all of the freshwater features assessed within this report. Hydrological connectivity of sites within the Arun Valley has altered significantly, changing the natural level of water supply and availability. Whilst it may be possible to remove such restrictions, through processes such as realigning flood embankments to allow for a more naturalised state, the existing environmental pressures present within this catchment would first need to be resolved. This is particularly important as preliminary investigations (Arun Valley Designated Sites; Water Quality Nature Recovery Plan – Phase 1, see section 13 for further details) have shown that the primary sources of nutrient and sediment delivery to the Arun Valley designated sites are coming from the local catchment and associated waterways. Both of which have been identified as contributing factors to poor water quality throughout the Arun Valley designated sites.

Siltation

Preliminary investigations on the hydrological connectivity, source of and delivery of nutrients, and sediments (Arun Valley Designated Sites; Water Quality Nature Recovery Plan – Phase 1, see section 13 for further details) into the three floodplain SSSIs (Amberley Wild Brooks, Pulborough Brooks, Waltham Brooks) indicated that the Rivers Arun and Stor were the likely, primary sources (overtopping during high rain-fall events). In-river benthic surveys showed that where siltation was observed during sampling (Van Veen grab sampling), fine particulate silt formed between 13 – 48 % of substrate composition. Whereas the same sampling method undertaken within the network of ditches of the respective SSSIs, showed a silt composition range of 18 – 58 %. Like the characteristics observed between in-river and ditch substrate composition, was the comparable data in sediment Phosphorous (P) concentration between the two habitat types. See Note 1 below; (230 – 3,700 mg/kg and 480 – 3,300 mg/kg respectively). This was particularly apparent within the ditches situated close to the main river network at both Amberley Wild Brooks and Pulborough Brooks SSSIs.

Calculated models, supported by the comparable data as described above, showed the connectivity between these floodplain sites and the main river network as having a

potential significant effect on water quality, and habitat characteristics. The transferal of fine particulate silt (inclusive and exclusive of P concentration) and smothering of substrate can have direct detrimental impacts on the benthic communities present, particularly invertebrates (such as the SAC feature, *Anisus vorticulus*) and flora. Whilst the continual, or frequent influx of sediment can decrease the water holding capacity and increase the rate of succession within slow flowing ditch networks, both of which are issues that have been highlighted within this report (see Section 8. Floodplain sites – Ditches). Declines such as this relating to habitat quality, and or extent have been identified as notable pressures currently impacting all the water dependent species related features within the Arun Valley designated sites.

Note 1: Sediment P concentration at survey location WB-5 (Arun Valley Designated Sites; Water Quality Nature Recovery Plan – Phase 1) at Waltham Brooks SSSI was significantly higher at 8,700 mg/kg. This site is situated downstream from Coldwaltham wastewater treatment works (WwTw's).

Water abstraction

Currently an adverse effect on the integrity of the Arun Valley SAC, SPA and Ramsar site cannot be ruled out with certainty as scientific doubt remains as to the impacts current water company groundwater abstractions are having upon these sites. In response to this, the water company that holds the license for groundwater abstraction in the area, Southern Water, are currently in the process of delivering a sustainability investigation under the Water Industry National Environmental Programme, or WINEP (Hardham Basin Environmental Study, HBES, due for completion 2025) to understand the full impacts of their abstraction. The investigation is being undertaken collaboratively between key stakeholders, which includes regulators (Natural England and the Environment Agency) to ensure environmental compliance. At the time of writing, the current understanding of hydrological connectivity between the three floodplain sites and the underlaying groundwater aquifer is as follows:

Amberley Wild Brooks SSSI

- The Wild Brook stream which flows through the centre of Amberley Wild Brooks SSSI from source (chalk springs on south downs) is the main freshwater input to site.
- Other inputs of freshwater to site – Limited supply from small stream on the South-East margin of the site. Freshwater inputs into the Northern and Western margins of the site comprise of run-off and diffuse seepages from groundwater (terrace gravel deposits, or underlying Folkestone Beds and Sandgate Beds aquifer currently unclear).

Pulborough Brooks SSSI

- Direct rainfall and run-off from marginal catchments in the East and South of the site.

- Diffuse seepages from the underlaying groundwater aquifer (Folkestone Beds) in the North-East and South-East margins of the site.

Waltham Brooks SSSI

- Two ditches connecting the site to higher land in the West of the site form the main inflow of freshwater.
- The Western half of the site was previously concluded to be situated above the Folkestone Beds aquifer. Exploratory boreholes drilled in 2005 and 2019 encountered Marehill clay beneath the terrace gravel deposits, indicating an absence of the Folkestone Beds aquifer (there is however, uncertainty around this which is being investigated as part of Southern Water's HBES).

The findings of this condition assessment report are showing a definitive issue with ditch water depth and quality where this is negatively impacting upon the three floodplain sites and their water-dependent features (please refer to section 8 for further details). These concerns have been raised with key stakeholders and the evidence obtained from this condition assessment report is being used to inform and guide the implementation of sequential monitoring, particularly for Southern Water's HBES.

Drainage

Although not directly related to any physical drainage issues on the Arun Valley sites, water quality monitoring undertaken during NE's 2021 assessment indicated a potential risk of saline inundation from the tidal River Arun at all three floodplain sites (Amberley Wild Brooks SSSI, Pulborough Brooks SSSI, Waltham Brooks SSSI). This was supported not only by the observed, twice daily fluctuation in water chemistry parameters most associated with tidal ingress (turbidity, and conductivity), but also a recorded presence of numerous invertebrate species typically associated with saltmarsh habitat (tolerant of mildly brackish water, Waltham Brooks SSSI only).

Whilst the data collected is not definitive, additional monitoring is being undertaken (as part of Southern Water's HBES) of the associated parameters (which now includes salinity) to better understand changes in water chemistry and connectivity via water level control structures (sluices) in place between the designated sites and main river system. These structures (sluices) are managed and maintained via the landowners and / or the Environment Agency. Collaborative effort across landowners, land managers and the Environment Agency is required to ensure these structures perform effectively. This is of particular importance, especially in safeguarding sensitive freshwater features, such as the SAC species *Anisus vorticulus* which is known to have no tolerance to salinity.

Invasive Non-Native Species (INNS)

Freshwater fish

Anecdotal evidence (RSPB Reserve manager, 2022) has indicated that Common carp (*Cyprinus carpio*) are present within the network of ditches at both Amberley Wild Brooks and Pulborough Brooks SSSIs. Whilst there is a clear economic value that can be attributed to the presence of Carp, the "most popular individual species" targeted by recreational anglers (freshwater angling contributed ≤ 1.46 Billion GBP to the UK economy in 2015, A survey of freshwater angling in England. Phase 1 - summary) the presence of this INNS outside of a contained fishery can lead to significant environmental impacts. This is typically attributed to the benthic feeding characteristics of the species which can impact habitat productivity, such as the displacement of sediment or flora habitat, an increase in suspended solids, subsequently decreasing water clarity and light penetration. Both Amberley Wild Brooks and Pulborough Brooks SSSIs failed to meet the attributed targets for water clarity. Therefore, the presence of *Cyprinus carpio* within these ditches may be contributing towards unfavourable condition. It should also be noted that Carp species are omnivorous and therefore pose a risk as a source of predation to notable species within these ditches such as the SAC feature *Anisus vorticulus*, present at both Amberley Wild Brooks and Pulborough Brooks SSSIs. No INNS freshwater fish have been reported present at Waltham Brooks SSSI.

Freshwater plants

A total of five freshwater plant INNS were recorded throughout Natural England's 2021 assessment of the Arun Valley designated sites. Of all the locations surveyed during this investigation, only Waltham Brooks, and Arun Banks SSSI's were the only sites where freshwater plant INNS were reported absent. The species recorded, relevant to each site are detailed below.

- Amberley Wild Brooks SSSI – New Zealand Pigmyweed *Crassula helmsii* and *Azolla spp* (not identified to species level).
- Pulborough Brooks SSSI – Canadian Waterweed *Elodea canadensis* and Nutall's Waterweed *Elodea nuttallii.*
- Upper Arun SSSI – Water Fern *Azolla filiculoides.*

Whilst the INNS recorded between each site differed, the potential negative impacts attributed to these species, if not sufficiently managed, are similar. These can include:

- The potential impediment of natural hydrological function,
- outcompeting of native plant species,
- obstruction of light through excessive growth/coverage,
- prevailing hypoxic conditions (depletion of DO), and
- subsequent decline in biodiversity (fish, invertebrates, aquatic flora etc.).

Terrestrial plants

Himalayan Balsam *Impatiens glandulifera* was the only truly terrestrial plant INNS identified during Natural England's 2021 assessment of the Arun Valley designated sites, being present at both Waltham Brooks and Upper Arun SSSIs. This highly invasive plant species is typically found in the riparian zone (the interface between land and freshwater), damp woodlands, or waste grounds, and if not sufficiently managed could result in negative environmental impacts on these features. This can include but is not restricted to:

- A monoculture colonisation leading to the dispersal of native plant species,
- overshading and the reduction of open water or other suitable habitats,
- disruption of the natural nutrient cycle, increasing the availability of nutrients such as nitrogen and phosphorus, which can result in increased growth of algae and reduced water quality,
- a reduction in natural invertebrate biodiversity through decreasing flora communities (only three UK species known to feed on *Impatiens glandulifera*, *CABI – Impatiens glandulifera*), and
- an increased risk of bankside erosion following winter plant dieback.

It should also be noted that, whilst *Crassula helmsii* comes under the classification of freshwater plant INNS (recorded present at Amberley Wild Brooks SSSI), the species does exist as a semi-terrestrial and has the potential to cover bare ground (if damp enough), impacting on the e of vital habitats for species such as wading birds (designation of the Arun Valley SPA, comprised of Amberley Wild Brooks, Pulborough Brooks, and Waltham Brooks SSSIs). Therefore, this species should also be considered under terrestrial management procedures for INNS.

Land Management

Ditch management regime.

The network of ditches within the Arun Valley floodplain sites (Amberley Wild Brooks, Pulborough Brooks, Waltham Brooks SSSIs) are of high ecological importance, solely providing or significantly contributing towards functional habitat for many of the designated species (flora and fauna). Therefore, any inconsistencies within or inappropriate management of these ditches could lead to significant environmental impacts on a local or national scale (particularly relating to the SAC feature, *Anisus vorticulus*). Whereas, the implementation of management plans developed in consideration of designated features, could conversely help to reduce the impact of most pressures highlighted within this report. During Natural England's 2021 assessment, several concerns relating to the current management of ditches were highlighted at all three floodplain sites. This primarily related to water level management (more detail is provided within the pressures section above relating to drainage), and habitat extent or structure (channel form, level of succession and shading).

The management (including rotational management) of ditches is included in the prescriptions within the current Countryside Stewardship grant agreements and Management Plans for these sites and/or are in part the responsibility of the Internal Drainage Board (IDB), currently the Environment Agency (for those ditches that are within the Internal Drainage District (IDD)). The observed disparities between current CSMG targets and those required to support biodiverse floral communities and where applicable, the SAC feature (Arun Valley SAC, Amberley Wild Brooks and Pulborough Brooks SSSIs) have been noted, an overview of which is detailed below.

Amberley Wild Brooks SSSI

- Only 53% of ditches surveyed, known to previously support *A. vorticulus* were shown to have a berm/margin with gentle gradient on one side or both (target as per MS being 80%).
- 64% of the ditches surveyed (across the whole site) were in a mid-successional stage, with a noted absence of ditch structure heterogeneity.

Pulborough Brooks SSSI

- Only 47% of ditches surveyed, known to support (or previously support) *A. vorticulus* were shown to have a berm/margin with gentle gradient on one side or both (target as per MS being 80%).
- 83% of the ditches surveyed (across the whole site) were in a mid-successional stage, with a noted absence of ditch structure heterogeneity.

Waltham Brooks SSSI

- The shading target was not met with 17% of ditches being heavily shaded.
- Too little number of ditches in early succession (5%) and a significantly higher proportion of ditches in late succession (50%).

For both Amberley Wild Brooks and Pulborough Brooks SSSIs, the over-abundance of trapezoidal banks and mid-successional stage ditches is believed to be inadequate to support the various life-cycle stages of the SAC feature *Anisus vorticulus*. Best available knowledge suggests, that to instil management practices which best conserve the species, a broader range of habitat homogeneity should be targeted. As it stands, the appropriate ditch management can be characterised by two key elements: staggered clearance (a series of cleared and un-cleared sections so refuges are provided), and rotational clearance (management carried out over a long rotation to allow time to recover).

In addition to the potential implications on *Anisus vorticulus* populations (where applicable), the channel form and structure of ditches currently present on the Arun Valley floodplain sites is believed to be impacting upon other designated features from achieving favourable condition status. For example, the loss of marginal habitat in the presence of trapezoidal banks may be restricting the ability for rare/notable plants and other important ecology that require shallow water or conditions related to marginally shallow graded banks to establish. Likewise, the lack of balance in successional stage ditches and

subsequent reduction in species diverse habitat could be attributing to a loss in biodiversity or availability, whether that be a certain plant species, a feeding source for birds, or refuge for aquatic species such as invertebrates, etc (Clarke, 2015).

The results of Natural England's assessment indicate that further action is required to better understand and advise on best practice management and identifying measures to support improving ditch management on these sites.

Land use change.

A change in land-use, either purposefully or through mismanagement (inappropriate or inconsistent management) can have a significant impact on site function and the diversity of species in which a habitat can support. During Natural England's 2021 assessment of the Arun Valley designated sites, it was concluded, that all three floodplain sites (Amberley Wild Brooks, Pulborough Brooks, Waltham Brooks SSSIs) were subject to receiving inappropriate levels of grazing/cutting. The designated features most impacted by this pressure, relative to each SSSI are as follows:

Amberley Wild Brooks SSSI – Ornithology and Wetland habitat

Pulborough Brooks SSSI – Ornithology and Wetland habitat

Waltham Brooks SSSI – Ornithology, Wetland habitat and Vascular Plant Assemblage (VPA).

For Ornithological features, the presence of under-grazing has been attributed to be a contributing factor, particularly impacting upon the availability of suitable supporting habitat. Whilst, where applicable (Amberley Wild Brooks SSSI inclusively), the habitat extent attribute was found to be in Favourable condition, limitations in distinguishing between different habitat types when using aerial imagery must be considered, hence resulting in a low confidence rating for this attribute being concluded. The results of Natural England's assessment also highlighted a significant concern surrounding the population presence of certain bird species, such as Redshank (Amberley Wild Brooks SSSI), Teal and Shoveler (Waltham Brooks SSSI). Further investigative work is required to better understand how different grazing regimes, and other on-site identified pressures are impacting upon these and other bird species, presence, and numbers.

In relation to the Wetland habitat feature and VPA, the data obtained from Natural England during this assessment indicate that insufficient habitat management practices are currently in place. A major contributing factor of this has been attributed to the inadequate volumes of, and regular movement of cattle around the floodplain sites, of which both were observed during assessment. This was further supported by a recorded absence in sward height diversity and over dominance of certain grass species, such as *D. cespitosa* (Amberley Wild Brooks SSSI) within areas of each site. Obtaining the appropriate grazing levels is not only important in controlling undesirable species and scrub, but also supports the control of shade-inducing marginal vegetation along the ditches (another designated

feature). This is a pressure that was also highlighted during Natural England's assessment as impacting upon the channel form and structure attribute of ditch features (Waltham Brooks SSSI).

Overgrazing (wild animals)

Anecdotal evidence and observations made throughout Natural England's assessment of the Arun Valley designated sites in 2021 has identified the overgrazing from wild animals (Deer) as a pressure attributing to certain features not achieving Favourable condition status. Whilst there is a clear collaborative involvement from both landowners and land managers to reduce the numbers of Deer present on these sites (implementing reactive measures such as Deer management schemes), the associated impacts of overgrazing are still apparent. The designated features thought to be most impacted by overgrazing pressures on site are as followed:

- Ornithology – The combined physical and audible disturbance created by large Deer communities within areas of the Arun Valley SPA has been suggested to be impacting upon the productivity capacity of nesting bird species.
- Ditches – The frequent poaching of water courses by large Deer communities has been partially attributed to increased sediment disturbance and the associated attribute of water turbidity being outside targeted range (Amberley Wild Brooks and Pulborough Brooks SSSIs).

Pollution

Agricultural sources

Although not yet fully clarified, preliminary investigations surrounding the source apportionment of nutrients to the Arun Valley designated sites have been undertaken (Arun Valley Designated Sites; Water Quality Nature Recovery Plan – Phase 1, see section 13 for further details). This has indicated that the Rivers Arun and Stor are the likely, primary source of delivery (overtopping during high rain-fall events), carrying high sediment loads deriving from agricultural land and bankside erosion (SEPARATE model developed by ADAS, calculating inputs of 70 and 30 % respectively). As part of this preliminary investigation, catchment scale model analysis (SAGIS) was used to determine the nutrient input, source (both Phosphorous and Nitrate sources) and composition percentile relevant to each SSSI, the calculated amount of which are as follows:

Amberley Wild Brooks SSSI

- Phosphorous – 92 % from Agriculture (60 % livestock, 32 % arable)
- Nitrate – 96 % from Agriculture (31 % livestock, 62 % arable, 3 % other)

Pulborough Brooks SSSI

- Phosphorous – 94 % from Agriculture (68 % livestock, 25 % arable, 1 % other)
- Nitrate – 77 % from Agriculture (18 % livestock, 58 % arable. 1 % other)

Waltham Brooks SSSI

- Phosphorous – 85 % from Agriculture (48 % livestock, 37 % arable, Note 1)
- Nitrate – 82 % from Agriculture (42 % livestock, 40 % arable, Note 2)

Environmental issues from certain agricultural practices have been the subject of investigation within the catchments upstream of the Arun Valley designated sites over many years (Boardman et al., 2020), the modelled calculations from this preliminary investigation do give an indication into the agricultural sectors input and subsequent responsibility over the environmental issues present on these sites. However, the preliminary investigations have highlighted evidence gaps, uncertainties, and limitations, such as models not being fully validated, limited consideration of impacts associated with water company wastewater asset malfunctions and storming events. Further action is required to ensure there is more certainty regarding the source apportionment.

The results of Natural England's assessment on water quality and water chemistry parameters (detailed in section 8) have shown that all three floodplain sites are currently exhibiting high nutrient status. This is not only concerning in relation to an insufficient or poor water quality aspect, the impact this may have on native and sensitive species (flora and fauna) or the subsequently increased risk of eutrophication (nutrient enrichment leading to harmful algal blooms and/ or hypoxic conditions) but also, the influence high nutrient status can have on INNS. For example, the INNS *Elodea canadensis* (present at Pulborough Brooks SSSI) has been shown to uptake phosphorous and store it within its roots for future use when concentrations in the water reach insufficient levels for growth (Invasive Species Specialist Group - Global Invasive Species Database). This indicates the potential for environmental risks even if, or when, water quality improves.

Note 1: Additional Phosphorous input at Waltham Brooks deriving from Coldwaltham WwTw's, accounting for approximately 5 %.

Note 2: Additional Nitrate input at Waltham Brooks deriving from Coldwaltham WwTw's, accounting for approximately 10 %.

Other/Unknown sources

The preliminary investigations into source apportionment of nutrients on the Arun Valley designated sites (Arun Valley Designated Sites; Water Quality Nature Recovery Plan – Phase 1, see section 13 for further details) have highlighted several, additional sources of nutrient input. This includes, the presence of wildfowl, the presence of fish (particularly *Cyprinus carpio*, Common Carp) and uncertainty regarding connectivity between the designated sites and main river system (leakage through river sluices). The inputs deriving from wildfowl populations have been calculated based on historic bird count data (Webs report data for the SSSI and SPA designated species) and export coefficients within SAGIS modelling. The cumulative total for Phosphorous (P) and Nitrogen (N) input

resulting from these main bird species has been calculated at 190.4 and 980.1 kg/year respectively. This has been defined as being a “relatively small” proportion of the total P and N inputs when compared with those deriving from the local catchment under normal conditions or following high rain-fall flood events, a representation of which is shown below.

Phosphorous:

- Wildfowl – 190.4 kg/year
- Local catchment – 1,000 kg/year
- Flood event – 600 – 2,000 kg/year

Nitrogen:

- Wildfowl – 980.1 kg/year
- Local catchment – 47,500 kg/year
- Flood event – 9,000 – 25,000 kg/year

The other sources of nutrient input (fish presence and river sluices) identified as being relevant to the Arun Valley designated sites, the absence of sufficient data or evidence makes the magnitude of impact from these sources difficult to quantify. These issues have been raised with the appropriate organisations and discussions have begun to try and identify potential mitigation measures.

Water company discharges

Water quality and water chemistry analysis undertaken during Natural England’s 2021 assessment of the Arun Valley designated sites identified several issues, mostly relating to elevated Total Phosphorous (TP) and Total Nitrogen (TN) concentrations. Whilst the current source apportionment of nutrients impacting these sites is yet to be fully clarified, preliminary investigations into this have started (Natural England’s Arun Valley Water Quality Nature Recovery Plan – Phase 1, please refer to section 13 for more details). Early indications of this work suggest that in general and with the exception of Waltham Brooks SSSI, pollutants deriving from point sources (water company discharges) are not significant and only contribute to a small amount to the overall nutrient input, with the Rivers Arun and Stor being the likely sources of delivery (overtopping during high rain-fall events). It has also been suggested, that due to the degree of dilution relationship shown in the analysis of river flow and nutrient concentration, the composition of pollutants during high rain-fall events leading to subsequent overtopping is expected to be primarily from diffuse sources.

However, the preliminary investigations have highlighted evidence gaps, uncertainties and limitations which reduces the confidence of the above conclusions. Anecdotal information obtained through undertaking this condition assessment report has also highlighted this such as risks around connectivity between the main river system and the designated sites (as detailed further in the pressures section on drainage). Whilst the magnitude of severity

is difficult to quantify in the absence of sufficient evidence, these concerns have been raised with all relevant stakeholders and collaborative works have begun to better understand these risks, identify potential impacts to designated sites and their associated features, and subsequent implementation of appropriate methods of mitigation if required.

The results of Natural England's 2021 assessment have concluded there is a significant concentration of point source pollutants into Waltham Brooks SSSI. This was demonstrated through both visual observations (recorded presence of sewage fungus within the ditches of Waltham Brooks SSSI and others within close proximity to the wastewater treatment works) and sequential water quality and water chemistry data. For example, at the most impacted monitoring location (Site B, Waltham Brooks SSSI), the recorded mean annual parameters for both Total Nitrogen and Total Phosphorous respectively were in excess of 13 and 57 times higher than the revised CSMG targeted range. These concerns have been raised and discussions are progressing with the relevant water company to address this issue as soon as feasibly possible.

Climate change and extreme events

To further support in obtaining evidence surrounding the Arun Valley Designated Sites and the current, and likely future impacts of climate change on designated features, Natural England have undertaken a SSSI Future Reforms pilot project on Amberley Wild Brooks SSSI (see section 13 for further details). This aimed at investigating the efficacy of current SSSI statutory framework in relation to the direct risks associated with climate change, and whether there would be a requirement for legal framework to evolve, to better protect habitats, species, and geological features. The direct risks identified through this project, relative to Amberley Wild Brooks and its associated designated features are as follows:

- Increased frequency of extreme events i.e., flooding, drought, heatwaves, wildfires.
- Changes or reductions to water quality parameters i.e., higher temperatures, saline intrusion, increased inundation of nutrients.
- Alterations to ecological structure and natural processes i.e., increased presence of INNS, changes to natural growing seasons, predator/prey imbalances, and reduced breeding success.

Using the best available climatic projections for the region (Southern England), the vulnerability of each feature was subsequently assessed for risk against two greenhouse gas scenarios up to 2060, a medium-high-, and high-risk scenario. An overview of which is detailed below:

Medium-High risk scenario:

- All designated features present at Amberley Wild Brooks SSSI are at Medium-High risk of being adversely affected or lost. Predicted impact of between 50 – 75 % for all features.

High risk scenario:

- All designated features present at Amberley Wild Brooks SSSI are at High risk of being adversely affected or lost. Predicted impact of 75 % for all features.

Anecdotal (surveyors, RSPB reserves manager, Pers Comm), and photographic evidence (from landowners) provided to Natural England have indicated that historic changes to hydrological and climatic conditions (low-water levels and ditches drying out over long-dry periods) are already impacting upon designated or geographically important features throughout the Arun Valley designated sites. This perception of exposure to change, and resultant “drying-out” in areas of floodplain habitat has been further supported in recent studies (Whiteley and others, 2025, Eco-hydrology and Peat report, see section 13 for further details) and peer-reviewed literature (Hicks *et al.,* 2019), detailing detrimental impacts on peat health and alterations to plant community structure respectively.

The findings of Natural England’s condition assessment report of the Arun Valley designated sites identified issues with water quality and availability as a pressure impacting on all designated features, likely to be a combination of direct anthropogenic catchment issues and wider climatic changes. It has also been concluded that in the absence of sufficient mitigation measures, and in consideration of the best available climatic projections, the severity of impacts to features in response to climate change will likely be exacerbated. Further review by Natural England specialists is required to ensure that the water quality and ditch water depth targets for these sites are sufficient in responding to climatic changes and appropriately detailed, updated and actioned within the MS’s (timeframes to complete this will be dependent on Natural England resources).

For further information relating to the risks, adaptability and resilience of environments in response to climate change, please refer to Natural England’s Natural England’s Climate Change Adaptation Manual (NE751).

Rainfall

As discussed within the previous section and highlighted within the SSSI Future Reforms pilot project undertaken on Amberley Wild Brooks SSSI (see section 13 for further details), there is a perceivable increased risk that extreme events including elevated rainfall will impact on the environmental characteristics of the designated sites within the Arun Valley. Whilst an increased precipitation of freshwater may be beneficial for water-dependent features, increasing the availability of supporting habitat, the delivery of excessive rainfall throughout the catchment will increase the likeliness of connectivity with the main river system, impacting overall water quality through facilitating the transferral of sediments, pollutants, and INNS.

Pressures Overview

Table 15.1 - Summary of pressures relevant to each Arun Valley SSSI

Pressure	Amberley Wild Brooks	Pulborough Brooks	Waltham Brooks	Upper Arun	Arun Banks
Drainage	**Yes**	**Yes**	**Yes**	**No**	**Yes**
Inland flood defence and physical modification	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Siltation	**Yes**	**Yes**	**Yes**	**No**	**No**
Water abstraction	**Yes**	**Yes**	**Yes**	**No**	**No**
INNS – Freshwater fish	**Yes**	**Yes**	**No**	**No**	**No**
INNS – Freshwater plants	**Yes**	**Yes**	**No**	**Yes**	**Yes**
INNS – Terrestrial plants	**No**	**No**	**Yes**	**Yes**	**No**

Pressure	Amberley Wild Brooks	Pulborough Brooks	Waltham Brooks	Upper Arun	Arun Banks
Ditch management regime	**Yes**	**Yes**	**Yes**	**No**	**No**
Land use change	**Yes**	**Yes**	**Yes**	**No**	**No**
Overgrazing (wild animals)	**Yes**	**Yes**	**No**	**No**	**No**
Agricultural sources of water pollution	**Yes**	**Yes**	**Yes**	**No**	**No**
Other/Unknown sources of water pollution	**Yes**	**Yes**	**Yes**	**No**	**No**
Water company discharges causing water pollution	**Yes**	**Yes**	**Yes**	**No**	**No**
Extreme events	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Rainfall	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

References

Abraham, F. 1998. Amberley Wild Brooks: A Survey of the Ditch Flora 1998. Arun District Council.

Abraham, F., Briggs, M., Harmes, P., Hoare, A., Knapp, A., Lording, T., Scott, B., Shaw, M., Streeter, D., and Sturt, N. 2018. The Flora of Sussex. Pisces Publications.

Barker, A. 2022. 'Illustrated report on a survey of the Damselflies and Dragonflies of the Upper Arun 2021'. Unpublished, Natural England.

Boardman, J., Burt, T., Foster, I. 2020. Monitoring soil erosion on agricultural land: results and implications for the Rother valley, West Sussex UK. *Journal of Earth Surface Processes and Landforms,* 45 (15), 3931-3942.

Brotherton, J., Whiteley, A., Wain, R., and Owen, G. 2025. 'Natural England commissioned Pulborough Brooks SSSI Eco-hydrology and Peat assessment report' (NECR602).

Cheffings, C. and Farrell, L. (Eds), Dines, T., Jones, R., Leach, S., McKean, D., Pearman, D., Preston, C., Rumsey, F., Taylor, I. 2005. The Vascular Plant Red Data List for Great Britain Species Status 7: 1-116. JNCC, Peterborough.

Clarke, S. 2015. 'Conserving freshwater biodiversity: The value, status and management of high-quality ditch systems.' *Journal for Nature Conservation,* 24; 93-100.

Daguet, C., French, G., and Taylor, P. 2008. The Odonata Red Data List for Great Britain. Species Status 11; 1-34. JNCC, Peterborough.

Drake, C. 2004. 'Grazing marsh assemblages and site classification using invertebrates', English Nature Research Report 579. English Nature.

Drake, C., Lott, D., Alexander, K., and Webb, J. 2007. 'Surveying terrestrial and freshwater invertebrates for conservation evaluation.' Natural England Research Report 005.

Environment Agency. 2006. Amberley Wild Brooks SSSI NVC Survey. Unpublished.

Environment Agency. 2009. Review of Consents. Unpublished.

Godfrey, A. 2021. 'Natural England commissioned Invertebrate Surveys – Arun Valley Designated Sites'. Internal report to Natural England. Unpublished.

Hicks, D., Abraham, F., Bardsley, L., Cousins, M., Webster, E., and Whitman, J. 2019. 'Spatial and temporal vegetation analysis of Amberley Wild Brooks over two decades.' *British and Irish Botany,* 1(4): 309-326.

JNCC. No date. 4056 Ramshorn snail (*Anisus vorticulus*). Available at: https://sac.jncc.gov.uk/species/S4056/ (Accessed: 27.03.2023).

IUCN. 2012. 'IUCN Red List categories and criteria' IUCN Species Survival Commission (SSC) version 3.1, second edition. Available at: https://portals.iucn.org/library/node/10315

Lyons, G. 2006. Waltham Brooks SSSI botanical surveys. Unpublished, Sussex Wildlife Trust.

Lyons, G. 2012. A review of biological monitoring at Waltham Brooks and recommendations for management. Unpublished, Sussex Wildlife Trust.

O'Brien, M. and Smith, K. 1992. 'Changes to the status of waders breeding on wet lowland grasslands in England and Wales between 1982 and 1989'. *Bird Study,* 30, 165-176.

Plant Atlas 2020, BSBI 2020. Botanical Society of Britain & Ireland Plant Atlas. Available at: https://plantatlas2020.org/atlas (Accessed: 21 February 2024)

Robertson, H. and Jefferson, R. 2000. 'Monitoring the condition of lowland grassland SSSIs. English Nature's rapid assessment method' English Nature Research Report 315, Peterborough.

RSPB. 1999-2004. Pulborough Brooks SSSI botanical surveys. Unpublished.

Savic, R., Stajic, M., Blagojevic, B., Bezdan, A., Vranesevic, M., Nikolic Jokanovic, V., Baumgertel, A., Bubalo Kovacic, M., Horvatinec, J and Ondrasek, G. 2022. Nitrogen and Phosphorus Concentrations and Their Ratios as Indicators of Water Quality and Eutrophication of the Hydro-System Danube–Tisza–Danube. Available at: https://www.mdpi.com/2077-0472/12/7/935 (Accessed: 28 February 2024)

Southern Water. 2008-09. 'Arun Valley sustainability study' (AVSS) Final Report. Southern Water AMP4. Unpublished.

Watson, A., Ormerod, S. 2005. 'The distribution and conservation of threatened *Sphaeriidae* on British grazing marshland'. *Biodiversity & Conservation,* 14, 2207–2220.

Whiteley, A., Brotherton, J., Wain, R. and Owen, G. (2025) 'Natural England commissioned Amberley Wild Brooks SSSI Eco-hydrology and Peat assessment report' (NECR602).

Willing, M. 2015a. 'A full survey of ditches on RSPB Pulborough Brooks for the Little Whirlpool Ramshorn Snail, Anisus vorticulus: November 2013-July 2014' Internal report to RSPB and Natural England. Unpublished.

Willing M. 2015b. 'A survey of ditches on the western sector of Amberley Wild Brooks for the Little Whirlpool Ramshorn Snail Anisus vorticulus: June - July 2015.' Internal report to Natural England. Unpublished.

Willing, M. 2022. ‘A survey: Little Whirlpool Ramshorn Snail on Amberley Wild Brooks, 2022’. Internal report to Natural England. Unpublished.

Glossary

Alluvial – made up of the sediment deposited by water flowing over floodplains or riverbeds.

Augering – using an auger (drill-like tool) to bore a hole in the ground in order to sample sub-surface deposits.

Berm – a flat strip of land or raised bank bordering a river.

Biochemical oxygen demand (BOD) – the amount of oxygen required by aerobic bacteria metabolising organic matter in water.

Broad Assemblage Type (BAT) – a suite of widespread (in this case invertebrate) species that occur in the same habitat and can be found across a range of sites.

Citation – a document that details the 'features of interest' for which a SSSI is considered special and has been legally notified. Each citation shows details of the SSSI location, size, and the date of notification. It also describes the reasons for notification and the special habitats, geology, plants and/or animals that are found at the site.

Common Standards Monitoring Guidance (CSMG) - guidance from the JNCC to assist on setting and assessing conservation objectives for the species, habitats, and Earth science features on protected sites.

Countryside Stewardship – a current scheme for farmers and landowners that provides funding for various sustainable and environmentally beneficial land management activities, such as planting riparian buffer strips.

DAFOR – a scale of species abundance consisting of Dominant (50-100% cover), Abundant (30-50% cover), Frequent (15-30% cover), Occasional (5-15% cover), Rare <5% cover).

Dissolved Oxygen (DO) – the amount of gaseous oxygen that is present in water.

European Sites – also known as ‘Natura’ sites, these are areas of protected species and habitats that were originally designated under European legislation.

FarmSCOPER (Farm Scale Optimisation of Pollutant Emission Reductions) – an agricultural decision support tool that assesses diffuse pollution (sediment and nitrate) loads on a farm and quantifies the impact of various mitigation measures.

Favourable – the designated feature(s) within a unit/site are being adequately conserved and the results from monitoring demonstrate that the feature(s) in the unit/site are meeting all the mandatory site-specific monitoring targets set out in the monitoring specification.

Feature – the specific habitats, species, and/or geodiversity that are of particular interest on a SSSI.

Higher Level Stewardship – a scheme for farmers that preceded Countryside Stewardship and provided funding for various sustainable and environmentally beneficial land management activities.

Invasive Non-Native Species (INNS) – species which have been introduced by human activity into an area outside of their natural range (non-native) and are capable of rapid spread with detrimental environmental or economic impact (invasive).

Mesotrophic – containing a moderate amount of dissolved nutrients, leading to an intermediate amount of productivity.

Monitoring Specification (MS) – a document that sets out the monitoring parameters for each feature on the site, providing guidance and rationale for surveyors to determine the condition of each of the features for which the site is designated.

National Vegetation Classification – a system for classifying habitat types based on the vegetation that they contain.

Odonata – an order of insects made up of dragonflies and damselflies.

Overtopping – the rising of water over the top of a barrier, such as riverbank.

Rare – a species not recorded in more than 15 hectares (10 km squares of the British Ordnance Survey National Grid).

Ramsar site – an internationally important wetland site, designated under the Ramsar Convention (also known as the Convention on Wetlands of International Importance). Ramsar sites are internationally (rather than European) designated sites but are given the same protection under UK law as SPAs and SACs, and so are included in any reference to European sites within this report.

Resist-Accept-Direct (RAD) – a framework to help land managers make strategic choices in response to rapid change (particularly climate change). The options are to resist change (by working to maintain/restore current or historic ecosystem conditions), accept change (by non-intervention), or direct change (by purposefully shaping ecosystem change towards desirable new conditions).

Ruderal – plant species that are the first to colonise disturbed ground.

Scarce – a species recorded in between 16 and 100 hectares (10 km squares of the British Ordnance Survey National Grid).

Site Improvement Plan (SIP) – a document that provides a high-level overview of the issues affecting the designated features of a site and outlines the priority measures required to improve the condition of the features.

Special Area of Conservation (SAC) – an area designated under the Conservation of Habitats and Species Regulations 2017 (as amended) in order to protect habitats and species (excluding birds) that are considered most in need of conservation. SACs complement SPAs and, prior to the UK exiting the EU, were part of the Natura 2000 network of protected sites across the EU.

Special Protection Area (SPA) – an area designated under the Conservation of Habitats and Species Regulations 2017 (as amended) in order to protect bird habitats and species that are considered most in need of conservation. SPAs complement SACs and, prior to the UK exiting the EU, were part of the Natura 2000 network of protected sites across the EU.

Specific Assemblage Type (SAT) – a suite of non-widespread species, typically with intrinsic conservation value, that therefore occur in sites with conservation value.

Stenotopic – a species or group capable of tolerating only a narrow range of habitats or environmental conditions.

Sonde – a probe which measures water quality parameters over an extended period of time, taking measurements at regular intervals.

Supplementary Advice on Conservation Objectives (SACO) – a document that provides more detailed and site-specific information on the conservation objectives for European sites.

Trapezoidal – in this case refers to a ditch which has a cross-section shaped like a trapezoid, with flat channel bottom.

Turbidity – the cloudiness of a fluid, in this case water, caused by suspended particles in the water.

Unfavourable Declining – the unit/feature is not being conserved and will not reach Favourable condition unless there are changes to site management or external pressures. The site condition is becoming **progressively worse**, and this is reflected in the results of monitoring over time, with at least one of the designated features mandatory attributes not meeting its target (as set out in the site specific FCT) with the results moving further away from the desired state.

Unfavourable No Change – the unit/feature is not being conserved and will not reach Favourable condition unless there are changes to the site management or external pressures and this is reflected in the results of monitoring over time, with at least one of the mandatory attributes not meeting its target (as set out in the site specific FCT) with the results not moving towards the desired state.

Unfavourable recovering – Units/features are not yet fully conserved but all the necessary management mechanisms are in place. At least one of the designated feature’s mandatory

attributes are not meeting their targets (as set out in the site specific FCT). Provided that the recovery work is sustained, the unit/feature will reach Favourable condition in time.

Unit - SSSI units are divisions of SSSIs used to record management and condition details. Units are the smallest areas for which Natural England gives a condition assessment. The size of units varies greatly depending on the types of management and the conservation interest.

Wetland Bird Survey (WeBS) – a regular monthly survey of non-breeding waterbirds carried out by the British Trust for Ornithology across a network of sites.

Species names

Arrowhead – *Sagittaria sagittifolia*

Ash Fraxinus - *excelsior*

Bewick's Swan – *Cygnus columbianus bewickii*

Blackthorn – *Prunus spinosa*

Bladderwort – *Utricularia vulgaris* (aggregate)

Brilliant Emerald – Somatochlora metallic

Bramble – *Rubus fructicosus*

British water-milfoils – *Myriophyllum spp.*

Canadian Waterweed – *Elodea canadensis*

Club-tailed Dragonfly – *Gomphus vulgatissimus*

Common Carp – *Cyprinus carpio*

Common Fleabane – Pulicaria dysenterica

Common Nettle - *Urtica dioica*

Common Reed - Phragmites australis

Creeping Bent – *Agrostis stolonifera*

Cut-grass – *Leersia oryzoides*

Damselfly – Coenagrion pulchellum

Downy Emerald – *Cordulia aenea*

Elder – *Sambucus nigra*

False-orb pea mussel – *Euglesa pseudosphaerium* (formerly Psidium pseudo-sphaerium)

Flowering-rush – *Butomus umbellatus*

Frogbit – *Hydrocharis morsus-ranae*

Greater Water-parsnip – *Sium latifolium*

Grey Club-rush – Schoenoplectus tabernaemontan

Hairy Dragonfly – *Brachytron pratense*

Hairy Sedge – *Carex hirta*

Hard Rush – *Juncus inflexus*

Hemlock Water-dropwort – Oenanthe crocata

Himalayan Balsam – *Impatiens glandulifera*

Lapwing – *Vanellus vanellus*

Large Mouthed Valve Snail – Valvata macrostomo

Least Duckweed – *Lemna minuta*

Little Whirlpool Ramshorn Snail – *Anisus vorticulus*

Marsh Fern – *Thelypteris palustris*

Marsh Foxtail – *Alopecurus geniculatus*

Marsh-mallow – *Althaea officinalis*

Marsh Ragwort – *Jacobaea aquatica* (also known as *Senecio aquaticus*)

Meadowsweet – *Filipendula ulmaria*

Migrant Hawker – *Aeshna mixta*

Narrow-leaved Water-dropwort – *Oenanthe silaifolia*

New Zealand Pigmyweed – *Crassula helmsii*

Norfolk Hawker – *Aeshna isoceles*

Nuttall's Waterweed – *Elodea nuttallii*

Oak - Quercus robu

Pintail – *Anas acuta*

Red-eyed Damselfly – *Erythromma najas*

Redshank – *Tringa totanus*

Reed Canary-grass – *Phalaris arundinacea*

Reed Sweet-grass - *Glyceria maxima*

Ruff – *Calidris pugnax* (formerly *Philomachus pugnax*)

Scarce Chaser – *Libellula fulva*

Scarce Emerald Damselfly – *Lestes sponsa*

Sea Club-rush – *Scirpus maritimus*

Sharp-leaved Pondweed – *Potamogeton acutifolius*

Shining Ramshorn Snail – *Segmentina nitid*

Shoveler –*Spatula clypeata* (formerly *Anas clypeata*)

Silverweed – *Potentilla anserina*

Small Water-pepper – *Persicaria minor*

Soft Rush – *Juncus effusus*

Teal – *Anas crecca*

Triangular Club-rush – Schoenoplectus triqueter

True Fox-sedge – *Carex vulpina*

Tufted Hair-grass – *Deschampsia flexuosa*

Variable Damselfly – *Coenagrion pulchellum*

Water-plantain – *Plantago-aquatica*

Water Fern – *Azolla filiculoides*

Water Mint – *Mentha aquatica*

White-legged Damselfly – *Platycnemis pennipes*

White Willow – *Salix alba*

Whorled Water-milfoil – *Myriophyllum verticillatum*

Wigeon – *Mareca penelope* (formerly *Anas penelope*)

Wild Privet – *Ligustrum vulgare*

Yellow Iris – Iris pseudacorus

Yellow Water-lily – *Nuphar lutea*

Yorkshire-fog – *Holcus lanatus*

Appendices

Appendix 1 - Feature to unit condition

Feature to unit condition following the 2021-23 review.

Any conclusions of condition assessment for those features and attributes that were not assessed during this review are classed as ‘unassessed’ in the following tables.

Table A1.1 Condition status of Arun Banks SSSI units and its monitored notified features following the 2021-23 review.

	Condition by SSSI unit	
Feature	**1**	**2**
Floodplain fen (lowland)	Unassessed	Not applicable
Population of declining plant species and species at the edge of their range - *Schoenoplectus lacustris sub-species Schoenoplectus x kuekenthalianus*	Favourable	Not applicable
Wet woodland	Not applicable	Unassessed

Table A1.2 Condition status of Upper Arun SSSI units and its monitored notified features following the 2021-23 review.

	Condition by SSSI unit			
Feature	**1**	**2**	**3**	**4**
Outstanding Odonata assemblage	Favourable	Favourable	Favourable	Favourable

Table A1.3 Condition status of Amberley Wild Brooks SSSI units and its monitored notified features following the 2021-23 review.

	Condition by SSSI unit													
Feature	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Outstanding Odonata assemblage	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable
Outstanding diverse invertebrate assemblages (W21, W31, F21)	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Not applicable	Unfavourable No Change	Not applicable
Breeding birds – *Tringa totanus*	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Non-breeding birds – Cygnus *columbianus bewickii*	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unassessed	Unfavourable Declining	Unassessed
Non-breeding birds – *Spatula clypeata*	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Unassessed	Favourable	Unassessed
Non-breeding birds – *Anas crecca*	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Unassessed	Favourable	Unassessed
Non-breeding birds – variety of wintering species	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Unassessed	Favourable	Unassessed
Assemblages of breeding birds – Mixed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed
Ditch Systems	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unassessed	Unassessed	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unassessed

	Condition by SSSI unit													
Feature	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Lowland neutral grassland (M23, MG6, M25) (note 1)	Unassessed	Unfavourable Declining	Unassessed	Unfavourable Declining	Unassessed	Unfavourable Declining	Unfavourable Declining	Unassessed	Unassessed	Unassessed	Unassessed	Not applicable	Unassessed	Unassessed
Vascular Plant Assemblage	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unassessed	Unassessed	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Not applicable
Leersia oryzoides	Unassessed	Favourable	Unassessed	Unfavourable Declining	Unfavourable Declining	Favourable	Unfavourable Declining	Unassessed	Unassessed	Unfavourable Declining	Unfavourable Declining	Not applicable	Favourable	Not applicable
Carex vulpina	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining	Unassessed	Unfavourable Declining	Unfavourable Declining	Not applicable	Unfavourable Declining	Not applicable
Rare invertebrates: *Anisus vorticulus*	Not applicable	Unfavourable Declining	Not applicable	Unfavourable Declining	Unfavourable Declining	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Unfavourable Declining	Not applicable	Unfavourable Declining	Not applicable
Alluvial grazing marshes with ditches, swamp (note 1)	Unassessed	Unfavourable Declining	Unassessed	Unfavourable Declining	Unassessed	Unfavourable Declining	Unfavourable Declining	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed
Wet woodland	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed	Unassessed

Note 1: Alluvial grazing marshes, and lowland neutral grassland are not designated features of Amberley Wild Brooks SSSI. However, are noted within the MS as an attribute of supporting habitat for notified features. Therefore, they have been included within this report.

Table A1.4 Condition status of Pulborough Brooks SSSI and its monitored notified features following the 2021-23 review.

	Condition by SSSI unit		
Feature	**1**	**2**	**3**
Outstanding Odonata assemblage	Favourable	Favourable	Favourable

	Condition by SSSI unit		
Feature	**1**	**2**	**3**
Rare Odonata: *Libellula fulva*	Favourable	Favourable	Favourable
Rare Odonata: *Gomphus vulgatissimus*	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change
Outstanding diverse invertebrate assemblages (W21, W31)	Unfavourable Declining [note 1]	Unfavourable Declining [note 1]	Unfavourable Declining [note 1]
Aggregations of non-breeding birds – *Cygnus columbianus bewickii*	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Aggregations of non-breeding birds – *Anas acuta*	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Aggregations of non-breeding birds – *Spatula clypeata*	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Aggregations of non-breeding birds – *Anas crecca*	Favourable	Favourable	Favourable
Aggregations of non-breeding birds – *Mareca penelope*	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Aggregations of non-breeding birds – *Calidris pugnax*	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Aggregations of breeding birds – Lowland damp grasslands	Favourable	Favourable	Favourable
Ditch Systems	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Lowland neutral grassland (M23, MG6, M25) (note 2)	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Vascular plant assemblage	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Rare invertebrates: *Anisus vorticulus*	Favourable	Unfavourable Declining	Unfavourable Declining

Note 1: Unfavourable Declining condition concluded as SAT W21 failed to meet Favourable condition by a significant margin.

Note 2: Lowland neutral grassland is not a designated feature of Pulborough Brooks SSSI. However, is noted within the MS as an attribute of supporting habitat for notified features. Therefore, has been included within this report.

Table A1.5 Condition status of Waltham Brooks SSSI and its monitored notified features following the 2021-23 review.

	Condition by SSSI unit		
Feature	**1**	**2**	**3**
Aggregations of non-breeding birds – *Cygnus columbianus bewickii*	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Aggregations of non-breeding birds – *Spatula clypeata*	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Aggregations of non-breeding birds – *Anas crecca*	Unfavourable Declining	Unfavourable Declining	Unfavourable Declining
Assemblage of breeding birds – Lowland damp grasslands	Unassessed	Unassessed	Unassessed
Ditch Systems	Unfavourable Declining	Unfavourable Declining	Unassessed
Lowland neutral grassland (M23, MG6, M25)	Unassessed	Unfavourable Declining	Unassessed
Vascular Plant Assemblage [note 1]	Unfavourable Declining	Unfavourable Declining	Unassessed
Leersia oryzoides	Not applicable	Unfavourable Declining	Unassessed
Alluvial grazing marshes with ditches, swamp (S4, S5, S6, S7, S11, S12, S19 related communities)	Unassessed	Unfavourable Declining	Unassessed

Note 1: VPA at Waltham Brooks is not a designated feature of the SSSI. However, is a designated feature of the Arun Valley Ramsar and is mentioned within the MS as an attribute under the ditch habitat feature of the SSSI. Therefore, it has been included within this report.

Feature to unit condition prior to this review

Not all features have been assessed in previous condition assessments and as outlined throughout this report, many features/attributes across the SSSIs and their MSs have changed and/or changes are proposed since this 2021-23 review. For this reason, the tables below will vary compared to those above.

Table A1.6 Condition status of the site and its monitored notified features for Arun Banks SSSI prior to this review.

	Condition per unit		
Feature	**1**	**2**	**Year last assessed**
Floodplain fen (lowland)	Favourable	Not applicable	2013
Population of declining plant species and species at the edge of their range - *Schoenoplectus lacustris* sub-species *tabernaemontani x triqueter*	Favourable	Not applicable	2010
Wet woodland	Not applicable	Favourable	2010

Table A1.7 Condition status of the site and its monitored notified features for Upper Arun SSSI prior to this review.

	Condition per unit				
Feature	**1**	**2**	**3**	**4**	**Year last assessed**
Outstanding Odonata assemblage	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	2011

Table A1.8 Condition status of the site and its monitored notified features for Amberley Wild Brooks SSSI prior to this review.

	Condition per unit														
Feature	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**Year last assessed**
Outstanding Odonata assemblage	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Not applicable	Unfavourable recovering	Not applicable	2011
Invert. assemblage (W21 only)	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Not applicable	Unfavourable recovering	Not applicable	2011
Aggregations of breeding birds - *Tringa totanus*	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unassessed	Favourable	Unfavourable recovering	Unassessed	Unfavourable recovering	Unassessed	2011
Aggregations of non-breeding birds - *Cygnus columbianus bewickii*	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Unfavourable No Change	Not applicable	Unfavourable No Change	Not applicable	2021
Aggregations of non-breeding birds - *Spatula clypeata*	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Not applicable	Favourable	Not applicable	2021
Aggregations of non-breeding birds - *Anas crecca*	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Favourable	Not applicable	Favourable	Not applicable	2021
Aggregations of non-breeding birds - variety of wintering species	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unassessed	Unfavourable recovering	Unfavourable recovering	Not applicable	Unfavourable recovering	Not applicable	2011

	Condition per unit													
Assemblages of breeding birds - Mixed: Lowland damp grassland, Woodland	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unassessed	Unfavourable recovering	Unfavourable recovering	Unassessed	Favourable	Unassessed	2011
Ditch systems	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Favourable	Unfavourable recovering	Unfavourable recovering	Not applicable	Unfavourable recovering	Not applicable	2011
Vascular Plant Assemblage	Not allocated to units														2011
Population of Schedule 8 plant - *Leersia oryzoides*, Cut-grass	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Favourable	Unfavourable recovering	Unfavourable recovering	Not applicable	Unfavourable recovering	Not applicable	2011
Population of RDB plant - *Carex vulpina*, True Fox-sedge	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Unfavourable recovering	Favourable	Unfavourable recovering	Unfavourable recovering	Not applicable	Unfavourable recovering	Not applicable	2011

Table A1.9 Condition status of the site and its monitored notified features for Pulborough Brooks SSSI prior to this review

	Condition per unit			
Feature	**1**	**2**	**3**	**Year last assessed**
Invertebrate assemblage (W21 only)	Favourable	Favourable	Favourable	2012
Aggregations of non-breeding birds - *Cygnus columbianus bewickii*	Favourable	Favourable	Favourable	2014

	Condition per unit			
Aggregations of non-breeding birds - *Anas acuta*	Favourable	Favourable	Favourable	2021
Aggregations of non-breeding birds - *Spatula clypeata*	Favourable	Favourable	Favourable	2021
Aggregations of non-breeding birds - *Anas crecca*	Favourable	Favourable	Favourable	2021
Aggregations of non-breeding birds - *Mareca penelope*	Favourable	Favourable	Favourable	2021
Assemblages of breeding birds - Lowland damp grasslands	Favourable	Favourable	Favourable	2012
Vascular Plant Assemblage	Favourable	Favourable	Favourable	2012
Population of RDB mollusc - *Anisus vorticulus*	Favourable	Favourable	Favourable	2014

Table A1.10 Condition status of the site and its monitored notified features for Waltham Brooks SSSI prior to this review

	Condition per unit			
Feature	**1**	**2**	**3**	**Year last assessed**
Aggregations of non-breeding birds - *Cygnus columbianus bewickii*	Not applicable	Unfavourable Declining	Unfavourable Declining	2021
Aggregations of non-breeding birds - *Spatula clypeata*	Not applicable	Unfavourable Recovering	Unfavourable Recovering	2013
Aggregations of non-breeding birds - *Anas crecca*	Not applicable	Unfavourable Recovering	Unfavourable Recovering	2013
Assemblages of breeding birds - Mixed: Lowland damp grassland, Woodland	Unfavourable Recovering	Unfavourable Recovering	Unfavourable Recovering	2013
Ditches	Unfavourable Recovering	Unfavourable Recovering	Unfavourable Recovering	2013
Population of Schedule 8 plant - *Leersia oryzoides*, Cut-grass	Not applicable	Unfavourable Recovering	Unfavourable Recovering	2013

	Condition per unit			
Lowland fens, including basin, flood-plain, open water transition and valley fens	Not applicable	Unfavourable Recovering	Unfavourable Recovering	2013

Appendix 2 – Feature targets: Arun Banks SSSI

Table A2.1 Site specific targets and measures for the features designated on Arun Banks SSSI.

Feature	Attribute	Target
Schoenoplectus x kuekenthalianus **Nationally notable plant species: *Schoenoplectus lacustris* sub species *tabernaemontani x triqueter* hybrid (Na). Glaucous bulrush**	**Presence**	Presence/absence. Clump should still be extant. Assessments should be regularly augmented by detailed survey by a specialist to check on health of remaining clump(s).
Schoenoplectus x kuekenthalianus **Nationally notable plant species: *Schoenoplectus lacustris* sub species *tabernaemontani***	**Negative indicators: competition**	Needs lack of competition from adjoining reed-swamp vegetation. Grows along the outermost edge of reed-beds fringing estuaries and the lower (somewhat brackish) reaches of rivers. There should be no evidence of any succession – use aerial photographs to check on the stability of the reed-swamp edge.

Feature	Attribute	Target
***x triqueter* hybrid (Na).** **Glaucous bulrush**		
***Alnus glutinosa - Carex paniculata* woodland (W5)** ***Alnus glutinosa-Urtica dioica* woodland (W6)**	**Habitat extent**	Habitat extent = circa 17.5 ha (measured from aerial photos). No loss of ancient semi-natural stands. At least current area of recent semi-natural stands maintained, although their location may alter. Stand loss due to natural processes e.g., in minimum intervention stands may be acceptable. Stand destruction may occur if the understorey and ground flora are irretrievably damaged even if the canopy remains intact. As a guideline, loss can be defined as at least 0.5 ha or 0.5% of the stand area, whichever is the smaller. 20% canopy cover is conventionally taken as the lower limit for an area to be considered as woodland. Targets for extent may be modified where a target has been set to increase the extent of other habitat features on the site at the expense of woodland.
***Alnus glutinosa - Carex paniculata* woodland (W5)** ***Alnus glutinosa-Urtica dioica* woodland (W6)**	**Structure and Natural processes**	Tall herb fen should be maintained. Understorey (2-5m) present over at least 20% of total stand. Canopy cover present over 30-90% of stand area. At least three age classes spread across the average life expectancy of the commonest trees. Some areas of relatively undisturbed mature/old growth stands, or a scatter of large trees allowed to grow to over-maturity/death on site (e.g. a minimum of 10% of the woodland or 5-10 trees per ha). A minimum of 3 fallen lying trees >20 cm diameter per ha and 4 trees per ha allowed to die standing. Approximately 2 ha (circa 10%) of this part of the site consists of tall herb fen (where the old riverbed was) which is gradually succeeding to scrub and woodland.

Feature	Attribute	Target
***Alnus glutinosa - Carex paniculata* woodland (W5) *Alnus glutinosa-Urtica dioica* woodland (W6)**	**Composition**	At least 95% of cover in any one layer of site - native or acceptable naturalised species. Minimum levels of particular native tree/shrub species (where important and appropriate), death, destruction or replacement of native woodland species through effects of introduced fauna or other external unnatural factors not more than 10% by number or area in a five-year period. In sites where there might be uncertainty as to what counts as site-native or as acceptable naturalised species this must be made clear (e.g. the position of sycamore). Death, destruction or replacement of native woodland species through effects of introduced fauna or other external unnatural factors not more than 10% by number or area in a five-year period.
***Alnus glutinosa - Carex paniculata* woodland (W5) *Alnus glutinosa-Urtica dioica* woodland (W6)**	**Indicators of local distinctiveness**	80% of ground flora cover referable to relevant National Vegetation Classification (NVC) community. Target(s) also to be set to maintain distinctive elements at current extent/levels and/or in current locations, e.g. to maintain important microhabitats (other than dead wood), patches of associated habitats, transitions between habitats, or existing populations of locally notable species (other than trees/shrubs). This attribute is intended to cover any site-specific aspects of this habitat feature (forming part of the reason for notification) which are not covered adequately by the previous attributes, or by separate guidance (e.g. notified species features). For notable species it is not intended to set a target for detailed species monitoring, rather to provide a rapid indication of presence/absence and/or approximate extent, allowing for natural fluctuations in population size.
Alnus glutinosa - Carex paniculata	**Regeneration potential**	Signs of seedlings growing through to saplings to young trees at sufficient density to maintain canopy density over a 10-year period (or equivalent regrowth from coppice

Feature	Attribute	Target
woodland (W5) ***Alnus glutinosa-Urtica dioica*** **woodland (W6)**		stumps). No more than 20% of areas regenerated by planting. All planting material of locally native stock No planting in sites where it has not occurred in the last 15 years. A proportion of gaps at any one time may develop into permanent open space; equally some current permanent open space/glades may in time regenerate to closed canopy. Regeneration may often occur on the edges of woods rather than in gaps within it. The density of regeneration considered sufficient is clearly less in parkland sites than in high forest; in coppice most of the regeneration will be as stump regrowth. The minimum level of regeneration to be acceptable from a nature conservation viewpoint is likely to be much less than that needed where wood production is also an objective.
Neutral Grassland - Lowland	**Habitat extent**	Habitat extent = circa 0.26 ha (taken from ENSIS). No reduction in area and any consequent fragmentation without prior consent.

Appendix 3 – Odonata survey methodology and targets: Upper Arun SSSI

The historical data available surrounding the Odonata assemblages and population presence at the Upper Arun SSSI is sparse where the last condition assessment was undertaken in 2011. This has indicated a requirement to assess the criteria for these species. The results of which are to be used as part of this wider condition assessment review to accurately assess the current condition of designated features within the Arun Valley catchment, and Habitats sites; SAC, SPA, Ramsar, and associated SSSIs.

The criteria for site specific designations and determination of whether a site is in Favourable condition, relating to both outstanding assemblages, or Nationally Rare and scarce dragonflies, has been defined within the CSMG for Terrestrial and Freshwater Invertebrates. The information within this guidance has been used in conjunction with that contained in "Surveying Terrestrial and Freshwater Invertebrates for Conservation Evaluation" (Drake *et al.*,, 2007) to create site specific, CSMG (Common Standard Monitoring Guidance) compliant sampling methodology for this condition assessment. This should aid in identifying potential mitigation measures to protect the diverse formation of nationally, and internationally protected species for which the Arun Valley is renowned for.

The attributes assessed within this methodology (and within the site's MS) to determine the condition of the Odonata assemblage and population presence of Nationally Rare, and scarce dragonflies at Upper Arun SSSI were as follows:

- Presence/absence of breeding - confirmed, possible, or probable breeding
- Number of species
- Larval habitat
- Emergent vegetation - % of river habitat cover
- Submerged vegetation - % of river habitat cover
- Habitat canopy cover - % of water's edge shaded by overhanging trees
- Adult foraging habitat - vegetative heterogeneity
- Adult foraging habitat (other)

Timing and samplers

Monitoring of Odonata assemblage was carried out between May and August 2021, as close to the specified dates recommended within the CSMG guidance as feasible. This was to ensure that the chosen sampling dates coincided with the presence of peak population abundance for larvae and adult aquatic bugs. The surveyed dates for each of the four units that form the Upper Arun SSSI were as follows:

- Unit 1 – 26th May 2021 (CSMG recommended dates 25th, 26th May)

- Unit 2 – 5th July 2021 (CSMG recommended dates 5th, 6th July)
- Unit 3 – 18th August 2021 (CSMG recommended dates 18th, 19th August)
- Unit 4 – 17th, 18th August 2021 (CSMG recommended dates 18th, 19th August)

In concurrence with recording species population and abundance, habitat characteristics for each of the four units were also assessed. This was undertaken between June 2021 and September 2021, with over 100 separate sections being assessed and recorded across the four units of the Upper Arun SSSI.

Prior to this condition assessment, the last Odonata surveys conducted at Upper Arun SSSI was in 2011, and all units were classed as Unfavourable recovering. The site passed the target for number of species, however not all were recorded breeding within a 3-year cycle. The indirect habitat attributes were classed as Unfavourable with a lack of vegetation heterogeneity and presence of negative factors.

Survey methods.

The assessment was completed with consideration to two primary categories, species and habitat. Both categories were assessed while following the same predetermined route along the riverbank. Confirmation of species presence/absence and confirmation of breeding were noted upon visual observations and recorded within the national grid references (NGR) for each of the SSSI units. Habitat characteristics were assessed similarly but the NGR of each surveyed point was recorded at each stop within these units.

Species - confirmation of presence/absence and confirmation of breeding

Confirmation of presence/absence, and confirmation of breeding Odonata assemblages at Upper Arun SSSI were assessed in line with the British Dragonfly Society's *Dragonfly Survey Guidance*. This included the undertaking of a transect survey, with a standardised field of monitoring (2 metres inland and 5 metres over water).

Methodology

- Walk along the predetermined route, noting down all dragonflies observed, including number of species and evidence of breeding.
    - Visual identification of Odonata assemblage presence/absence to be undertaken using binoculars.
    - Confirmation of breeding to be confirmed by identifying larval stage Odonata, using one of the following methods: sweep netting, spot sweeping, and / or pond netting.
    - Surveyed walk undertaken by four people, split into two teams and assessed at varying times of the year (May, July, and August).
- Data to be recorded against the NGR's of units assessed, including specified points (point counts) where observations were recorded, and where limited viewpoints

were present. This will allow for surveyed assessments to be replicated for future analysis.

Table A3.1 Odonata breeding status and relevant criteria as described in British Dragonfly Society - Proof of Breeding Criteria.

Breeding Status	Criteria
Confirmed	Exuviae or larvae present or teneral (newly emerged) adjacent to suitable water. (However, it should be noted that only the presence of an exuvia constitutes absolute proof that at least one specimen has completed a cycle form egg to adult at the site).
Probable	Pair copulating or female ovipositing or regular presence of both sexes at suitable water body (normally annual presence or a repeated period consistent with the species' life-cycle length).
Possible	Female seen at a water body suitable for the species where at least one male has been observed to be engaged in some form of reproductive behaviour, such as territoriality or pursuing females.

Habitat characteristics

Habitat characteristics were assessed at varying points along the predetermined route. Surveys were undertaken at specified points (NGR's recorded), where the habitat characteristics were assessed against the condition assessment table of aggregations (described below). Due to time constraints the habitat characteristics for the Upper Arun SSSI were assessed separately to Odonata assemblages, with surveys taking place between June 2021 and September 2021.

The following criteria was assessed to determine the habitat characteristics favourability:

- Larval habitat
- % cover emergent vegetation
- % cover submerged vegetation
- % water's edge shaded by over-hanging trees
- Adult foraging habitat vegetation heterogeneity
- Adult foraging habitat

Sampling locations

Site selection

The route of the predetermined walk should be fixed and closely follow the river in each of the four units of the Upper Arun SSSI. The order in which each unit is assessed should be determined based on the species previously recorded on site, with consideration of the following criteria, where applicable:

- May assessment – Club-tailed, Hairy, Downy Emerald (Unit 1)
- June assessment – Scarce Chaser (Not assessed following CSMG)
- July assessment – White-legged Damselfly (Unit 2)
- August assessment – Abundance of diverse species (Units 3 and 4)

The estimated area of each of the following units assessed was as follows:

- Unit 1 - New Bridge to Harsfold Hanger (4.1245 ha)
- Unit 2 - Harsfold Hanger to Weir (3.4135 ha)
- Unit 3 - Weir to Rumbeam Copse (3.0892 ha)
- Unit 4 - Rumbeam Copse to Stopham (6.9526 ha)

The route for each unit's Odonata Assemblage and Habitat Characteristics assessment are shown in the following maps (Figures A3.1, A3.2, A3.3 and A3.4).

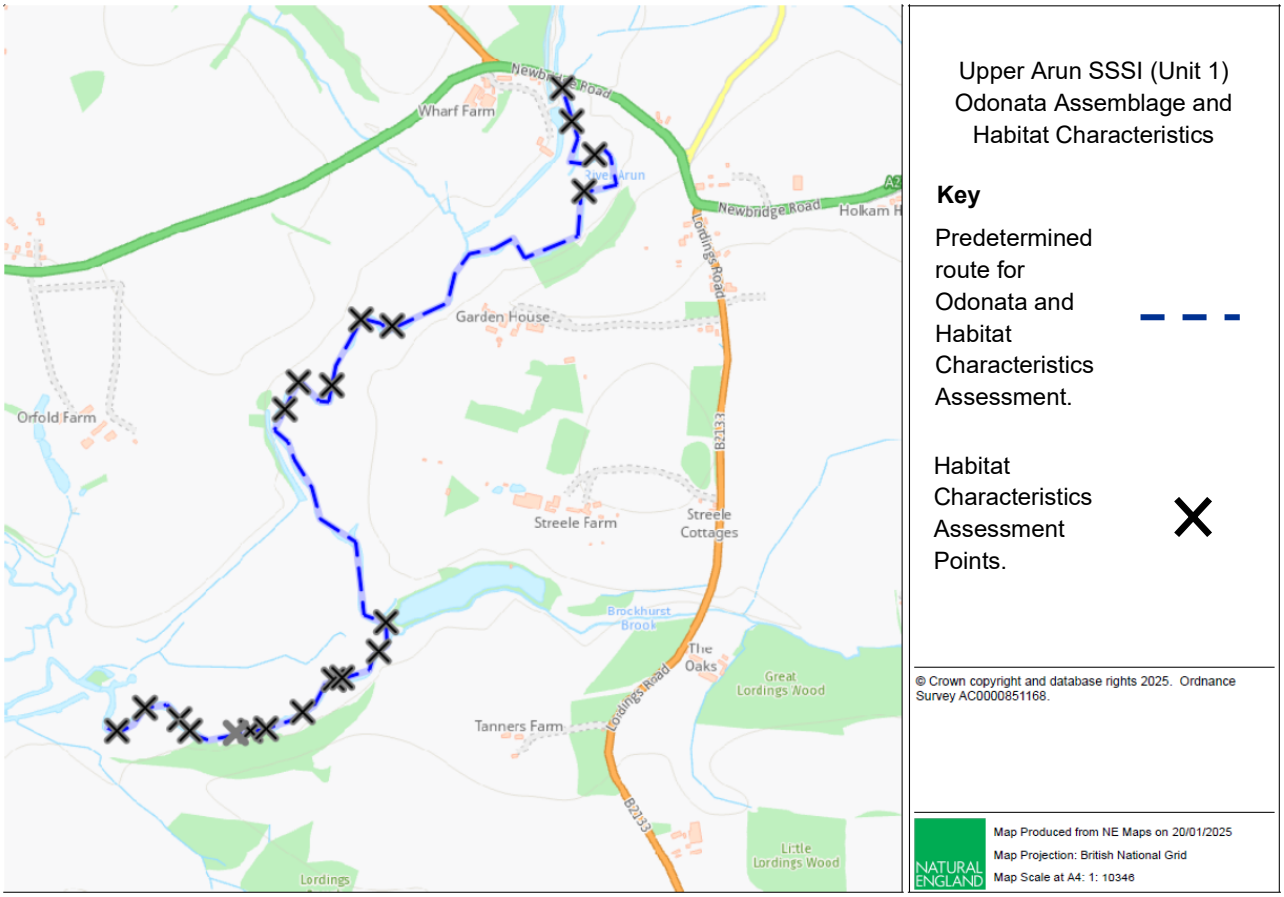


Figure A3.1 Map of Upper Arun SSSI (Unit 1), detailing the predetermined route (Blue line) and approximate sampling locations (Black crosses) used for Odonata Assemblage, and Habitat Characteristics Assessment in the Natural England 2021 Surveys. © Crown copyright and database rights 2025.

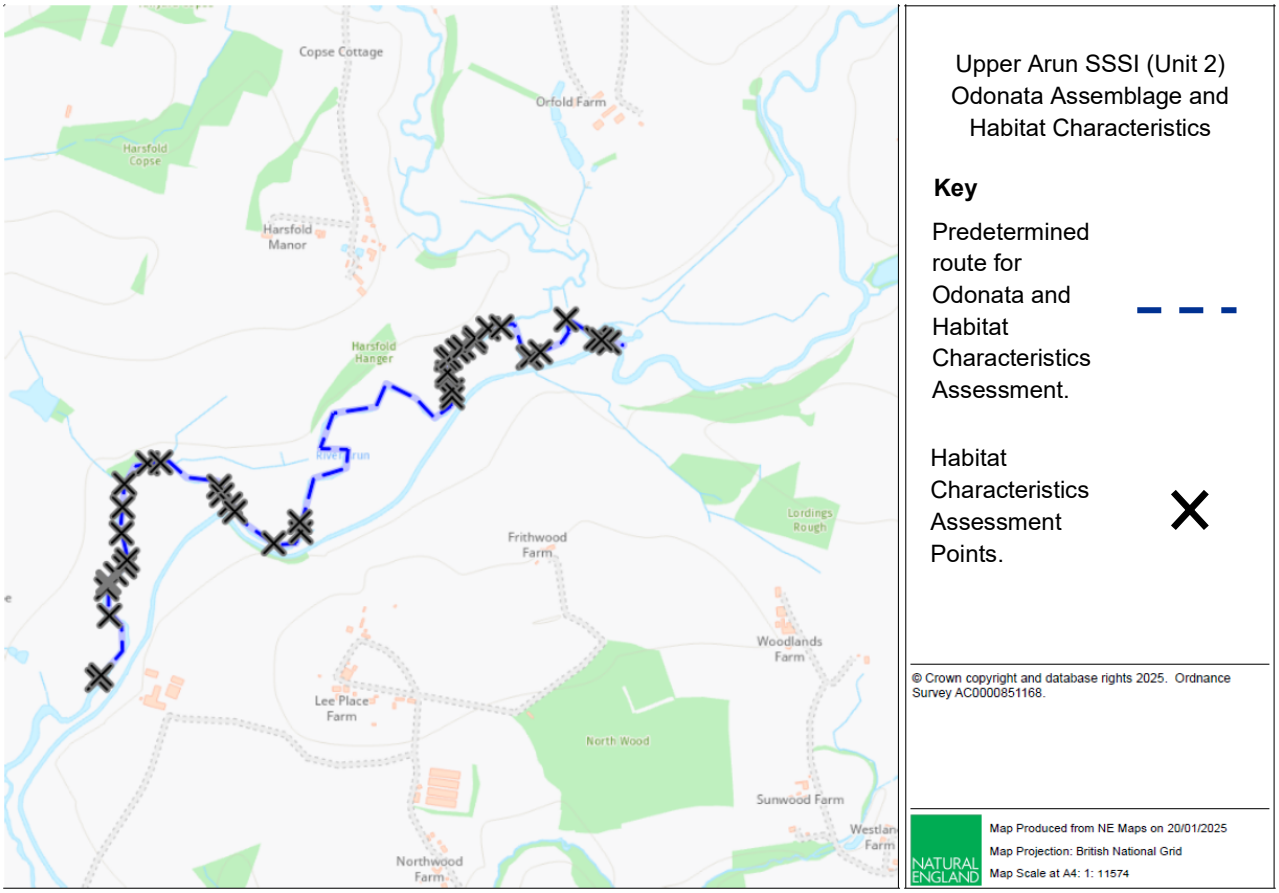


Figure A3.2 Map of Upper Arun SSSI (Unit 2), detailing the predetermined route (Blue line) and approximate sampling locations (Black crosses) used for Odonata Assemblage, and Habitat Characteristics Assessment in the Natural England 2021 Surveys.

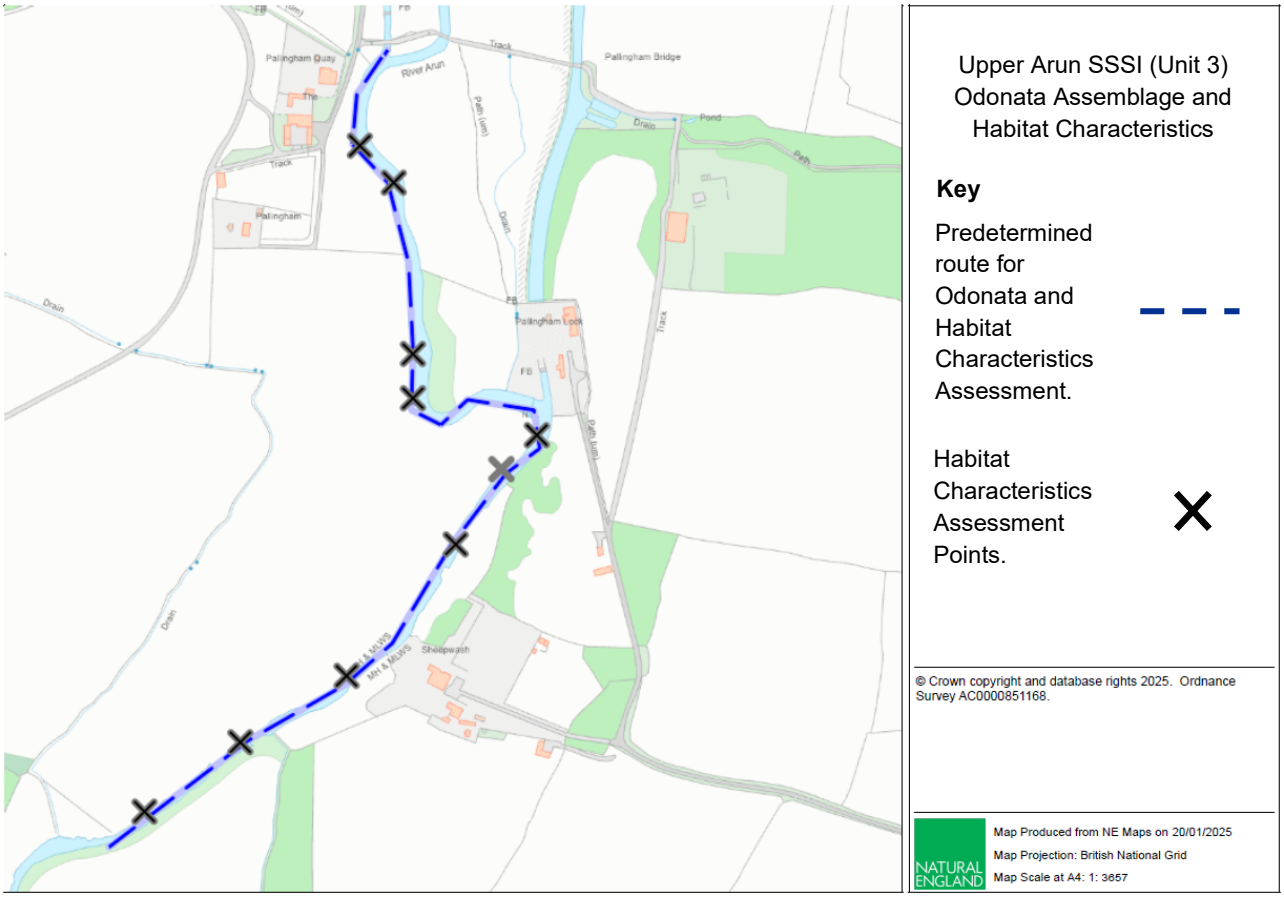


Figure A3.3 Map of Upper Arun SSSI (Unit 3), detailing the predetermined route (Blue line) and approximate sampling locations (Black crosses) used for Odonata Assemblage, and Habitat Characteristics Assessment in the Natural England 2021 Surveys.

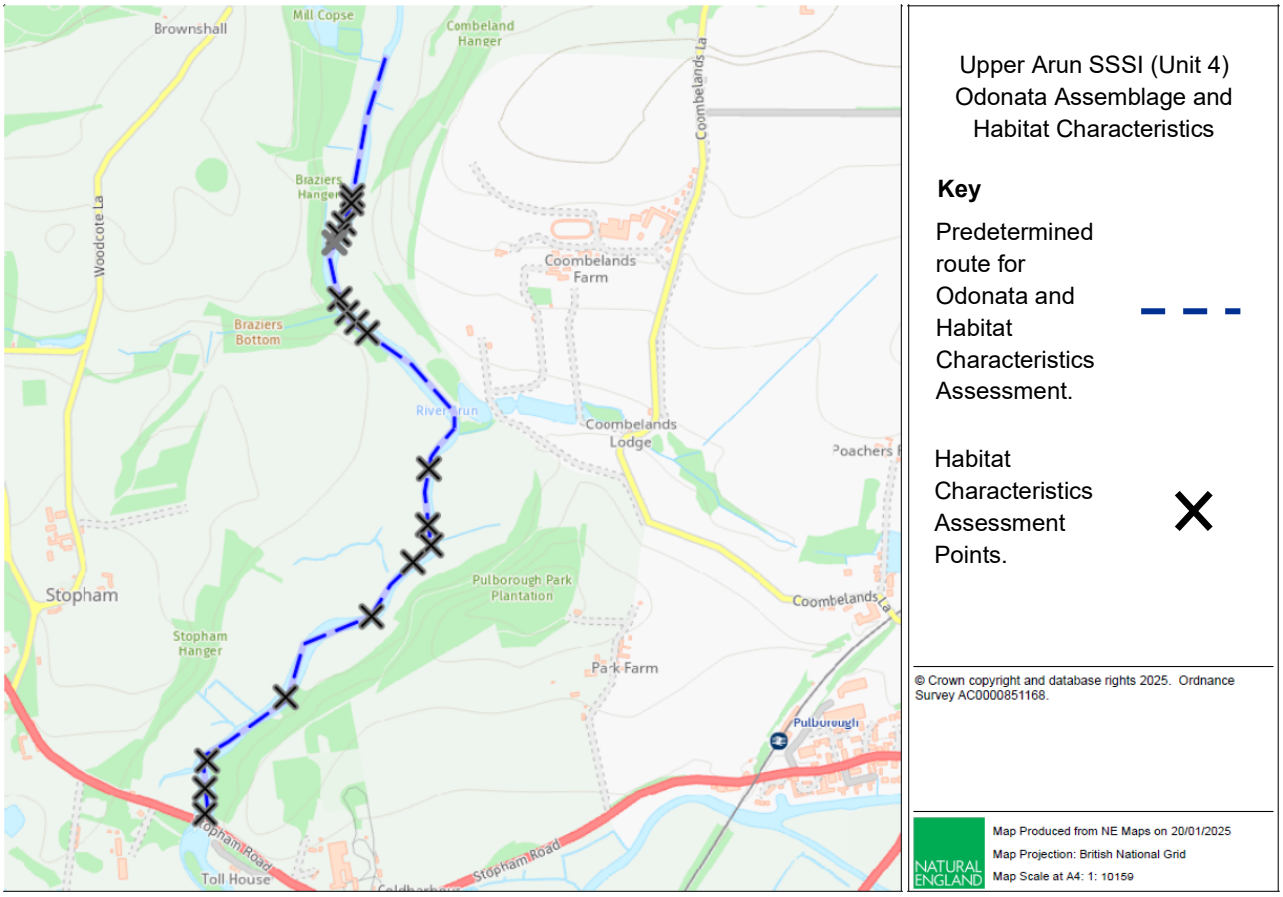


Figure A3.4 Map of Upper Arun SSSI (Unit 4), detailing the predetermined route (Blue line) and approximate sampling locations (Black crosses) used for Odonata Assemblage, and Habitat Characteristics Assessment in the Natural England 2021 Surveys.

Condition Assessment targets.

Table A3.2 Site specific condition assessment targets for the Odonata assemblage feature at Upper Arun SSSI

Attribute	Target
Presence and evidence of breeding	Assess presence of species (as below in number of species row) present and number of species breeding every 6 years. Breeding is taken to be confirmed or inferred if exuviae or larvae are present, newly emerged individuals are sighted, females ovipositing, or both sexes of same species regularly seen.
Number of species	15 species are known to breed in the river at time of notification. It is desirable, but not essential for maintenance of Favourable condition, that the particularly notable species *Libellula fulva*, *Gomphus vulgatissimus*, *Brachytron pratense* and *Somatochlora metallica*, are present.
Larval habitat	No more than 25% reduction in core larval habitat from original baseline. No assessment was made of this feature during notification therefore targets below will be used.
% Cover emergent vegetation	15-40% emergent vegetation.
% Cover submerged vegetation	0-50% submerged vegetation cover.

Attribute	Target
% Water's edge shaded by overhanging trees	Less than 25-30% shade.
Adult foraging habitat Vegetation heterogeneity	Diverse surface topography of vegetation types. Proxy habitat table used: Water bodies – ponds, pools, ditches, reeds, and lakes. Record Structural Recording Surveys (SRS) of 6m radius at a minimum of 10 sample stops Preferred surfaces are: 1) Bare substrate layer, 2) Benthic layer; 3) Water Column layer, 4) Surface layer, 5) Low Emergent, 6) High Emergent layer. Favourable condition: A single surface present in no more than 50% of SRSs. More than 3 different surfaces present in at least 20% of SRSs.
Adult foraging habitat	The presence of negative factors will only fail the unit where they impact on the feature, i.e. dragonfly assemblage. The following negative indicator factors should be considered: • Steeply shelving banks • Deepening of shallow water • Excessive stock access to banks • Eutrophication characterised by algal blooms • Addition of large fish (trout and coarse fish) to otherwise fish-free water • Removal of fallen timber from water • Excessive marginal trees and scrub leading to excess shading >50% if margin

Attribute	Target
	• Aquatic and marginal invasive species

Appendix 4 – Odonata survey methodology and targets: floodplain sites

The methodology for the outstanding Odonata features at the two relevant floodplain sites, Amberley Wild Brooks SSSI and Pulborough Brooks SSSI is split into habitat and number of species.

Habitat attributes

The habitat attributes have been based upon the relevant attributes/features for the ditch features.

Number of species

Data was provided by the RSPB on species lists and numbers from January 2018 to October 2022. This was used to assess the relevant attributes on number of species and the species-specific targets for Amberley Wild Brooks SSSI and Pulborough Brooks SSSI.

Condition Assessment targets.

Amberley Wild Brooks SSSI

Table A4.1 Site specific targets and measures for the outstanding Odonata assemblage feature at Amberley Wild Brooks SSSI.

Attribute	Target
Habitat extent	There should be no reduction in the total length of ditch system in relation to the established baseline greater than 1%. Habitat extent = ca 47,500 m of ditch (estimated from 2000 aerial photograph and most recent OS 1:10,000 map). The outstanding dragonfly assemblage is linked to the ditches, streams, and areas of open water that criss-cross the site for breeding, but many will also forage extensive across surrounding open semi-natural habitat.
Number of species	Minimum of 17 species should be recorded (17 species present at notification). Follow standard Odonata assemblage monitoring guidance - minimum of 2 visits in early and later summer – walk at least 10% of suitable habitat.
Habitat structure: emergent vegetation	Percentage cover emergent vegetation between 15%- 40%.
Habitat structure: submerged vegetation	Percentage cover submerged vegetation 30-50% of the pond.

Attribute	Target
Vegetation heterogeneity: Diverse surface topography of vegetation types	Which surfaces and layers are required critically depends on the successional stage required. Single surface present in no more than 5 out of 10 SRSs. 3 or more different surfaces present in at least 20% of SRSs. Record Structural Recording Surveys (SRS) of 6m radius at sample stops to determine number of structural surfaces and representation of preferred surfaces within the assessed unit. Preferred surfaces for the water margins are: Wet muds, peats or thin water covered substrates. Typically bare, maybe with algal mats, sparse higher plants. Marginal hydrophilic vegetation with typical species including *Lycopus, Scutellaria* etc and grazed grassy vegetation. Possible preferred surfaces for the water margins (depending on fauna and circumstances) include: Young to medium-aged scrub - often maintained by rotational coppice. Typical species include marginal *Salix* spp, *Alnus, Frangula*. Preferred layers for the water body are: A water column layer with typical species including *Ceratophyllum, Calitriche, Myriophyllum, Potamogeton* spp. A water surface layer with typical species including *Nuphar, Nymphaea ,Stratiotes*, crowfoots *Ranunculus* etc, G*lyceria fluitans, Polygonum amphibium.* A low emergent layer with typical species including *Alisma, Ranunculus flammula, Mentha*, etc *Eleocharis*. Possible preferred layers for the water body (depending on fauna and circumstances) include: Benthic layer with typical species including *Chara* spp, *Lobelia, Littorella.*
Presence of negative factors	If a preferred feature is significantly impacted by a negative factor, then the unit should fail. The presence of negative factors on the rest of the unit depends on the level of impact, whether it is increasing/declining, and its location.

Attribute	Target
	Negative indicators for this assemblage include: Steeply shelving banks, deepening of shallow water, excessive stock access to banks, eutrophication characterised by green algal blooms, addition of large fish (trout & coarse fish) to otherwise fish-free water, removal of fallen timber from water, excessive marginal trees and scrub leading to excess shading >50% of margin, aquatic and marginal invasive species - *Azolla, Lemna minuta, Crassula, Hydrocotyle* etc.

Pulborough Brooks SSSI

Table A4.2 Site specific targets and measures for the outstanding Odonata assemblage feature at Pulborough Brooks SSSI. Currently, the outstanding Odonata assemblage feature is not assessed as a monitored interest feature within the MS for this SSSI, it will be added when the specification is revised in the near future as per below (subject to Natural England resources).

Attribute	Target
Habitat extent	There should be no reduction in the total length of ditch system in relation to the established baseline greater than 1%. Habitat extent = ca 47,500 m of ditch (estimated from 2000 aerial photograph and most recent OS 1:10,000 map). The outstanding dragonfly assemblage is linked to the ditches, streams and areas of open water that criss-cross the site for breeding, but many will also forage extensive across surrounding open semi-natural habitat.
Number of species	Minimum of 17 species should be recorded (17 species present at notification). Follow standard Odonata assemblage monitoring guidance - minimum of 2 visits in early and later summer – walk at least 10% of suitable habitat.

Attribute	Target
Habitat structure: emergent vegetation	Percentage cover emergent vegetation between 15%- 40%.
Habitat structure: submerged vegetation	Percentage cover submerged vegetation 30-50% of the pond.
Vegetation heterogeneity: Diverse surface topography of vegetation types	Which surfaces and layers are required critically depends on the successional stage required. Single surface present in no more than 5 out of 10 SRSs. 3 or more different surfaces present in at least 20% of SRSs. Record Structural Recording Surveys (SRS) of 6m radius at sample stops to determine number of structural surfaces and representation of preferred surfaces within the assessed unit. Preferred surfaces for the water margins are: Wet muds, peats or thin water covered substrates. Typically bare, maybe with algal mats, sparse higher plants. Marginal hydrophilic vegetation with typical species including *Lycopus, Scutellaria* etc and grazed grassy vegetation. Possible preferred surfaces for the water margins (depending on fauna and circumstances) include: Young to medium-aged scrub - often maintained by rotational coppice. Typical species include marginal *Salix* spp, *Alnus, Frangula*. Preferred layers for the water body are: A water column layer with typical species including *Ceratophyllum, Calitriche, Myriophyllum, Potamogeton* spp. A water surface layer with typical species including *Nuphar, Nymphaea, Stratiotes*, crowfoots *Ranunculus* etc, G*lyceria fluitans, Polygonum*

Attribute	Target
	amphibium. A low emergent layer with typical species including *Alisma, Ranunculus flammula, Mentha*, etc *Eleocharis*. Possible preferred layers for the water body (depending on fauna and circumstances) include: Benthic layer with typical species including *Chara* spp, *Lobelia, Littorella.*
Presence of negative factors	If a preferred feature is significantly impacted by a negative factor, then the unit should fail. The presence of negative factors on the rest of the unit depends on the level of impact, whether it is increasing/declining, and its location. Negative indicators for this assemblage include: Steeply shelving banks, deepening of shallow water, excessive stock access to banks, eutrophication characterised by green algal blooms, addition of large fish (trout & coarse fish) to otherwise fish-free water, removal of fallen timber from water, excessive marginal trees and scrub leading to excess shading >50% of margin, aquatic and marginal invasive species - *Azolla, Lemna minuta, Crassula, Hydrocotyle* etc.

Table A4.3 Site specific targets and measures for the rare Odonata species *Libellula fulva*, feature at Pulborough Brooks SSSI.

Attribute	Target
Presence/absence	Species should be present. Widespread (Survey records: Requires good water quality, plenty of emergent vegetation: *Phalaris arundinacea*, with lesser growth of Branched Bur-reed *Sparganium erectum* and *Phragmites australis*, plus submerged and floating vegetation.

Attribute	Target
Evidence of breeding	Evidence of breeding. Breeding is taken to be confirmed or inferred if exuviae or larvae are present, newly emerged individuals are sighted, females ovipositing, or both sexes of same species regularly seen.

Table A4.4 Site specific targets and measures for the rare Odonata species *Gomphus vulgatissimus*, feature at Pulborough Brooks SSSI.

Attribute	Target
Presence/absence	Species should be present. Recorded in 2001/2005 from 2007 recorded annually. Particularly sensitive to water quality. Research needed on habitat requirements, little known (British Dragonfly Society).
Evidence of breeding	Evidence of breeding. Breeding is taken to be confirmed or inferred if exuviae or larvae are present, newly emerged individuals are sighted, females ovipositing, or both sexes of same species regularly seen.

Appendix 5 – Invertebrates survey methodology and targets: floodplain sites

The methodology for the invertebrate surveys is based on "Surveying terrestrial and freshwater invertebrates for conservation evaluation(Drake *et al.,* 2007). Some modifications and additions are included, guided by Natural England Invertebrate Specialist, David Heaver.

Invertebrate assemblages are defined as "a suite of species occurring in the same piece of homogenous habitat". Two levels of assemblage type are recognised:

- Broad Assemblage Types (BATs): There are 14 Broad BATs, and these are characterised by species that are more widespread, BATs can be found in a wide range of sites. Their classification reflects environmental factors such as hydrology and disturbance cycles that have an important effect on invertebrate assemblages.
- Specific Assemblage Types (SATs): There are 28 SATs. These are characterised by stenotopic species and are considered to have an intrinsic conservation value, as such they are generally only found in sites with conservation value. SATs are more narrowly defined than BATs and each SAT is nested within a parent BAT.

Table A5.1 Summary of survey requirements for Arun Valley designated sites (revised but based on information from the SSSI MSs and Invertebrate Assemblage CSMG).

Site	Habitat (BAT/SAT)	Target taxa	Survey type
Amberley Wild Brooks SSSI	Ditch habitat *W211 open water on disturbed sediments*	(Aquatic macroinvertebrates) Coleoptera; Heteroptera; Mollusca; Trichoptera; Neuroptera; Odonata	Pond-netting
Amberley Wild Brooks SSSI	Riparian habitat *W314 rich fen*	Diptera; Coleoptera; Heteroptera; Mollusca; Lepidoptera; Odonata; Hymenoptera	Ground searching, sweeping
Amberley Wild Brooks SSSI	Grassland & scrub habitat – F001: *F211 Herb-rich dense sward, F212 Scrub edge* [Note 1]	Coleoptera; Heteroptera; larger Diptera; Aculeates; day-flying Lepidoptera; Orthoptera	Sweeping, spot sweeping, ground searching

Site	Habitat (BAT/SAT)	Target taxa	Survey type
Amberley Wild Brooks SSSI	**Species mentioned in SSSI citation:** *Anisus vorticulus (mollusc), Cordulia aenea (Odonata), Pseudamnicola confusa (mollusc)*		
Pulborough Brooks SSSI	Ditch habitat *W211 open water on disturbed sediments*	(Aquatic macroinvertebrates) Coleoptera; Heteroptera; Mollusca; Trichoptera; Neuroptera; Odonata	Pond-netting
Pulborough Brooks SSSI	Riparian habitat *W314 rich fen, W531 saltmarsh* [Note 2]	Diptera; Coleoptera; Heteroptera; Mollusca; Lepidoptera; Odonata; Hymenoptera	Ground searching, sweeping
Pulborough Brooks SSSI	**Species mentioned in SSSI citation:** *Anisus vorticulus (mollusc), Libellula fulva (Odonata), Gomphus vulgatissimus (Odonata), Coenagrion pulchellum (Odonata), Erythromma najas (Odonata), Rhantus suturalis (Coleoptera), Hydraena Testacea (Coleoptera), Enochrus melanocephalus (Coleoptera) Helochares lividus (Coleoptera),*		

Site	Habitat (BAT/SAT)	Target taxa	Survey type
	Macropis euopaea (Hymenoptera)		
Waltham Brooks SSSI	Ditch habitat	(Aquatic macroinvertebrates) Coleoptera; Heteroptera; Mollusca; Trichoptera; Neuroptera; Odonata	Pond-netting
Waltham Brooks SSSI	Riparian habitat	Diptera; Coleoptera; Heteroptera; Mollusca; Lepidoptera; Odonata; Hymenoptera	Ground searching, sweeping
Waltham Brooks SSSI	**Species mentioned in SSSI citation:** *Pisidium pseudosphaerium (mollusc)*		

Note 1: F211 and F212 are no longer used, there is a cross-cutting scrub-edge SAT F001 – target taxa and sampling type amended for F001.

Note 2: It is questionable whether saltmarsh is relevant on this site and the SAT for this is now M311. The target taxa and sample type are based on W314 which is present.

Note 3: Arun Valley Ramsar site relevant criteria (not updated since 1999): Criterion 2: site holds 7 wetland invertebrates on British Red Data book as threatened and 1 of these is endangered: Psuedamnicola confusa, Sciomyza drymyzina, Anisus vorticulus, Psisdium pseudophaerium, Libellula fulva, Hydrophilus piceus, Paraphotistus nigricornis.

Note 4: Arun Valley SAC qualifying species (updated in 2019): S4056. Anisus vorticulus; Little Whirlpool Ramshorn snail.

Invertebrate BATs / SATs listed in the SSSI MSs assessed in this 2021-23 review.

Mineral marsh and open water assemblages (W21)

This assemblage includes completely aquatic groups (e.g., caddis flies, stoneflies, mayflies) which are diverse at a high taxonomic level. The littoral component is dominated by beetles. Littoral beetles, water bugs and, to a lesser extent, water beetles are best sampled in the spring when the adults are most easily found.

Permanent wet mire (W31)

The choice of taxa within W31 is wide and should include some families of both flies and beetles. Spiders and leaf hoppers are well represented. There are no special considerations for timing a survey of lowland mires and wetlands that do not dry out. They remain productive throughout the summer months.

Grassland and scrub matrix assemblages (F001)

The five big groups (beetles, flies, bugs, aculeates, butterflies and moths) dominate grassland but beetles, bugs (Heteroptera and Auchenorrhyncha) and aculeates are the most important for survey. Spiders, although species-rich, are relatively less important in making an evaluation. It is not practical to expect all these major groups to be surveyed, but a robust evaluation will be possible using any two of the beetles, flies, bugs, and aculeates. The last order will be less useful in herb-poor grasslands. The useful season extends from May to September. The presence of breeding birds on damp meadows may reduce the window of opportunity in Spring.

Sampling Plan

For CSM, a minimum of four samples are required per site (as advised by Natural England invertebrate specialist, David Heaver). A sample is composed of a set of timed captures (a number of “capture events”), under the CSM guidance, for these assemblages this could consist of ground searching, sweeping, and/or pond netting. There is an emphasis that the number of surveys enables the heterogeneity to be represented. For each site the following was required:

- Amberley Wild Brooks SSSI – 8 ditch and riparian habitat sample locations and 2 grassland habitat sample locations
- Pulborough Brooks SSSI – 6 ditch and riparian habitat sample locations
- Waltham Brooks SSSI – 4 ditch and riparian habitat sample locations.

Site Selection

Locations were determined taking into consideration the following:

1. the range of habitats/features present
2. accessibility
3. ownership and access
4. absence of nesting bird features (surveys should be planned, and sites located to avoid nesting birds and disturbance to birds especially in the grassland sites).

Where possible sites were selected that had previously been monitored for consistency and to understand how condition has changed over time. Other data, reports where

invertebrate surveys have been undertaken on the sites were also considered in determining site locations.

Timing

The period through mid-April to mid-June is recommended for the assemblage types that required surveying.

Based on the information set out in Drake *et al.*, (2007), Table A5.2 demonstrates the surveying windows for BAT assemblages indicating months where sampling should occur, based on taxa that the assemblage grouping represents. Question marks are included for W31, depending on whether the site dries during the summer months. If so, then July-September should be avoided.

Table A5.2 Surveying windows for BAT assemblages.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
W21	Unsuitable	Unsuitable	Suitable	Suitable	Suitable	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Unsuitable
W31	Suitable	Suitable	Suitable	Suitable	Suitable	Suitable	?	?	?	Suitable	Suitable	Suitable
F001 (F21)	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Suitable	Suitable	Suitable	Suitable	Suitable	Unsuitable	Unsuitable	Unsuitable
W53	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Suitable	Suitable	Suitable	Suitable	Suitable	Unsuitable	Unsuitable	Unsuitable
Molluscs	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Suitable	Suitable	Unsuitable	Suitable	Suitable	Unsuitable	Unsuitable	Unsuitable

Condition Assessment targets.

Amberley Wild Brooks SSSI

Currently, the SATs listed on the monitoring specification for this site are not up to date. These will be revised in line with updates below in the near future (subject to Natural England resources).

Table A5.3 Site specific targets for the outstanding invertebrate assemblage feature at Amberley Wild Brooks SSSI.

SAT/Attribute	Target
Open water & mineral marsh (W21) **Presence/Absence Score**	Using defined invertebrate sampling protocols thresholds to be met: W21 open water & mineral marsh: SQI score 170 W211 open water on disturbed sediments: Weighted Species Score: 4. Score based on presence/absence of specified proportion of species typical of habitat listed in ISIS. The above has now been superseded where invertebrate data is now analysed through Pantheon (developed by Natural England). This software analyses the data and determines condition status against the SATs.
Permanent wet mire, fen & seepage (W31) **Presence/Absence Score**	Using defined invertebrate sampling protocols, thresholds to be met: W31 permanent wet mire & seepage: SQI score 160 W314 rich fen: Weighted Species Score: 10 Score based on presence/absence of specified proportion of species typical of habitat listed in ISIS. The above has now been superseded where invertebrate data is now analysed through Pantheon (developed by Natural England). This software analyses the data and determines condition status against the SATs.

SAT/Attribute	Target
Grassland & scrub matrix (F001) **Presence/Absence Score**	Using defined invertebrate sampling protocols thresholds to be met: F21 grassland & scrub matrix (now known as F001 grassland & scrub matrix): SQI score 160. Score based on presence/absence of specified proportion of species typical of habitat listed in ISIS. The above has now been superseded where invertebrate data is now analysed through Pantheon (developed by Natural England). This software analyses the data and determines condition status against the SATs.
Habitat extent for all SATs	No net loss of greater than 5% of 314 hectares (ha) of fen marsh and swamp and grassland, no increase of these open communities beyond 317 ha. Habitat extent = circa 314 ha of fen, marsh, swamp and grassland (estimated from the 2000 aerial photograph together with 2006 National Vegetation Classification survey (NVC)). This assessment has been based on the new agreed condition status for the habitat extent attribute for the relevant supporting habitats for these species; ditch systems (also a designated feature for this site) and lowland neutral grassland. Aerial photography (compared between 2001 and 2022) has been used to assess this target.
Vegetation heterogeneity **Diverse surface topography** **W21, W31, F001**	W21 and W31, Favourable condition: A single surface present in no more than 5 out of 10 Structural Recording Surveys (SRSs). More than 3 different Surfaces present in at least 20% of SRSs. Preferred surfaces for this site are: Surface 2: Benthic layer: eg Chara spp. Surface 3: Water column layer: eg Ceratophyllum, Callitriche, Myriophyllum, Potamogeton spp. Etc. Surface 4: Water surface layer: eg Hydrocharis, Stratiotes, Ranunculus, Apium, Persicaria, Glyceria fluitans etc. Surface 5: Low emergent layer: eg Alisma, Mentha, Ranunculus flammula etc. Surface 6: High emergent layer: eg Sparganium, Phragmites, Typha, Glyceria maxima, Phalaris etc.

SAT/Attribute	Target
	Ditch sides (variety of ditch form) should not all be steep but have 1-10% cattle-poached shallow ‘berms'. F001 Favourable condition: Single FES present in no more than 50% of untargeted Structural Recording Surveys (SRSs). 3+ different FES present in at least 20% of untargeted SRS. Preferred surface 1 present in 20% of untargeted SRS (see below for scrub target). Preferred surface 5 present in 5-10% of untargeted SRS. Preferred surfaces for this site - determined from assemblage types: 1. bare ground/sparse lichen/bryophyte cover, 2. short swards grass & herb, 3. longer sward grass & herb, 5. young scrub. Preferred features: South facing scrub margins, preferably of flowering shrub species. Open gaps within scrub.
Dead organic matter: litter	F21 grassland & scrub matrix (now known as F001 grassland & scrub matrix): Total extent no more than 25% of the unit sward. Record cover of litter where in a more or less continuous layer, distributed either in patches or in one larger area. If the entire litter resource is lost at any one time, then the habitat may be considered Unfavourable.
Nectar sources	F21 field assemblages (now known as F001 grassland & scrub matrix): At least 40% of the unit sward area can flower in the season. Visual estimate of the presence of flowering species across the unit + assessment of their likelihood to flower. This includes all the forbs and grasses though the latter should not dominate the sward and so be recorded as favourable in the absence of forbs and would include shrubs such as hawthorn but not the trees such as Ash or Oak.

SAT/Attribute	Target
Seed heads	F21 field assemblages (now known as F001 grassland & scrub matrix): Unit surface area with 15% or more with seed heads persisting over winter. Record the cover of seed heads in winter or assess the likelihood of target being met from summer visit and knowledge of current management practices. The seed head resource is a proxy measure for a whole range of structural attributes, including the seed heads themselves, the range of stem heights and diameters (some being hollow), the litter of the previous season, attached dried curled leaves etc.

Pulborough Brooks SSSI

Currently, the SATs listed on the monitoring specification for this site are not up to date. These will be revised in line with updates below in the near future (subject to Natural England resources).

Table A5.4 Site specific targets for the outstanding invertebrate assemblage feature at Pulborough Brooks SSSI.

SAT/Attribute	Target
Open water & mineral marsh (W21) **Presence/Absence score**	Using defined invertebrate sampling protocols thresholds to be met: W21 open water & mineral marsh: SQI score 170 W211 open water on disturbed sediments: Weighted Species Score: 4 Score based on presence/absence of specified proportion of species typical of habitat listed in ISIS. The above has now been superseded where invertebrate data is now analysed through Pantheon - developed by Natural England. This software analyses the data and determines condition status against the SATs.

SAT/Attribute	Target
Permanent wet mire, fen & seepage (W31) **Presence/Absence score**	Using defined invertebrate sampling protocols thresholds to be met: W31 permanent wet mire: SQI score 160 W314 rich fen: Weighted Species Score: 10 Score based on presence/absence of specified proportion of species typical of habitat listed in ISIS. The above has now been superseded where invertebrate data is now analysed through Pantheon - developed by Natural England. This software analyses the data and determines condition status against the SATs.
Habitat extent	Maintain the area of ditch systems that support invertebrate and Vascular Plant Assemblage - No reduction in length of ditches and any consequent fragmentation greater than 1%. This assessment has been based on the new agreed condition status for the habitat extent attribute for the relevant supporting habitat for these species (that is also a designated feature of the site); ditch systems. Aerial photography (compared between 2001 and 2022) has been used to assess this target.
W21 **Vegetation heterogeneity** **Diverse surface topography**	W211 open water on disturbed sediments: Weighted Species Score: 4. 3+ different surfaces present in at least 20% of SRSs single surface present in no more than 50% of SRSs. Layer 1: bare substrate (mud), Layer 2: Benthic layer, Layer 3: water column, Layer 4: Water surface layer, Layer 5: low emergent, Layer 6: High emergent. Required: *Anisus*: At least 10% of the ditches surveyed should support up to 50% floating/submerged and up to 50% emergent. Odonata: Good benthic vegetation structure, Complex structure of submerged vegetation, areas with high proportion of macrophytes with floating leaves.

SAT/Attribute	Target
	Emergents with abundant flowers, small patches of marginal scrub or trees, Fallen wood in the water, Areas of bare wet sediment. The SRS should proportionally represent these features.
W31 **Vegetation heterogeneity** **Diverse surface topography**	W314 rich fen: Weighted Species Score: 10. 3+ different surfaces present in at least 20% of SRSs single surface present in no more than 50% of SRSs. Layer 1: bare substrate (mud), Layer 2: Benthic layer, Layer 3: water column, Layer 4: Water surface layer, Layer 5: low emergent, Layer 6: High emergent. Required:*Anisus*: At least 10% of the ditches surveyed should support up to 50% floating/submerged and up to 50% emergent. Odonata: Good benthic vegetation structure, Complex structure of submerged vegetation, Areas with high proportion of macrophytes with floating leaves.

Appendix 6 – Ornithological survey methodology and targets: floodplain sites

Habitat extent attributes were assessed using aerial images. Aerial images as close to the date of notification as possible were used to compare against the current aerial imagery. Where there were no obvious signs of major habitat changes or decline, including no sign of woodland increase and encroachment on open wetland bird feeding areas, this was deemed as Favourable.

Wintering birds

Assessments of non-breeding bird features have been based predominately on Wetland Bird Survey (WeBS) data, supplied by the British Trust for Ornithology (BTO). WeBS is a partnership project, jointly funded by the BTO, RSPB and JNCC, with fieldwork conducted by volunteers.

The number of species of wintering birds was assessed using BTO BirdTrack data provided by Sussex Ornithological Society. Species counted towards the total number of species present if they were recorded during November to February.

Individual species analysis was based off BTO WeBS data, 5 year peak means (defined as the sum of the annual maximum counts in each of the last five years divided by five) have been used to represent the species number and compared with targets set in Natural England's MS documents for each of these bird features. Where available the 5-year peak mean from time of site designation have also been included.

Assessments for 'variety of wintering birds' features have also involved reviewing data from land managers for the sites (where it has been deemed CSMG compliant).

Breeding birds

Assessments for breeding bird features have involved reviewing data from land managers for the sites as well as reliable records from external organisations such as iRecord and Sussex Biodiversity Records centre.

Within the report the data sources are provided.

Condition Assessment targets.

Amberley Wild Brooks SSSI

Wintering birds

Table A6.1 Amberley Wild Brooks condition assessment table of the aggregations of wintering birds feature based on 2021 surveys.

Feature	Attribute	Target
Variety of wintering species	Habitat extent	Extent of all habitats used by the feature should be maintained - losses of 5% or more of any relevant habitat type unacceptable. Habitat extent = circa 327 ha of fen, marsh, swamp, grassland and woodland i.e. the whole site (estimated from the 2000 aerial photograph together with 2006 National Vegetation Classification survey). It is not considered necessary to differentiate habitats required by the wintering bird and breeding bird assemblages beyond the broad habitat types namely woodland, grassland, fen, marsh, swamp and open water. However, as all these habitats are considered

Feature	Attribute	Target
		important, the total area for this attribute also equals the total SSSI area.
Variety of wintering species	Number of species	Maintain diversity of wintering bird assemblage: 102 If the number of wintering species falls by 25% or more then the feature is in Unfavourable condition (winter is November to February). 102 wintering species at notification. Therefore, if species number falls below 76 it will be Unfavourable. 102 species of wintering bird recorded at notification (1984). Record presence/absence of all species. [note 1]
Shoveler, *Spatula clypeata*	Population	Maintain population within acceptable limits for Shoveler. Based on the known natural fluctuations of the population in the site, maintain the population at or above the minimum for the site. Where the limits of natural fluctuations are not known, maintain the population above 75% of that at designation - loss of 25% or more unacceptable. Therefore, any drop below the following minimum 5-year peak means are unacceptable. The baseline from time

Feature	Attribute	Target
		of notification is 38 and so the threshold for favourable condition is 29. [note 1]
Teal, *Anas crecca*	Population	Maintain population within acceptable limits for Teal. Based on the known natural fluctuations of the population in the site, maintain the population at or above the minimum for the site. Where the limits of natural fluctuations are not known, maintain the population above 75% of that at designation - loss of 25% or more unacceptable. Therefore, any drop below the following minimum 5-year peak means are unacceptable: Teal = 382. [note 1] 5-year peak mean from WeBS data (monthly counts) at time of SSSI notification (1983): Teal = 508.
Bewick's swan, *Cygnus columbianus bewickii*	Population	Maintain population within acceptable limits for Bewick's Swans. Based on the known natural fluctuations of the population in the site, maintain the population at or above the minimum for the site. Where the limits of natural fluctuations are not known, maintain the population above 75% of that at designation - loss of 25% or more

Feature	Attribute	Target
		unacceptable. Therefore, any drop below the following minimum 5-year peak means are unacceptable: Bewick's swan = 38/87, the two numbers are for the threshold of favourable condition for the SSSI and whole SPA, respectively. [note 1] 5-year peak mean from WeBS data (monthly counts) at time of SSSI notification (1983): Bewick's swan = 50, 5-year peak mean from WeBS data at time of SPA notification (1992 - 97): Bewick's swan = 115.

Note 1: Population targets for this feature were amended during revision of the FCT (Circa 2011) and as such are more stringent than those stated within CSMG.

Breeding birds

Table A6.2 Amberley Wild Brooks condition assessment table of the aggregations of breeding birds feature based on 2021 surveys.

Feature	Attribute	Target
Assemblages of breeding birds - Mixed: Lowland damp grassland, Woodland	Number of species	Maintain diversity of breeding bird assemblage (woodland/grassland): If the total score calculated for a breeding bird assemblage falls by the equivalent of 25% or more in points, then the assemblage is in Unfavourable condition. Absolute

		minimum required is 33 but based on new threshold should be 42. When the site was notified in 1984, the figure required was 40, and the total score was 43. Amendments to bird scoring system requires a score of 55 to qualify using the combined requirements for damp grassland (16) and woodland (39). [note 1]
Redshank, *Tringa totanus*	Habitat extent	No increases in area of these open communities beyond 317 ha. Habitat extent = ca314 ha of fen, marsh, swamp and grassland (estimated from the 2000 aerial photograph together with 2006 National Vegetation Classification survey). Redshank: 1% breeding population - No net loss greater than 5%.
Redshank, *Tringa totanus*	Population	Maintain population within acceptable limits. Based on the known natural fluctuations of the population on the site, maintain the population at or above the minimum for the site. Where the limits of natural fluctuations are not known, maintain the population above 75% of that at designation - loss of 25% or more unacceptable. Baseline population at time

		of notification was 22 pairs, therefore, 16 pairs or more is Favourable [note 1].

Note 1: Population targets for this feature were amended during revision of the FCT (Circa 2011) and as such are more stringent than those stated within CSMG.

Pulborough Brooks SSSI

Wintering birds

Table A6.3 Pulborough Brooks condition assessment table of the aggregations of wintering birds feature based on 2021 surveys.

Feature	Attribute	Target
Shoveler, *Spatula clypeata*	Population	Based on the known natural fluctuations of the population at this site, maintain the population using the lowest annual figure immediately prior to designation. If current population falls below this level (using 5-year mean counts, lowest annual figure) consider Unfavourable. Bird population size: 5-year peak mean lowest figure from WeBS data for the SSSI (1993-1997) Shoveler 140, WeBS data for the SPA (1993-1997) 154.
Wigeon, *Mareca penelope*	Population	Based on the known natural fluctuations of the population at this site, maintain the

Feature	Attribute	Target
		population using the lowest annual figure immediately prior to designation: If current population falls below this level (using 5-year mean counts, lowest annual figure) consider Unfavourable. Bird population size: 5-year peak mean from WeBS data for the SSSI (1993-1997) Wigeon 2255 WeBS data for the SPA (1993-1997) 3355.
Teal, *Anas crecca*	Population	Based on the known natural fluctuations of the population at this site, maintain the population using the lowest annual figure immediately prior to designation: lowest annual figure from 5-year WeBS data (1993-1997) (using 5-year mean counts, lowest annual figure) consider Unfavourable. Bird population size: 5-year peak mean from WeBS data for the SSSI (1993-1997) Teal 425. WeBS data for the SPA (1993-1997) 655.

Feature	Attribute	Target
Ruff, *Calidris pugnax*	Population	Based on the known natural fluctuations of the population at this site, maintain the population using the lowest annual figure immediately prior to designation: lowest annual figure from 5-year WeBS data (1993-1997) (using 5-year mean counts, lowest annual figure) consider Unfavourable. Bird population size: 5-year peak mean from WeBS data for the SSSI (1993-1997) Ruff 39.
Pintail, *Anas acuta*	Population	Based on the known natural fluctuations of the population at this site, maintain the population using the lowest annual figure immediately prior to designation: lowest annual figure from 5-year WeBS data (1993-1997) (using 5-year mean counts, lowest annual figure) consider Unfavourable. Bird population size: 5-year peak mean from WeBS data for the SSSI (1993-1997) Pintail = 166. WeBS data for the SPA (1993-1997) 221.

Feature	Attribute	Target
Bewick's swan, *Cygnus columbianus bewickii*	Population	Based on the known natural fluctuations of the population at this site, maintain the population using the lowest annual figure immediately prior to designation: lowest annual figure from 5-year WeBS data (1993-1997) (using 5-year mean counts, lowest annual figure) consider Unfavourable. Monthly WeBS counts – 5-year peak mean for SSSI. Bird population size prior to notification: 1993-1998 peak mean of 52, SPA 115.

Breeding birds

Table A6.4 Pulborough Brooks condition assessment table of the aggregations of breeding birds feature based on 2021 surveys.

Feature	Attribute	Target
Assemblages of breeding birds - Lowland damp grasslands	Presence/absence of breeding species	Maintain assemblage diversity: If the total score calculated for the breeding bird assemblage falls by the equivalent of 25% or more in points, then the assemblage is

Feature	Attribute	Target
		in Unfavourable condition. The index score at designation: 16. [note 1] Assemblage score (BTO index) [features qualifying under criterion 3.5 only] Please refer to annex for species list. Includes: Mute Swan, Shelduck, Gadwall, Teal, Garganey, Shoveler, Quail, Lapwing, Snipe, Redshank, Yellow Wagtail, Sedge Warbler, and Reed bunting, barn owl. Breeding must be confirmed as proven or probable. Data on rare and common species will be needed. Particularly notable species in the breeding assemblage include snipe, redshank, gadwall, shoveler, but it is not essential for Favourable condition for these species to be confirmed as present.

Note 1: Population targets for this feature were amended during revision of the FCT (Circa 2011) and as such are more stringent than those stated within CSMG.

Waltham Brooks SSSI

Wintering birds

Table A6.5 Waltham Brooks condition assessment table of the aggregations of wintering birds feature based on 2021 surveys.

Feature	Attribute	Target
Bewick's swan, *Cygnus columbianus bewickii*	Population	SSSI target: Based on the known natural fluctuations of the population at this site, maintain the population using the lowest count from the 5-year mean figure prior to notification. SSSI data: 1984/85 to 1988/89 5-year peak mean (WeBS) = 119 individuals across SSSI SPA data: 1992-97 5-year peak mean (WeBS) = 115 individuals.
Shoveler, *Spatula clypeata*	Population	Wintering population of Shoveler - SSSI target: maintain the population above 42 individuals across SSSI (50% of that at designation) - loss of 50% or more unacceptable. SSSI data: 1984/85 to 1988/89 5-year peak mean (WeBS) = 83 individuals across SSSI.
Teal, *Anas crecca*	Population	Wintering population of Teal - SSSI target: Maintain the population above 247 individuals across SSSI (50% of that at designation) - loss of 50% or more unacceptable. SSSI data: 1984/85 to 1988/89 5-year peak mean (WeBS) = 494 individuals across SSSI.

Breeding birds

Table A6.6 Waltham Brooks condition assessment table of the aggregations of breeding birds feature based on 2021 surveys.

Feature	Attribute	Target
Assemblages of breeding	Number of species	SSSI target: Maintain assemblage diversity across SSSI: If the total score calculated for a breeding bird assemblage falls by the equivalent of 25% or more in points, then the

birds - Lowland damp grasslands		assemblage is in Unfavourable condition. Score at notification = 23. Therefore, a score of 17 or below is Unfavourable. SSSI data: score at notification: = 23. [note 1] Assemblage at designation included: mute swan, mallard, shelduck, snipe, redshank, cuckoo, grasshopper warbler, reed warbler, moorhen, lapwing, carrion crow, sedge warbler, yellow wagtail, reed bunting.

Note 1: Population targets for this feature were amended during revision of the FCT (Circa 2011) and as such are more stringent than those stated within CSMG.

Appendix 7 – Ditch survey methodology and targets: floodplain sites

Recent data on ditch flora and structure was one of the significant evidence gaps identified. There are seven habitat attributes defined within the CSMG for ditches, which are to be used to determine whether the site is in Favourable condition. The historical data available from the statutory environmental protection agencies and landowner concerns both suggest water quality/pollution problems within the designated sites at Arun Valley. Due to this and to ensure there is sufficient data to assess whether CSMG nutrient targets are being met, water chemistry was assessed this time.

As the southern part of the designated sites (Amberley Wild Brooks SSSI) is potentially exposed to saline intrusion, the salinity gradient was also considered. Water quality monitoring was undertaken (in 2021-22) through a collaborative project across Natural England, Sussex Wildlife Trust, RSPB, Environment Agency, and private landowners to provide water chemistry data for the condition assessment of these three SSSIs (see Appendix 10 on water quality monitoring for survey methods and maps of the water quality sample locations). Additional water chemistry data was collected during the ditch surveys where possible (limited equipment available).

Indicators of local distinctiveness were assessed where this is a distinct feature of the site – in this case, as the Vascular Plant Assemblage is an important aspect of Amberley Wild Brooks, Waltham Brooks and Pulborough Brooks SSSIs with numerous rare species noted at designation, rare plant vegetation surveys were required.

The 7 attributes assessed:

- Extent of the ditch feature
- Habitat functioning: ditch water depth
- Habitat functioning: water quality:
    - Water clarity
    - Algal dominance
    - Water chemistry including salinity (conductivity)
- Habitat structure:
    - Channel form
    - Extent and composition of in-channel vegetation
    - Extent and composition of bankside vegetation
- Aquatic vegetation composition: native species richness
- Indicators of negative change:
    - introduced/non-native plants
    - botanical indicators (presence of saline-tolerant aquatic plant species)
- Indicators of local distinctiveness:
    - Botanical indicators (presence of plant communities)
    - Presence of rare species and quality indicators (including population size, extent, and successful regeneration of notified plant species).

Timing and sampling

Sampling was carried out between mid-June and late August 2021, ideally during the same month. Sampling occurred before cutting or took place a few weeks afterwards to give the vegetation time to recover.

The last monitoring visit by Natural England surveying ditches was 2016 on Amberley Wild Brooks, 2012 on Pulborough Brooks and 2004 on Waltham Brooks.

Normally, limited amount of taxonomic expertise is required for monitoring ditch vegetation, however the Arun Valley designated sites are known to have very rich diverse flora and fauna (including many internationally and Nationally Rare species) due to the variation in geology, soils, and water supply. Vascular plants were identified to species level where possible, but where this was difficult, in some cases genus level may be sufficient. In many cases species ID is important e.g., *Potamogeton* and Duckweed species. The surveys were therefore led by experienced Natural England staff with support from local botanists and ecologists. Where there were occasions where ID was not possible, samples were taken and labelled for later identification.

Survey methods.

The assessment was completed using a mix of structured site walks and fixed-point sampling. See Table A7.1 for a summary of methodology used to assess the mix of sampling.

Fixed point sampling 20m ditch lengths

Vegetation sampling units were representative of 20m lengths of ditch in mid or late succession (20m was chosen as this can be viewed in detail from one spot and is easily estimated).

Number of sampling points was between 5-10 per ditch depending on ditch length and heterogeneity. Licenses were not required as the survey was not specifically targeting/removing Schedule 8 species.

Method:

- Sampling site should be photographed.
- Grapnel is thrown into ditch.
- Plants retrieved are identified (aquatic and riparian/emergent species found in and within banks of ditches) and recorded using DAFOR scale of abundance. As per method in the structured site walk continue to record notified plant species.
- Steps 2 and 3 are repeated until no additional species are found.
- Emergent and floating plants observed in the 20 m length of ditch that are visible but not captured by the grapnel should also be identified and recorded.

Structured site walk

The route should make note of features including:

- Depth gauges
- Inflow and outflow points
- Populations of characteristic of the side
- Uncommon plant communities
- All the vegetation sampling sites.

The structured walk should be divided into sub-sections of approximate equal length, with a review point at the end of each (the recording form should be filled in at each review point). Then, the overall result is obtained by combining the results of all the subsections.

Table A7.1 Details on how each attribute was assessed during the structured walk.

Attribute	Method of assessment
Extent of the ditch feature	Note any changes caused by active management, e.g., infilling or channel diversion. This does not include drying out or successional change.
Habitat functioning: ditch water depth	During the walk, water levels should be recorded using existing gauges and/or graduated poles.
Habitat functioning: water quality – clarity	Note unnatural turbidity or discoloration of water. For each sub-section record % length (to the nearest 5%) with: • Clear water (ditch bottom is visible) • Slight turbidity/coloration (50cm vegetation visible) • Marked turbidity/coloration (<15cm of stick end can be seen).
Habitat functioning: water quality – extent of algal dominance	For each subsection estimate cover of the channel (to the nearest 5%) by filamentous algae and *Entermorpha* species (combined). Result will be mean cover of subsections.
Habitat functioning: water quality – water chemistry	Total phosphorous – not applicable for this site as there is a separate survey taking place. Take water chemistry measurements with equipment if available (phosphate, nitrate, ammonia, dissolved oxygen, temperature, salinity/conductivity, and pH).
Habitat structure: channel form	During structured walk, note % (to nearest 5%) of the subsection that is trapezoidal and non-trapezoidal in cross-section. Result will be mean of %.

Attribute	Method of assessment
Habitat structure: extent/composition of in-channel vegetation	For each subsection, record % of channel length (to nearest 5%) in early, mid and late successional stages. Result will be a mean.
Habitat structure: composition of bankside vegetation	For each subsection, record the % (to the nearest 5%) of the channel length that is heavily shaded (over 50% of channel surface overhung) by coarse ruderal vegetation, scrub or hedges. The result is the mean of subsections.
Indicators of negative change: introduction of or natural colonisation of non-native plants	For each sub-section, estimate abundance of non-native or introduced aquatic plant species: • for each of the 4 most invasive non-native species - *Azolla* spp*, Crassula helmsii, Hydrocotyle ranunculoides* and *Myriophyllum aquaticum (*to nearest 5%) • combined cover of all non-natives and introduced species (to nearest 5%). A grapnel may be needed for this.
Indicators of negative change: salinity gradient	Botanical indicators – within the 20m length, record the presence of saline-tolerant aquatic plant species such as *Boldoschoemus maritimus, Ceratophyllum submersum, Myriophylum spicatum, Potamogeton pectinatus, Potamogeton pusillus, Ranunculus baudotti, Ruppia* spp*., Schoenoplectus tabernaemontani, Typha angustifolia, Zannichellia paulustris* and some *Chara* spp*.* All listed except *Ruppia* spp and *B. maritimus* may also occur in eutrophic freshwater.
Indicators of local distinctiveness: rare species and quality indicators	Record for each sub-section of the structured walk the presence of rare aquatic plant species and other species/communities chosen as quality indicators for each site including: *Leersia oryzoides, Carex vulpina, Potamogeton acutifolius, Oenanthe silaifolia, Sium latifolium, Polygonum minus, Thelypteris palustris.* If possible, record condition of the population, and the extent of flowering.

Sampling locations

Site selection

Route of the structured walk should be fixed and closely follow the ditches and should cover at least 10% of the total channel length on the site. However, Natural England national specialist confirmed that this does not have to be the case where the site is so large that 10% would be cumbersome. Instead, emphasis should be made on ensuring that the sites selected are representative of the biodiversity and variation of the site. Such variation includes:

- Salinity gradients
- Major and subsidiary channels
- Different soil types
- Areas with different ditch management regimes
- Grazed and un-grazed areas
- A range of successional stages in the ditch systems

The estimated total length of ditches at each site:

1. Amberley Wild Brooks SSSI = 47,500m (across approx. 240 ditches). Estimated to survey 20-25 ditches. 30 ditches were surveyed.
2. Pulborough Brooks SSSI = 15,700m (across approx. 94 ditches). Estimated to survey between 10-15 ditches. 19 ditches were surveyed.
3. Waltham Brooks SSSI = 1,450m (across approx. 10 ditches). Estimated to survey between 5-10 ditches. 10 ditches were surveyed.

Sampling locations were considered based on locations where surveys of ditches, vascular plant and aquatic invertebrate have been done in the past, the invertebrate surveys being undertaken in the same year, water quality monitoring sites past and present and any other relevant historical species records/data.

Ditch sites are shown in the following map (Figure A7.1). The numbering of ditches within the maps are purely for the purposes of ensuring survey teams could distinguish ditch sites to survey, as multiple teams were out on the same days. Sites have been chosen from previous surveys (in some case numerous different numbering systems have been used), the comparable ditch numbers were made clear in maps. As above, sites were primarily chosen to overlap with previous ditch survey sites and locations where rare plants were found.

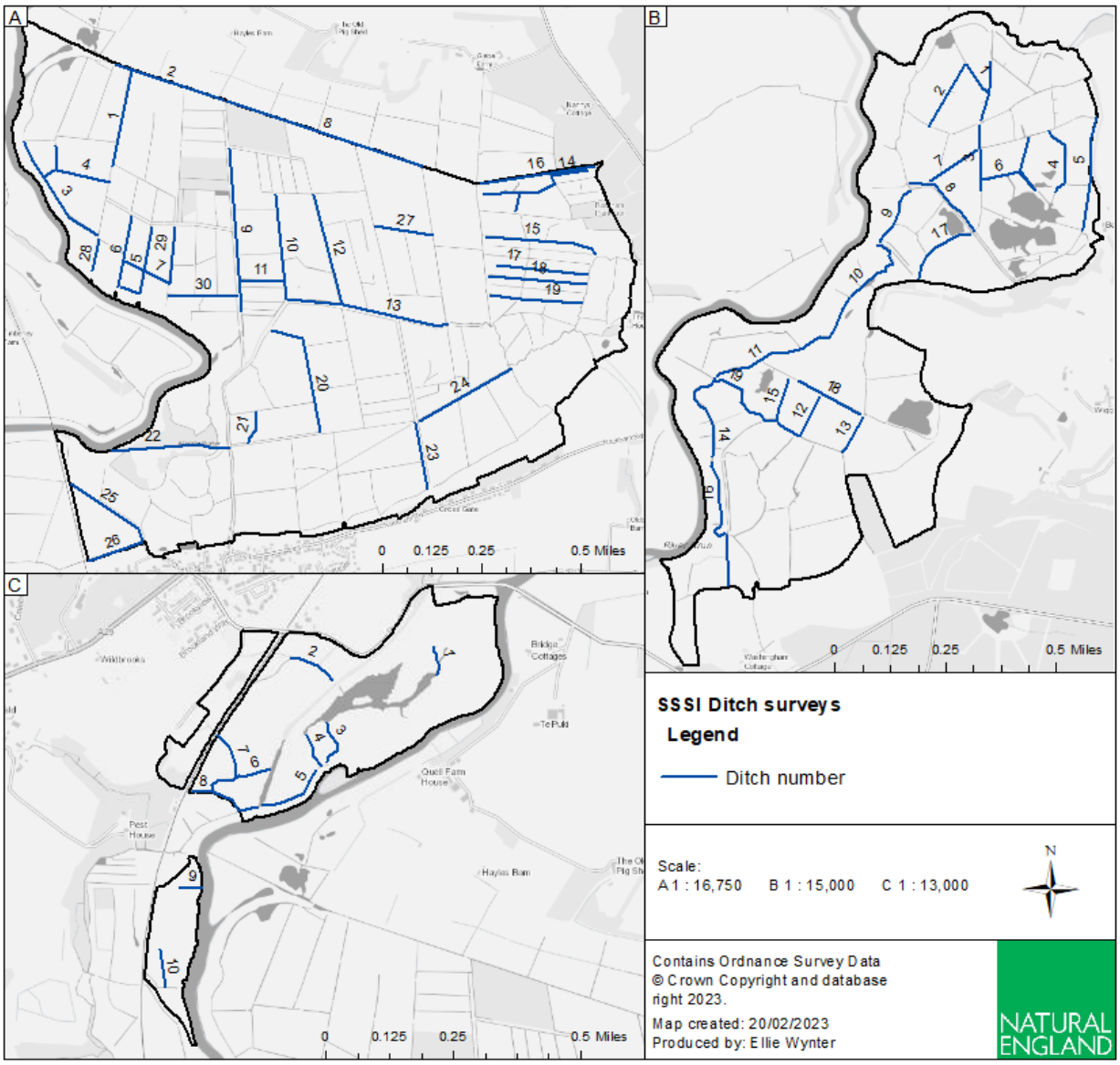


Figure A7.1 Map of Arun Valley designated sites (A: Amberley Wild Brooks SSSI, B: Pulborough Brooks SSSI; C: Waltham Brooks SSSI), detailing the ditches (Blue lines) and assigned ditch numbers (1 – 29) as assessed in the NE 2021 surveys.

Condition Assessment targets.

Amberley Wild Brooks SSSI

Table A7.2 Site specific targets and measures for the ditch systems feature at Amberley Wild Brooks SSSI.

Attribute/Feature	Target
Habitat extent	There should be no reduction in the total length of ditch system in relation to the established baseline greater than 1%. Habitat extent = ca 47,500 m of ditch (estimated from the 2000 aerial photograph and most recent OS 1:10,000 map). Many of the rare plant species and invertebrates, are found in or immediately adjacent to ditches. *Leersia oryzoides* is associated with trodden down ditch sides.
Habitat extent & structure: channel form	Propose to revise this target based on specialist advice. The current MS does not include the amended target, it will be added when the specification is revised in the near future (subject to Natural England resources). A range of variation in ditch profiles: no more than 75% of ditch length with a trapezoidal cross-section. During the structured walk, note variation in ditch profiles and make an estimate of the percentage (to the nearest 5%) of ditch length with trapezoidal and non-trapezoidal cross sections in each sub-section of the route. The overall result is calculated by taking the mean of the figures for the sub-sections. Shallow, as well as deep water, is important for the maintenance of diverse plant and invertebrate assemblages. Non-trapezoidal profiles include those where the banks have been trampled by stock, where the ditch has been allowed to silt up but still contains water, or where berms have been constructed. Berm creation is especially desirable in sites where there is little opportunity for extensive stands of emergent vegetation to develop by

Attribute/Feature	Target
	leaving some ditches unmanaged, where trampling of the banks by stock is limited, or where ditches are the only permanent wetland feature present. *Anisus vorticulus* requirements: 80% of all the surveyed ditches should have a berm/margin (with gentle gradient) on one side or both (<80% of relevant ditches should be more than 50% trapezoidal). This rule applies where snail is present (unit 2) and also units where it used to be present (units 4, 5, 11, 13).
Habitat extent & structure: succession	Propose to revise this target based on specialist advice. The current MS does not include the amended target, it will be added when the specification is revised in the near future (subject to Natural England resources). Composition of in-channel vegetation - mix of early, mid, and late succession ditches: 15-25% early 35-75% mid 10-25% late. *Anisus vorticulus* requires mid to late ditches. Early succession ditches are defined here as those that have been desilted or reprofiled in the same year as the monitoring visit. Late succession ditches have >70% cover of emergent species. This may not be apparent if ditch vegetation has been cut in the season of the site visit. The large amount of organic debris and stems under the water will indicate this.
Habitat extent & structure: shading	Composition of bankside vegetation - where aquatic vegetation is a key feature of the site, no more than 10% of the channel length should be heavily shaded. Some ditches are alongside woodland or within scrubbier units and as such would be more shaded. For each of the structured walk sub-sections, assess the percentage (to nearest 5%) of channel length that is heavily shaded (i.e., over 50% of the channel surface overhung) by coarse ruderal vegetation, scrub or hedges. The overall result is the mean of the values recorded for the sub-sections. Heavy shading (the feature assessed here) is defined as >50% of the ditch surface being overhung by bankside vegetation.

Attribute/Feature	Target
Ditch Water Depth	Summer – minimum depth of 75% (3/4 depth of ditch, with a minimum depth of 30cm in the middle, and within 30cm of field height. 90% of channel length should reach this target. Winter – aim for 70% of ditches at field height for winter. Characteristic water levels to be maintained. Ideally, depth gauges should be inserted in ditches at strategic points, including the main feeder and recorded monthly.
Water quality: water clarity	Water clear or only slightly turbid/discoloured in at least 90% of channel length. Along the structured walk note unnatural turbidity or discoloration of water. Both turbidity and coloration are recorded under this attribute. Blooms of planktonic algae cause reduced water clarity. Ochre deposits in peaty areas can also cause discoloration. Brown coloration of the water in acid peat areas is natural, so should not be regarded as discoloration.
Water quality: extent of algal dominance	Mean cover of filamentous macro-algae and Enteromorpha not more than 10% (mid-June to end August). For each structured walk sub-section, in freshwater ditches only, estimate % cover of the channel (to nearest 5%) by filamentous algae and Enteromorpha species taken together. The effect of excessive nutrient enrichment is often signified by increased prevalence of algae, either filamentous or planktonic. Algae such as Enteromorpha are not good indicators in saline conditions. Charophytes are not included in the group of macro-algae indicative of nutrient enrichment because they need clear water.
Water quality: water chemistry	The current MS does not include the agreed revised and added targets outlined below, these will be added when the specification is revised. Total phosphorus (TP) <0.05 mg/l; Total nitrogen (TN) <1.0 mg/l; Biological GQA Class ‘a’ or ‘b’ depending on reach type. In addition, no drop in class from existing situation. Chemical GQA Class ‘A’ or ‘B’ depending on reach type. In addition, no drop in class from existing situation.

Attribute/Feature	Target
	Total phosphorus levels for groundwater-fed systems should be considerably less than 0.05 mg/l (consult the national specialist for advice). Water chemistry should be assessed by reference to existing Environment Agency monitoring data either for the site or, where this is not available, for the feeding waters.
Number of species present: vegetation	Propose to revise this target based on specialist advice. The current MS does not include the amended target, it will be added when the specification is revised in the near future (subject to Natural England resources). Native species richness - aquatic flora of ditches species-rich: freshwater ditches – no more than 20% reduction in mean species number per 20m from the 1998 baseline study. One 20 m sampling area per ditch monitored. Between mid-June and mid-August, record (on DAFOR scale of abundance) all native aquatic plant taxa in each of the 20 sampling sites. Calculate the mean number of species to give the overall result. Appendix 2 of the common standards guidance should be used as a checklist of native aquatic plants (submerged, floating and emergent). In sites of exceptionally high quality, ditches may contain considerably more species per 20 m length than the target numbers. If this is the case, the mean number of taxa per sample should be used as the target in subsequent monitoring visits. If there is then a decrease of two or more species on average, compared with the initial visit, the condition of the ditch should be graded as Unfavourable, even if the generalised target is met.
Indicators of negative change	Introduction of or natural colonisation by non-native plants: mean cover of each very competitive non-native plant not exceeding 1%. Mean total combined cover of all non-native species and introduced species less than 30%. For each structured walk sub-section estimate abundance of non-native or introduced aquatic plant species: (a) for each of the four most invasive non-native species: separate percentage cover values (b) for all non-native and introduced species: a combined percentage cover value (to the nearest 5%). The overall results (for a and b) are the mean of the cover values for the sub-sections.

Attribute/Feature	Target
	The non-native *Lemna minuta* is not included in this assessment unless it is found to be dominant, because it is very difficult to distinguish from *Lemna minor*. Where invasive native plants with a restricted natural distribution in the UK (e.g. *Stratiotes aloides* and *Nymphoides peltata*) are introduced to a site outside their natural range, these species should be treated as 'non-native'.
Indicators of local distinctiveness: rare species and quality indicators	Populations of rare species and other species/communities characteristic of high-quality ditch systems should persist. These include: *Leersia oryzoides, Potamogeton* spp including *Potamogeton acutifolius & Potamogeton trichoides, Myriophyllum* spp including *Myriophyllum verticillatum, Lemna* spp, *Rorippa* spp, *Persicaria minor* and *Sium latifolium*. Where possible, take note of the size and condition of the population and the extent of flowering. The aquatic flora may include internationally or nationally protected, nationally threatened or scarce species and should include other species indicative of high quality ditch systems. All these are listed in Appendix 2 of the CSMG. A suite of these species should be selected.

Pulborough Brooks SSSI

Table A7.3 Site specific targets and measures for the ditch systems feature at Pulborough Brooks SSSI.

Attribute/Feature	Target
Habitat extent	No reduction in length of ditches and any consequent fragmentation without prior consent. During assessments note any changes caused by active management, such as infilling or channel diversion. Maintain the area of ditch systems that support invertebrate assemblage and Vascular Plant Assemblage. These observations do not include drying out or successional change, which are covered under other attributes.

Attribute/Feature	Target
Habitat extent & structure: channel form	A range of variation in ditch profiles. If ditches are the only wetland feature, no more than 75% of ditch length with a trapezoidal cross-section. *Anisus vorticulus* requirements: 80% of all the surveyed ditches should have a berm/margin (with gentle gradient) on one side or both. During the structured walk, note variation in ditch profiles and make an estimate of the percentage (to the nearest 5%) of ditch length with trapezoidal and non-trapezoidal cross sections in each sub-section of the route. The overall result is calculated by taking the mean of the figures for the sub-sections. Shallow, as well as deep water, is important for the maintenance of diverse plant and invertebrate assemblages. Non-trapezoidal profiles include those where the banks have been trampled by stock, where the ditch has been allowed to silt up but still contains water, or where berms have been constructed.
Habitat extent & structure: succession	Propose to revise this target based on specialist advice. The current MS does not include the amended target, it will be added when the specification is revised in the near future (subject to Natural England resources). Composition of in-channel vegetation: mix of early, mid and late succession ditches: 15-25% early 35-75% mid 10-25% late. Make an assessment for each of the structured walk sub-sections of the percentage (to nearest 5%) of channel length in early, mid, and late successional stages. The overall results are the means of the three sets of values. Characteristic faunal assemblages require a range of successional stages, from open water, through domination by submerged higher plants, to swamp communities. Some open water plant species require early and mid-successional stages, but late succession ditches are important for emergent species. *Anisus vorticulus* requires mid to late ditches. Early succession ditches are defined here as those that have been desilted or reprofiled in the same year as the monitoring visit. Late succession ditches have >70% cover of emergent species. This may not be apparent if

Attribute/Feature	Target
	ditch vegetation has been cut in the season of the site visit. The large amount of organic debris and stems under the water will indicate this.
Habitat extent & structure: shading	Composition of bankside vegetation: where aquatic vegetation is a key feature of the site, no more than 10% of the channel length should be heavily shaded. *Anisus voritculus*: Scrub should be absent or less than 5%. Tall emergent vegetation should be less than 25%. For each of the structured walk sub-sections, assess the percentage (to nearest 5%) of channel length that is heavily shaded (i.e., over 50% of the channel surface overhung) by coarse ruderal vegetation, scrub, or hedges. The overall result is the mean of the values recorded for the sub-sections. Although some bankside shading can provide habitat for some invertebrate species, heavy shading is detrimental to characteristic ditch flora and fauna. Heavy shading (the feature assessed here) is defined as >50% of the ditch surface being overhung by bankside vegetation.
Ditch Water depth	Characteristic water levels to be maintained. Generally, in wet ditches summer water depth at least 0.5m in minor ditches and 1m in major drains. 90% of channel length should reach this target. *Anisus vorticulus*: 30% of ditches should not exceed 1m in depth. Ideally, depth gauges should be inserted in ditches at strategic points, including the main feeder. The levels characteristic of the site, in relation to both freeboard and water depth, should be maintained. High water levels are particularly important in spring and early summer for semi-aquatic riparian invertebrates.
Water quality: water clarity	Water clear or only slightly turbid/discoloured in at least 90% of channel length. Along the structured walk note unnatural turbidity or discoloration of water. For each sub-section, record % of the length (to nearest 5%) with clear water, % with slight turbidity/coloration and % with marked turbidity/coloration. The overall result is the mean of each set of figures from the sub-sections.

Attribute/Feature	Target
	Both turbidity and coloration are recorded under this attribute. Blooms of planktonic algae cause reduced water clarity. Ochre deposits in peaty areas can also cause discoloration. Brown coloration of the water in acid peat areas is natural, so should not be regarded as discoloration.
Water quality: extent of algal dominance	Mean cover of filamentous macro-algae and Enteromorpha not more than 10% (mid-June to end August). For each structured walk sub-section, in freshwater ditches only, estimate % cover of the channel (to nearest 5%) by filamentous algae and *Enteromorpha* species taken together. The overall result is the mean of cover values for the sub-sections. The effect of excessive nutrient enrichment is often signified by increased prevalence of algae, either filamentous or planktonic. Algae such as Enteromorpha are not good indicators in saline conditions. Charophytes are not included in the group of macro-algae indicative of nutrient enrichment because they need clear water.
Water quality: water chemistry	The current MS does not include the agreed revised and added targets outlined below, these will be added when the specification is revised. Total phosphorus (TP) <0.05 mg/l; Total nitrogen (TN) <1.0 mg/l; Biological GQA Class ‘a’ or ‘b’ depending on reach type. In addition, no drop in class from existing situation. Chemical GQA Class ‘A’ or ‘B’ depending on reach type. In addition, no drop in class from existing situation. Total phosphorus levels for groundwater-fed systems should be considerably less than 0.05 mg L-1 (consult the national specialist for advice). Water chemistry should be assessed by reference to existing Environment Agency monitoring data either for the site or, where this is not available, for the feeding waters.

Attribute/Feature	Target
Number of species present: vegetation	Propose to revise this target based on specialist advice. The current MS does not include the amended target, it will be added when the specification is revised in the near future (subject to Natural England resources). Native aquatic flora of ditches species-rich: freshwater ditches - mean at least 15 species per 20m; brackish ditches - mean at least 5 (only to be applied to sites which are known to have a saline influence, which is the case with Pulborough Brooks SSSI, however degree of salinity not known). 5 to 10 fixed sampling points are established in each ditch. Between mid-June and mid-August, record (on DAFOR scale of abundance) all native aquatic plant taxa in each 20 m sampling site. Calculate the mean number of species to give the overall result. As the site is both a SSSI and Ramsar for the diversity and abundance of its plant species an attempt should be made to record all emergent and aquatic plant species present including those present in the Vascular Plant Assemblage. Appendix 2 of the common standards guidance should be used as a checklist of native aquatic plants. DAFOR scale of abundance enables trends in relative species abundance to be detected over a series of monitoring cycles, if required. In sites of exceptionally high quality, ditches may contain considerably more species per 20 m length than the target numbers. If this is the case, the mean number of taxa per sample should be used as the target in subsequent monitoring visits. If there is then a decrease of two or more species on average, compared with the initial visit, the condition of the ditch should be graded as Unfavourable, even if the generalised target is met.
Indicators of negative change	Introduction of or natural colonisation by non-native plants: mean cover of each very competitive non-native plant not exceeding 1%. Mean total combined cover of all non-native species and introduced species less than 30%. For each structured walk sub-section estimate abundance of non-native or introduced aquatic plant species: (a) for each of the four most invasive non-native species: separate percentage cover values (b) for all non-native

Attribute/Feature	Target
	and introduced species: a combined percentage cover value (to the nearest 5%). The overall results (for a and b) are the mean of the cover values for the sub-sections. The very competitive *Azolla* spp., *Crassula helmsii,* and *Hydrocotyle ranunculoides* can blanket sections of ditch and out-compete native species, resulting in a significant loss in diversity. *Myriophyllum aquaticum* may also have this potential in ditches. Native plants are able to co-exist somewhat more easily with other non-native species, such as *Acorus calamus*, *Elodea* spp, and *Lagarosiphon major*. *Elodea* is present in a small number of ditches, particularly in unit 1, but the population has not increased, so should not fail on this attribute if *Elodea* found.
Indicators of local distinctiveness: rare species and quality indicators	Record presence and population size (population size not crucial if have recent survey data) of *S.latifolium, O. Silaifolia, P.acutifolius*. Record for each sub-section of the structured walk the presence of rare aquatic plant species and other species/ communities chosen as 'quality indicators'. Where possible, take note of the size and condition of the population and the extent of flowering.

Waltham Brooks SSSI

Table A7.4 Site specific targets and measures for the ditch systems feature at Waltham Brooks SSSI.

Attribute/Feature	Target
Habitat extent	There should be no reduction in the total length of ditch system in relation to the established baseline. No net loss greater than 1%. A baseline map showing the boundary of the habitat should be used to assess any changes in extent. Aerial photographs can offer a convenient means of rapidly assessing extent in some cases.

Attribute/Feature	Target
	Habitat extent = circa 1450m of ditch (estimated from 2010 aerial photographs and most recent OS 1:10,000 map).
Habitat extent & structure: channel form	A range of variation in ditch profiles: no more than 75% of ditch length with a trapezoidal cross-section. (This target may be adjusted according to the characteristics of the site). During the structured walk, note variation in ditch profiles and make an estimate of the percentage (to the nearest 5%) of ditch length with trapezoidal and non-trapezoidal cross sections in each sub-section of the route. The overall result is calculated by taking the mean of the figures for the sub-sections. Shallow, as well as deep water, is important for the maintenance of diverse plants.. The context and traditional management practices of the site should be taken into consideration when deciding on the target for non-trapezoidal ditch length.
Habitat extent & structure: succession	Propose to revise this target based on specialist advice. The current MS does not include the amended target, it will be added when the specification is revised in the near future (subject to Natural England resources). Composition of in-channel vegetation: mix of early, mid, and late succession ditches: 15-25% early, 35-75% mid, 10-25% late. Make an assessment for each of the structured walk sub-sections of the percentage (to nearest 5%) of channel length in early, mid, and late successional stages. The overall results are the means of the three sets of values. Characteristic faunal assemblages require a range of successional stages, from open water, through domination by submerged higher plants, to swamp communities. Some open water plant species require early and mid-successional stages, but late succession ditches are important for emergent species. Early succession ditches are defined here as those that have been desilted or reprofiled in the same year as the monitoring visit. Late succession ditches have >70% cover of emergent species. This may not be apparent if

Attribute/Feature	Target
	ditch vegetation has been cut in the season of the site visit. The large number of organic debris and stems under the water will indicate this.
Habitat extent & structure: shading	Composition of bankside vegetation: Where aquatic vegetation is a key feature of the site, no more than 10% of the channel length should be heavily shaded. For each of the structured walk sub-sections, assess the percentage (to nearest 5%) of channel length that is heavily shaded (i.e., over 50% of the channel surface overhung) by coarse ruderal vegetation, scrub, or hedges. The overall result is the mean of the values recorded for the sub-sections. Heavy shading (the feature assessed here) is defined as >50% of the ditch surface being overhung by bankside vegetation.
Ditch Water Depth	Generally, in wet ditches summer water depth at least 0.5m in minor ditches and 1m in major drains. 90% of channel length should reach this target. Characteristic water levels to be maintained. Ideally, depth gauges should be inserted in ditches at strategic points, including the main feeder.
Water quality: water clarity	Water clear or only slightly turbid/discoloured in at least 90% of channel length. Along the structured walk note unnatural turbidity or discoloration of water. For each sub-section, record % of the length (to nearest 5%) with clear water, % with slight turbidity/coloration, and % with marked turbidity/coloration. The overall result is the mean of each set of figures from the sub-sections. Both turbidity and coloration are recorded under this attribute. Blooms of planktonic algae cause reduced water clarity. Ochre deposits in peaty areas can also cause discoloration. Brown coloration of the water in acid peat areas is natural, so should not be regarded as discoloration.

Attribute/Feature	Target
Water quality: extent of algal dominance	Mean cover of filamentous macro-algae and *Enteromorpha* not more than 10% (mid-June to end August). For each structured walk sub-section, in freshwater ditches only, estimate % cover of the channel (to nearest 5%) by filamentous algae and *Enteromorpha* species taken together. The overall result is the mean of cover values for the sub-sections.
Water quality: water chemistry	The current MS does not include the agreed revised and added targets outlined below, these will be added when the specification is revised. Total phosphorus (TP) <0.1 mg/l; Total nitrogen (TN) <1.5 mg/l; Biological GQA Class 'a' or 'b' depending on reach type. In addition, no drop in class from existing situation. Chemical GQA Class 'A' or 'B' depending on reach type. In addition, no drop in class from existing situation. Total phosphorus levels for groundwater-fed systems should be considerably less than 0.05 mg L-1 (consult the national specialist for advice). Water chemistry should be assessed by reference to existing Environment Agency monitoring data either for the site or, where this is not available, for the feeding waters. Coldwatham STW discharges into the site. An impact assessment, part of site monitoring was carried out in 2012 (Mott MacDonald). The ditch that feeds directly from the SWT is not cleared in order for the reed to act as a filter.
Number of species present: vegetation	Propose to revise this target based on specialist advice. The current MS does not include the amended target, it will be added when the specification is revised in the near future (subject to Natural England resources). Native aquatic flora of ditches species-rich: freshwater ditches - mean at least 15 species per 20m; brackish ditches - mean at least 5 (only to be applied to sites which are known to have a saline influence, which is the case with Pulborough Brooks SSSI, however degree of salinity not known).

Attribute/Feature	Target
	5 to 10 fixed sampling points are established in each ditch. Between mid-June and mid-August, record (on DAFOR scale of abundance) all native aquatic plant taxa in each 20 m sampling site. Calculate the mean number of species to give the overall result. As the site is both a SSSI and Ramsar for the diversity and abundance of its plant species, an attempt should be made to record all emergent and aquatic plant species present including those present in the Vascular Plant Assemblage. Appendix 2 of the common standards guidance should be used as a checklist of native aquatic plants. DAFOR scale of abundance enables trends in relative species abundance to be detected over a series of monitoring cycles, if required. In sites of exceptionally high quality, ditches may contain considerably more species per 20m length than the target numbers. If this is the case, the mean number of taxa per sample should be used as the target in subsequent monitoring visits. If there is then a decrease of two or more species on average, compared with the initial visit, the condition of the ditch should be graded as Unfavourable, even if the generalised target is met.
Indicators of negative change	Introduction of or natural colonisation by non-native plants: mean cover of each very competitive non-native plant not exceeding 1%. Mean total combined cover of all non-native species and introduced species less than 30%. For each structured walk sub-section estimate abundance of non-native or introduced aquatic plant species: (a) for each of the four most invasive non-native species: separate percentage cover values (b) for all non-native and introduced species: a combined percentage cover value (to the nearest 5%). The overall results (for a and b) are the mean of the cover values for the sub-sections. The very competitive *Azolla* spp., *Crassula helmsii,* and *Hydrocotyle ranunculoides* can blanket sections of ditch and out-compete native species, resulting in a significant loss in diversity. *Myriophyllum aquaticum* may also

Attribute/Feature	Target
	have this potential in ditches. Native plants are able to co-exist somewhat more easily with other non-native species, such as *Acorus calamus*, *Elodea* spp, and *Lagarosiphon major*.
Indicators of local distinctiveness: rare species and quality indicators	Populations of rare species and other species/communities characteristic of high quality ditch systems should persist. *Leersia Oryzoides* should be present in 10% of ditches. Record for each sub-section of the structured walk the presence of rare aquatic plant species and other species/communities chosen as 'quality indicators'. Where possible, take note of the size and condition of the population and the extent of flowering. The aquatic flora may include internationally or nationally protected, nationally threatened or scarce species and should include other species indicative of high quality ditch systems. All these are listed in Appendix 2 of the CSMG. The following vascular plant species which are designated in their own right are found on ditch habitats; *Leersia oryzoides*, *Potamogeton acutifolius, Potamogeton trichoides, Oenanthe silaifolia, Sium latifolium, Polygonum minus* and *Carex vulpina* - only *Leersia* has SSSI designation, the other species' indirect attributes can be assessed by monitoring their habitat condition.

Appendix 8 – Lowland grassland and vascular plants survey methodology and targets: floodplain sites

A key evidence gap identified that has informed the scope of the current condition assessment was the assessment of the wet grassland habitat. This is especially important to assess as this habitat is not currently a monitored interest feature in its own right on all the SSSIs within the SAC, SPA and Ramsar designations (where in cases currently it is only captured as a supporting feature for breeding bird assemblages).

The following sections explain the basic methodology used for site-based assessment of inland wet grassland habitat and wetland (wet mire and swamp), using the CSMG for Lowland Grassland Habitats, CSMG for Lowland Wetland, Monitoring the condition of lowland grassland SSSIs and the site's MS.

Table A8.1 Summary of interest features of Arun Valley SSSIs.

Site	Biodiversity Action Plan	Feature	Detail
Amberley Wild Brooks SSSI	Fen, marsh and swamp	Alluvial grazing marshes - Inland wet grassland consisting of M23a, M23b, M25b, MG6a, MG7b, MG9a, MG10a, MG13 and Ov25 (note 1) *This comes under the wetland guidance*	These plant communities are currently not notified habitats in their own right, but are supporting habitats for the breeding waders, breeding bird assemblage of lowland grassland, wintering wildfowl, and grassland invert assemblage. Of these habitats, M23a and b communities are a designated interest feature, as is M25b, and will therefore be the focus of the surveys, along with MG6a communities. According to the 2006 National Vegetation Classification (NVC), areas of M23 communities persist in the northwest, whilst MG13/ S7 occurring in the northeast in an area of historical botanical interest.
	Fen, Marsh and Swamp	Alluvial grazing marshes with	The majority of the south of the site comprises low diversity permanent

Site	Biodiversity Action Plan	Feature	Detail
		ditches - S3 *Carex paniculata* sedge swamp, S5 *Glyceria maxima* swamp, S7 *Carex acutiformis* swamp (note 1) *This comes under the wetland guidance*	grassland, whilst the majority of the interest, wet mire, is in the north of the site. The NVC 2006 survey confirms the presence of S3, S5 and S7 communities.
Pulborough Brooks SSSI	Lowland Grassland – grazing marsh (note 1)	MG13-related; Inland wet grassland *This comes under the lowland grassland guidance*	Wet grassland with ditches, which support important communities of wetland flora and fauna.
Pulborough Brooks SSSI	Fen, marsh and swamp	S5 *Glyceria maxima* swamp	Pulborough Brooks SSSI mostly comprises of grassland, though there is reportedly (according to 2010 NVC surveys) an area of S5 swamp in the north of the site. Though not notified, this will be an area of survey.
Waltham Brooks SSSI	Lowland Grassland – grazing marsh	MG13-related; Inland wet grassland *This comes under the lowland grassland guidance*	The citation for Waltham Brooks SSSI lists rapidly declining mire plants including common cotton-grass and bog pimpernel. These are not components of 'MG13-related' vegetation, and are more typical of permanently wet, low-nutrient mire. It is not clear what kind of vegetation they occurred in however it is suggested they were in something approaching 'M22' or at least a damaged/modified version of this or wetter progenitor. If these species are no longer present it is indicative of negative change, potentially driven by dehydration or nutrient enrichment or a combination of these. It is important that such losses – if that's what they are – are noted and

Site	Biodiversity Action Plan	Feature	Detail
			used in determining condition, and in understanding why the site is in that condition.

Note 1: Alluvial grazing marshes is not a designated features of Amberley Wild Brooks and Pulborough Brooks SSSI's. However, are noted within the MS as an attribute of supporting habitat for notified features. Therefore, they have been included within this report.

Timing and samplers

For lowland wetlands, monitoring was undertaken in early June 2021 to end of September 2021 when sedges should be flowering/fruiting and identification is easiest.

Natural England alongside technical experts carried out the sampling, and included those with:

- Ability to recognise NVC units for assessing community extent and other attributes.
- Ability to identify a range of British grassland vascular plant species.
- Botanical expertise within the team – ID certain sedges and bryophytes, support from local botanists and ecologists will be provided.
- Knowledge of wetlands – interpret structure, function, and identify likely water sources.

Survey methods.

For consistency, though the attributes of the features listed in the MSs differ between sites, the following at each location was assessed (based on MSs requirements, attributes listed within 2007 condition assessment at Amberley Wild Brooks SSSI, and Robertson & Jefferson guidance (2000), as referenced above.

Wetland habitats (S4, S5, S6, S7, S11, S12, S19):

- Habitat extent/composition
- Habitat structure
- Vegetation composition - positive indicators
- Vegetation composition - indicators of negative change - undesirable non-woody species
- Vegetation composition - indicators of negative change - woody species (for Amberley Wild Brooks SSSI)
- Indicators of local distinctiveness - presence of rare species to include population size, extent, and successful regeneration of notified plant species.

Wet grassland habitats (M23, MG6, M25):

- Extent of community
- Winter flooding
- Spring/summer flooding

- Sward structure:
    - Height
    - Litter cover
    - Extent of bare ground (not rock)
- Sward composition:
    - Negative indicator species (frequency and cover)
    - Abundance of listed soft leaved and seed-bearing plants.
    - Presence of rare species to include population size, extent and successful regeneration of notified plant species.

Positive/negative indicators – cover and frequency

Summary: Structured walk or transects for monitoring habitat/vegetation structure and presence of indicators of local distinctiveness to estimate cover.

Method:

1. Following the assessment of extent of features, roughly map a route to follow on the SSSI. This should cover the whole area in a 'W' shape.
2. Depending on the size and heterogeneity of the area, decide the stopping distance for recording, e.g., every 20 paces.
3. Follow the route. At each stopping point, search for the indicators listed within 3-4m^2 of the recorder location (roughly equivalent to a quadrat in character). Robertson and Jefferson (2000) suggest that "this may be searched as two semi-circles around the observer or a 'quadrat' in front of the observer whichever is quicker." This should take two to three minutes per stopping point.
4. Record presence and occurrence (DAFOR) of species that are listed in Appendix 5.2 and 5.3 for wet grassland and wetland habitats, respectively. Also record % cover of negative indicator.
5. Work out the frequencies of each indicator.
6. Compare against accurate baseline maps and assess whether a certain percentage of sample points laid out upon a grid conform to the community or not.

Habitat structure

Summary: Visual estimate of % cover of exposed substrate and litter

Method:

- Follow the method for the structured walk as above.
- At each stop visually assess the cover of any litter (dead plant material) layer and bare ground at intervals during the walk and estimate % cover. If the swards are tall and litter is not obvious, check around the base to see litter is present. Bare ground must be visible from above without disturbing the vegetation and does not include rock exposures, stones, pebbles, and flints.

Sward height

Summary: conduct a visual assessment of the average height of the sward during a structured walk.

Method:

- Follow the method for the structured walk as above.
- At each stop, estimate the average height of the sward in the surrounding 3-4m. This should be the height of the main mass of herbage, not the tops of scattered flowering spikes of grasses and taller herbs which project above the main sward.
- The advice is for this to be an estimate, rather than using measuring tapes. As such, the recording forms should include cm measurements along one side to aid in estimation or use a graduated pole.

Sampling locations

Robertson and Jefferson (2000) recommend that for visually estimating features, a sampling area of a minimum of 0.25ha to a maximum of 16ha should be chosen. Previously, assessments have taken place on a unit level. As assessments are moving towards feature level, sampling areas that represent the variation on site should be selected, regardless of unit boundaries.

Figure A8.1 shows the minimum and maximum areas for sampling against the SSSIs. On reflection, smaller sampling units should be chosen (~0.5-1ha), to avoid crossing multiple ditches/water bodies and capture localised biodiversity.

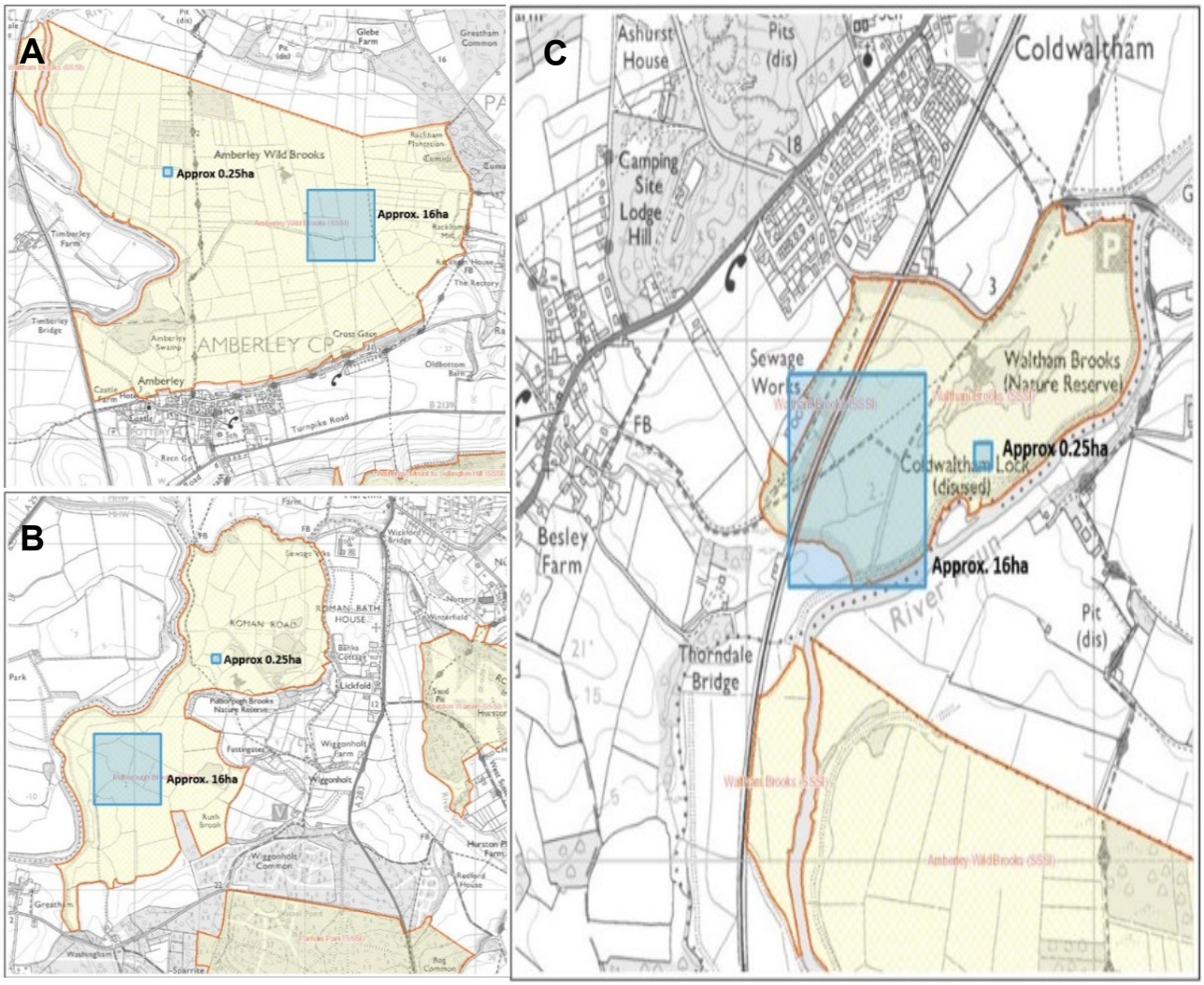


Figure A8.1 Map of Arun Valley designated sites (A: Amberley Wild Brooks SSSI, B: Pulborough Brooks SSSI; C: Waltham Brooks SSSI), detailing the approximate variation in recommended sampling area of units (Blue boxes, 0.25ha and 16ha).

Site selection

Within sampling areas, routes should be set using information from baseline map, ensuring that all habitats, vegetation types, populations of notable species and other indicators of local distinctiveness can be examined. However, if during the initial extent of feature assessment indicated that an alternate route would be beneficial to capture site condition, then this can be done.

Sites selected for assessment have taken account of the following:

- Historic presence of vascular plants of interest
- Variation in soil types
- Accessibility
- Wet grassland habitats: presence of relevant communities (M23a, M23b, MG6) and wetland habitats: presence of relevant communities (S3, S4, S5, S7, S12, S14,

S19) using previous NVC surveys (Thomson, 2010; Environment Agency, 2006; Lyons, 2012).

Amberley Wild Brooks SSSI

There are 14 units on Amberley Wild Brooks SSSI, so previously there would have likely been wet grassland surveys on the majority of these sites although the lower half was managed as a grass ley so botanical interest outside of the ditches was mostly in the Amberley swamp area and the northern and eastern parts of the site. Figure A8.2 shows 9 sites, selected to cover sites known to be important for vascular plants, differing soil types and hydrogeology, numerous units and a range of communities identified in the Environment Agency 2006 NVC survey (see Table A8.2). Selecting similar sites for assessment as previous surveys will allow comparison on how the communities present have changed over the past 15 years. Based on anecdotal evidence, the locations also vary in distance to the centre of the site where the River Arun flows, as there may be drying towards the edge of the site.

Table A8.2 Survey location numbers for Amberley Wild Brooks SSSI habitats assessment, and communities present.

Site/s	Detail
1	2006 NVC survey identified M23b community
2, 3	2006 NVC survey identified M23a community
4	2006 NVC survey identified MG9a community
5	2006 NVC survey identified MG13/S7, MG9a and M23b communities in close proximity
6, 8	2006 NVC survey identified S5a community
7	2006 NVC survey identified S3 and S7 communities

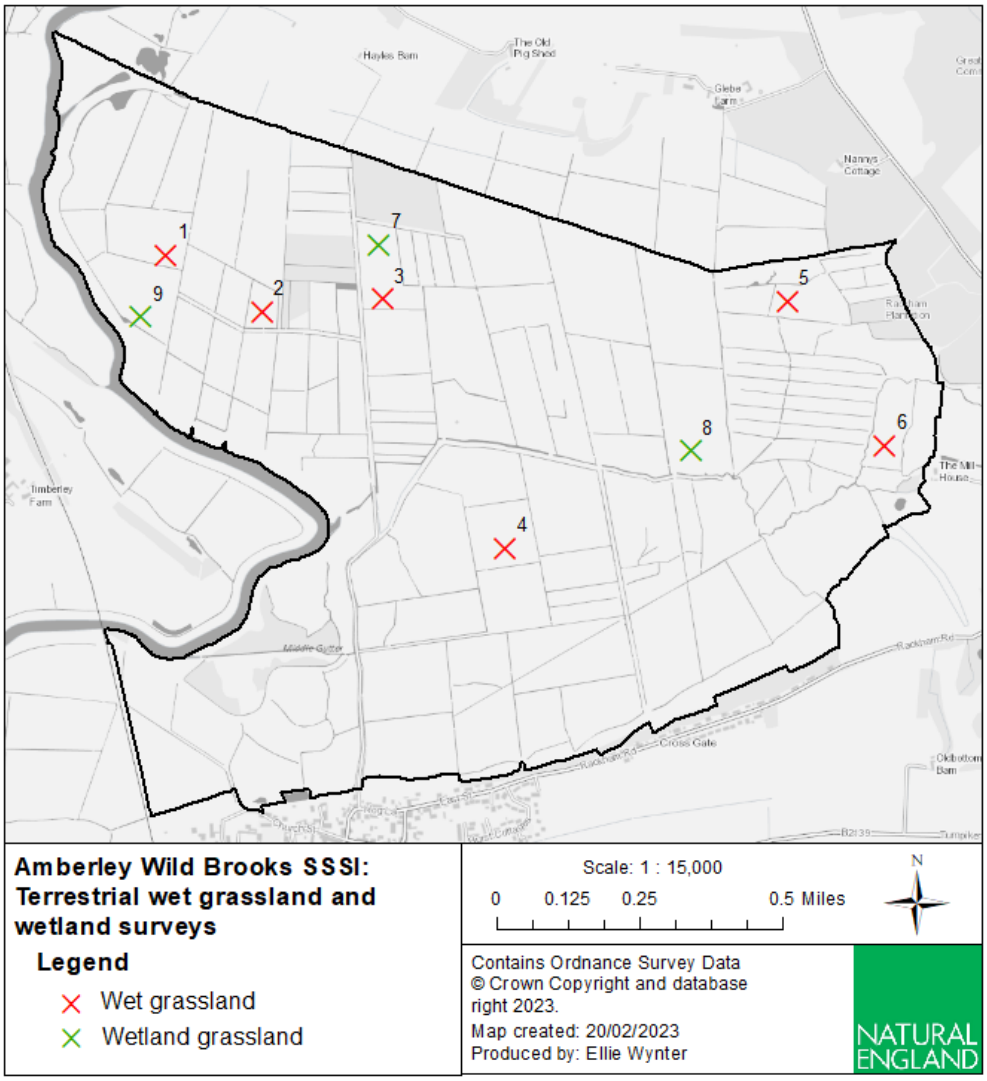


Figure A8.2 Map of Amberley Wild Brooks SSSI, detailing the approximate sampling locations for terrestrial wet grassland (Red crosses) and wetland grassland (Green crosses) as assessed in the NE 2021 surveys.

Site specific plant species

Table A8.3 Site specific plant species of Amberley Wild Brooks SSSI. Detailing the common name, scientific name, rarity (Great Britain), level of threat and conservation designation.

Common Name	Scientific Name	Rarity [note 1] (Great Britain)	Threat [note 2]		Conservation Designation
Cut-grass	*Leersia oryzoides*	Rare	GB Red List	**EN**	Schedule 8 (Great Britain) and England NERC List (Sec. 41)
			England Red List	**EN**	
Greater Water-parsnip	*Sium latifolium*	Scarce	GB Red List	**EN**	England NERC List (Sec. 41)
			England Red List	**EN**	
Narrow-leaved Water-dropwort	*Oenanthe silaifolia*	Scarce	GB Red List	**LC**	
			England Red List	**LC**	
Sharp-leaved Pondweed	*Potamogeton acutifolius*	Rare	GB Red List	**EN**	England NERC List (Sec. 41)
			England Red List	**EN**	
Small Water-pepper	*Persicaria minor*		GB Red List	**VU**	
			England Red List	**LC**	
True Fox-sedge	*Carex vulpina*	Rare	GB Red List	**VU**	England NERC List (Sec. 41)
			England Red List	**VU**	

Note 1: Rarity – Rare (Species recorded in 15 or fewer hectares in GB 2000 - 2019, Scarce (Species recorded in 16-100 hectares in GB 2000 -2019

Note 2: Threat – EX – Extinct; EW – Extinct in the wild; RE – Regionally extinct; CR – Critically endangered; EN – Endangered; VU – Vulnerable; NT – Near threatened; LC – Least concern. (IUCN, 2012)

Pulborough Brooks SSSI

There are 3 units on Pulborough Brooks, though each is very large. Based on the previous NVC survey maps and anecdotal evidence, the site is more homogenous than Amberley Wild Brooks SSSI. It is also smaller and has less coverage of wet grassland and associated communities. Therefore, fewer sites were required to be visited. The map below (Figure A8.3) shows three sites selected to cover a variety of areas known to be important for vascular plants, differing soil types, hydrogeology, numerous units and a range of communities identified in the Thomson (2010) NVC survey.

Table A8.5 Survey location numbers for Pulborough Brooks SSSI habitats assessment, and communities present.

Site	Detail
1	2010 NVC survey identified MG6b communities.
2	2010 NVC survey identified MG9 communities.
3	2010 NVC survey identified S5 communities in 4 fields in this location.

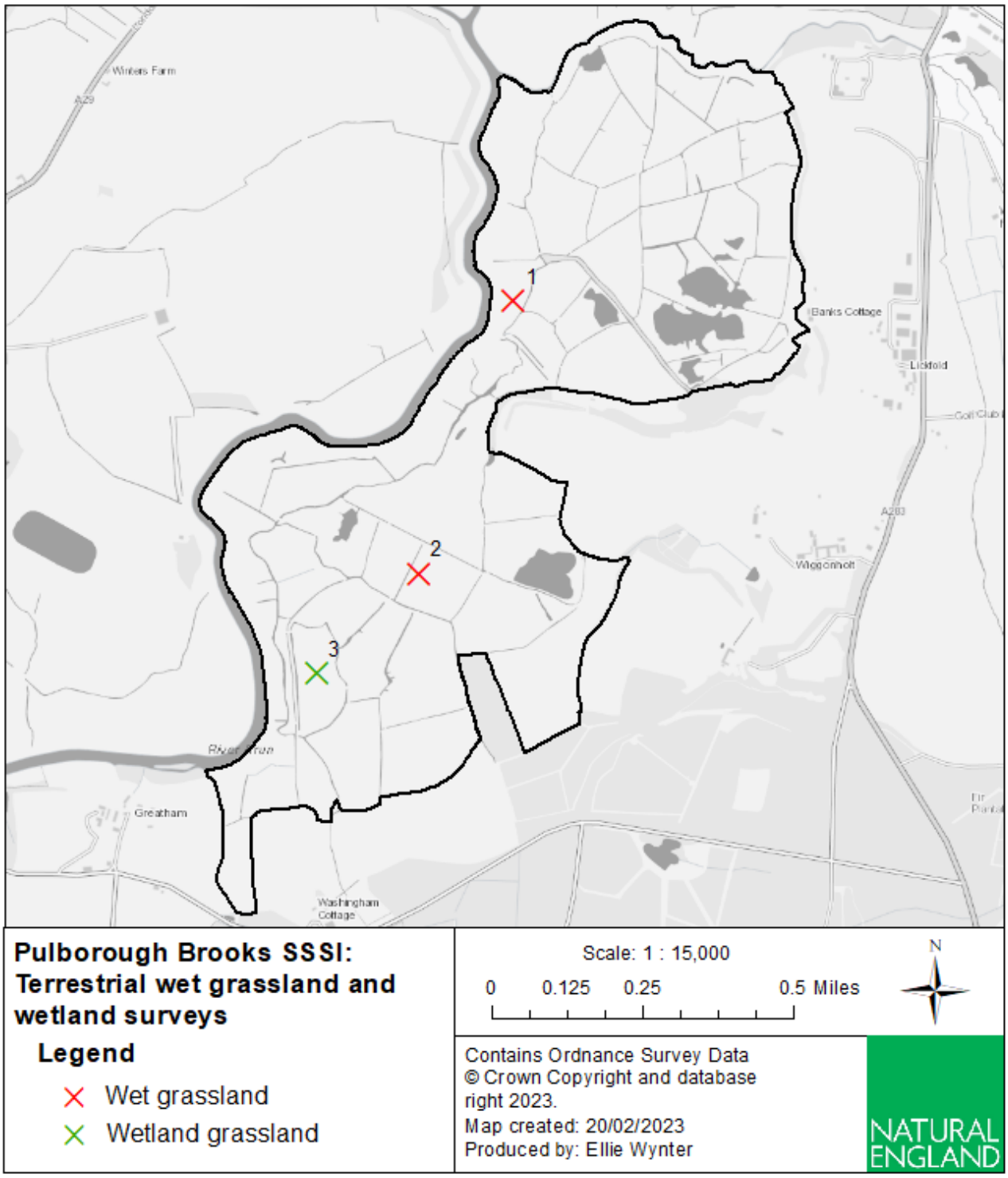


Figure A8.3 Map of Pulborough Brooks SSSI, detailing the approximate sampling locations for terrestrial wet grassland (Red crosses) and wetland grassland (Green crosses) as assessed in the NE 2021 surveys.

Site specific plant species

Table A8.6 Site specific plant species of Pulborough Brooks SSSI. Detailing the common name, scientific name, rarity (Great Britain), level of threat and conservation designation.

Common Name	Scientific Name	Rarity [note 1] (Great Britain)	Threat [note 2]		Conservation Designation
Cut-grass	*Leersia oryzoides*	Rare	GB Red List	**EN**	Schedule 8 (Great Britain) and England NERC List (Sec. 41)
			England Red List	**EN**	
Greater Water-parsnip	*Sium latifolium*	Scarce	GB Red List	**EN**	England NERC List (Sec. 41)
			England Red List	**EN**	
Narrow-leaved Water-dropwort	*Oenanthe silaifolia*	Scarce	GB Red List	**LC**	
			England Red List	**LC**	
Sharp-leaved Pondweed	*Potamogeton acutifolius*	Rare	GB Red List	**EN**	England NERC List (Sec. 41)
			England Red List	**EN**	

Note 1: Rarity – Rare (Species recorded in 15 or fewer hectares in GB 2000 - 2019, Scarce (Species recorded in 16-100 hectares in GB 2000 -2019

Note 2: Threat – EX – Extinct; EW – Extinct in the wild; RE – Regionally extinct; CR – Critically endangered; EN – Endangered; VU – Vulnerable; NT – Near threatened; LC – Least concern. (IUCN, 2012)

Waltham Brooks SSSI

Due to a significantly smaller size, fewer sites were selected for monitoring, and using the same process as previously set out. Information used about vascular plants present, and the arrangement of wetland communities has been taken from the unpublished review of biological monitoring report by Lyons (2012). There is a complex mosaic of wet grassland surrounding the lake, therefore it was difficult to distinguish communities. Figure A8.4 displays a map of the sites selected for monitoring.

Table A8.8 Survey location numbers for Waltham Brooks SSSI habitats assessment, and communities present.

Site/s	Detail
1	2012 NVC survey identified MG6 communities.
2	2012 NVC survey identified S12 communities.
3, 4	2012 NVC survey identified a mosaic of S5 and S14 communities.

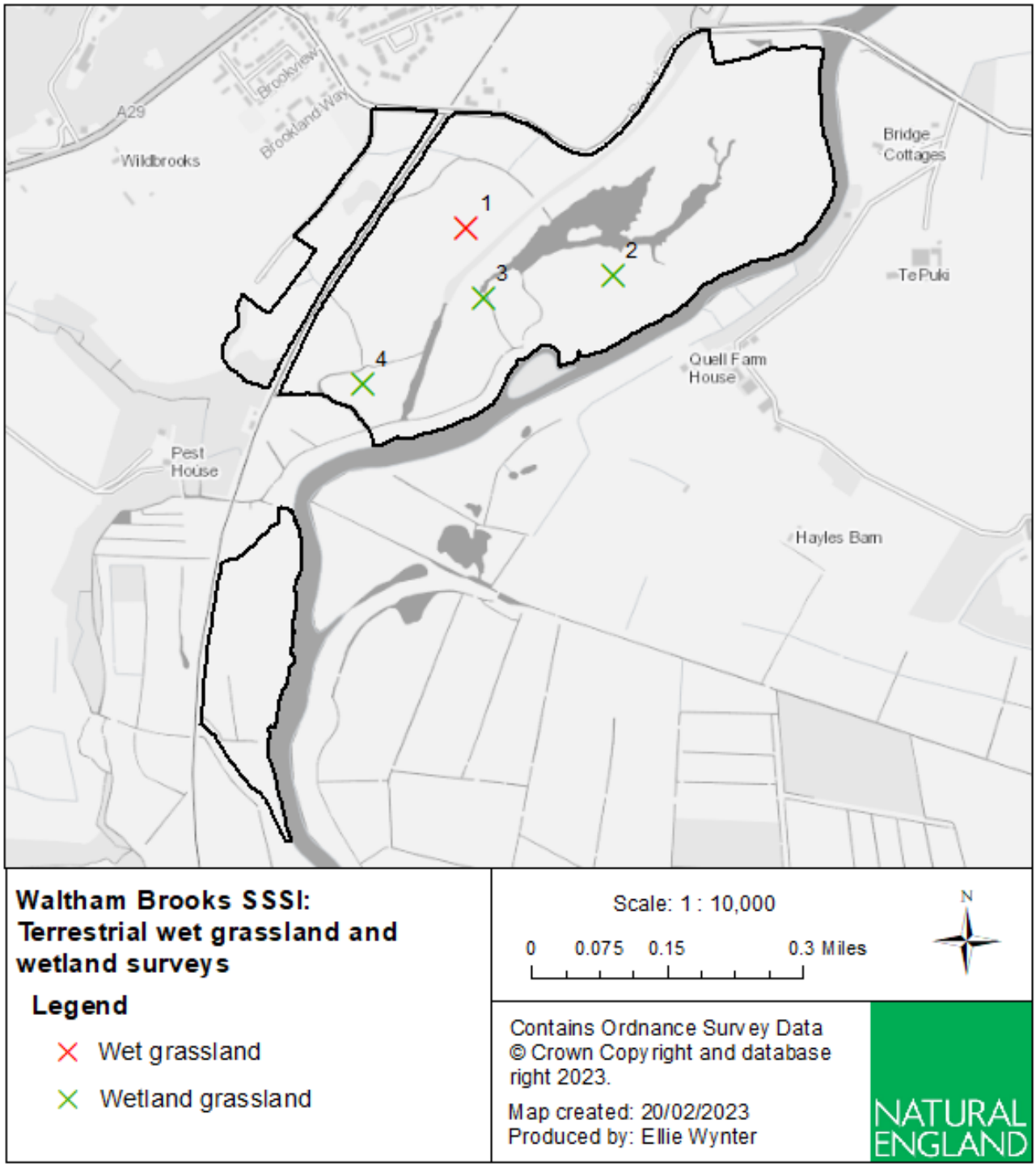


Figure A8.4 Map of Waltham Brooks SSSI, detailing the approximate sampling locations for terrestrial wet grassland (Red crosses) and wetland grassland (Green crosses) as assessed in the NE 2021 surveys.

Site specific plant species

Table A8.9 Site specific plant species of Waltham Brooks SSSI. Detailing the common name, scientific name, rarity (Great Britain), level of threat and conservation designation.

Common Name	Scientific Name	Rarity [note 1] (Great Britain)	Threat [note 2]		Conservation Designation
Greater Water-parsnip	*Sium latifolium*	Scarce	GB Red List	**EN**	England NERC List (Sec. 41)
			England Red List	**EN**	
Marsh Fern	*Thelypteris palustris*	Scarce	GB Red List	**LC**	
			England Red List	**LC**	
Narrow-leaved Water-dropwort	*Oenanthe silaifolia*	Scarce	GB Red List	**LC**	
			England Red List	**LC**	
Sharp-leaved Pondweed	*Potamogeton acutifolius*	Rare	GB Red List	**EN**	England NERC List (Sec. 41)
			England Red List	**EN**	
Cut-grass	*Leersia oryzoides*	Rare	GB Red List	**EN**	Schedule 8 (Great Britain) and England NERC List (Sec. 41)
			England Red List	**EN**	

Note 1: Rarity – Rare (Species recorded in 15 or fewer hectares in GB 2000 - 2019, Scarce (Species recorded in 16-100 hectares in GB 2000 -2019

Note 2: Threat – EX – Extinct; EW – Extinct in the wild; RE – Regionally extinct; CR – Critically endangered; EN – Endangered; VU – Vulnerable; NT – Near threatened; LC – Least concern. (IUCN, 2012)

Rare Plant searches

In addition to the ditch and wet grassland surveys, the notified plant species for the three floodplain SSSIs were surveyed using rare plant searches (for more details on the species targeted see section 10). The locations of these searches are shown in Figure A8.5, Figure A8.6 and Figure A8.7, and were based on known historical locations of the specific species from previous ecological surveys and records such as Natural England unpublished surveys (from previous condition assessments), RSPB unpublished Pulborough Brooks SSSI botanical surveys (1999-2004), Amberley Wild Brooks SSSI ditch flora surveys (Abraham, 1998), Sussex Wildlife Trust unpublished botanical surveys (Lyons, 2006), Sussex Biodiversity records centre and Botanical Society of Britain and Ireland records. These additional rare plant species searches were completed at the same time as the ditch or wet grassland surveys in 2021.

Sampling location

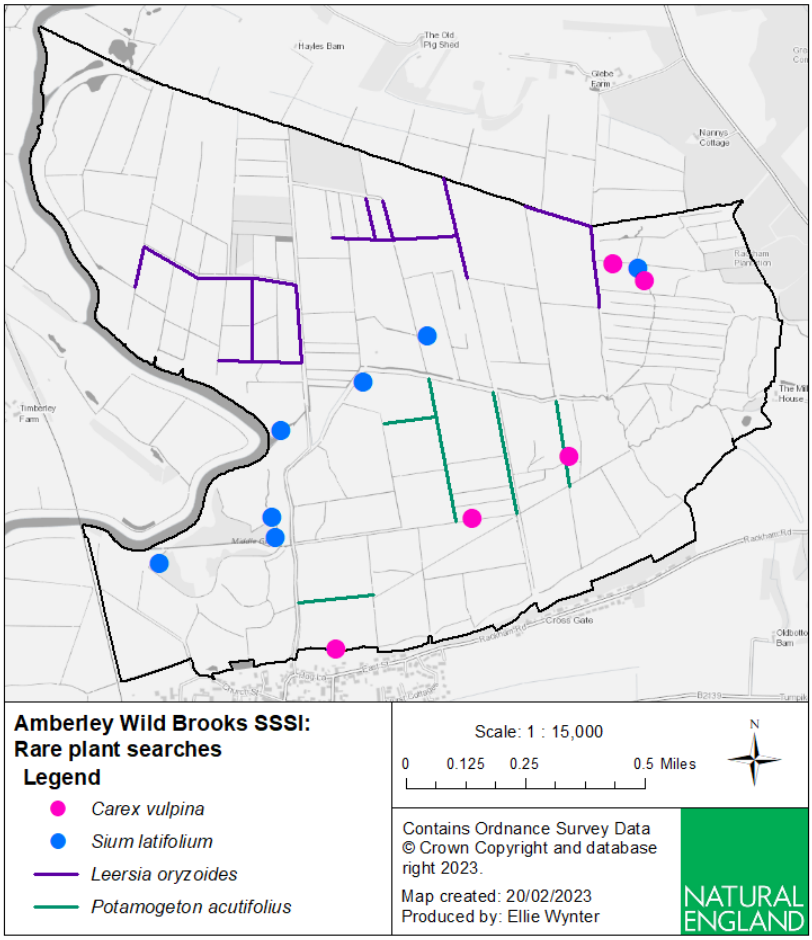


Figure A8.5 Map of Amberley Wild Brooks SSSI, detailing the approximate search locations for rare plant species. This includes *Carex vulpina* (Pink dots), *Sium latifolium* (Blue dots), *Leersia oryzoides* (Purple line), and *Potamogeton acutifolius* (Green line).

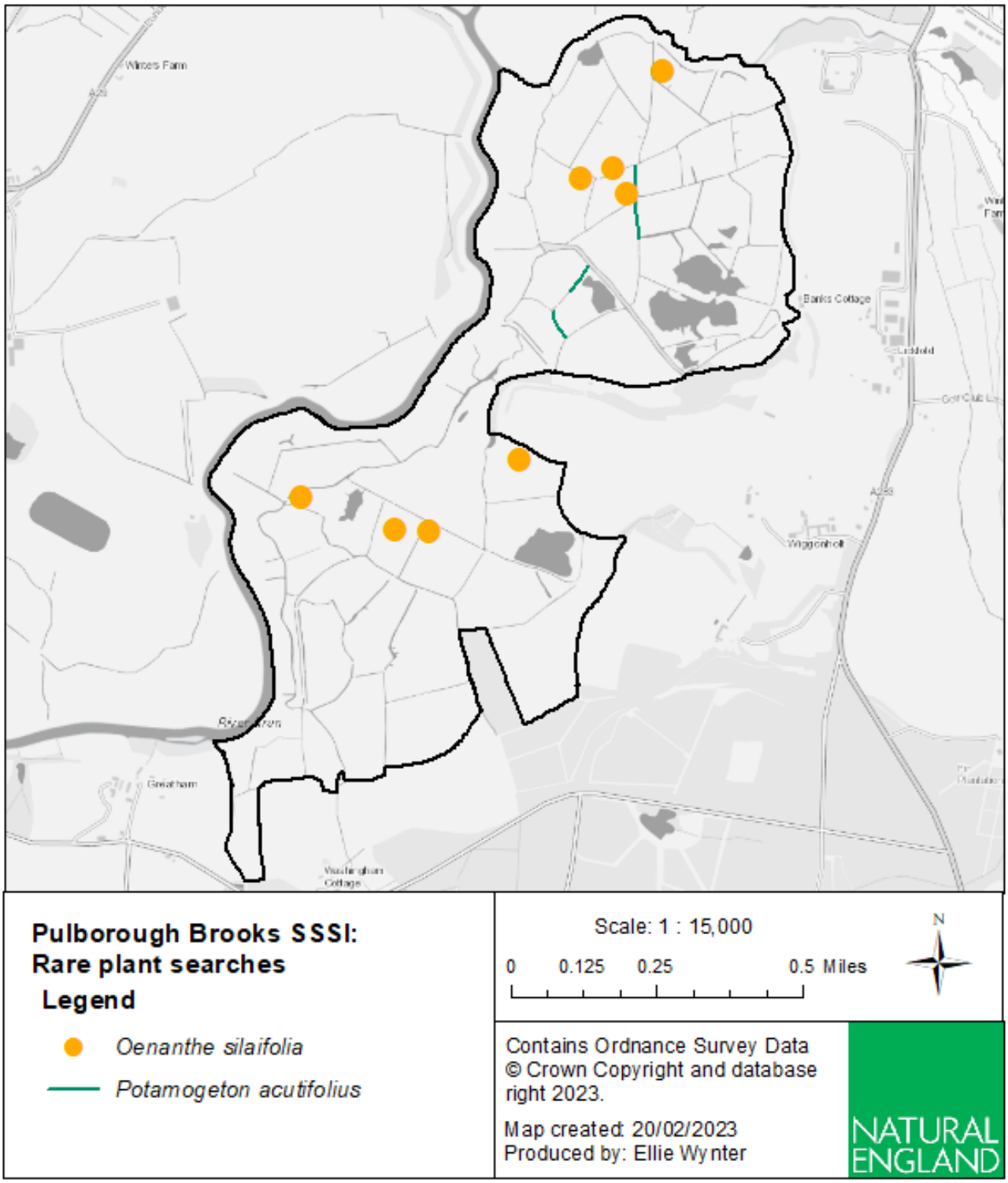


Figure A8.6 Map of Pulborough Brooks SSSI, detailing the approximate search locations for rare plant species. This includes Oenanthe silaifolia (Orange dots) and Potamogeton acutifolius (Green line).

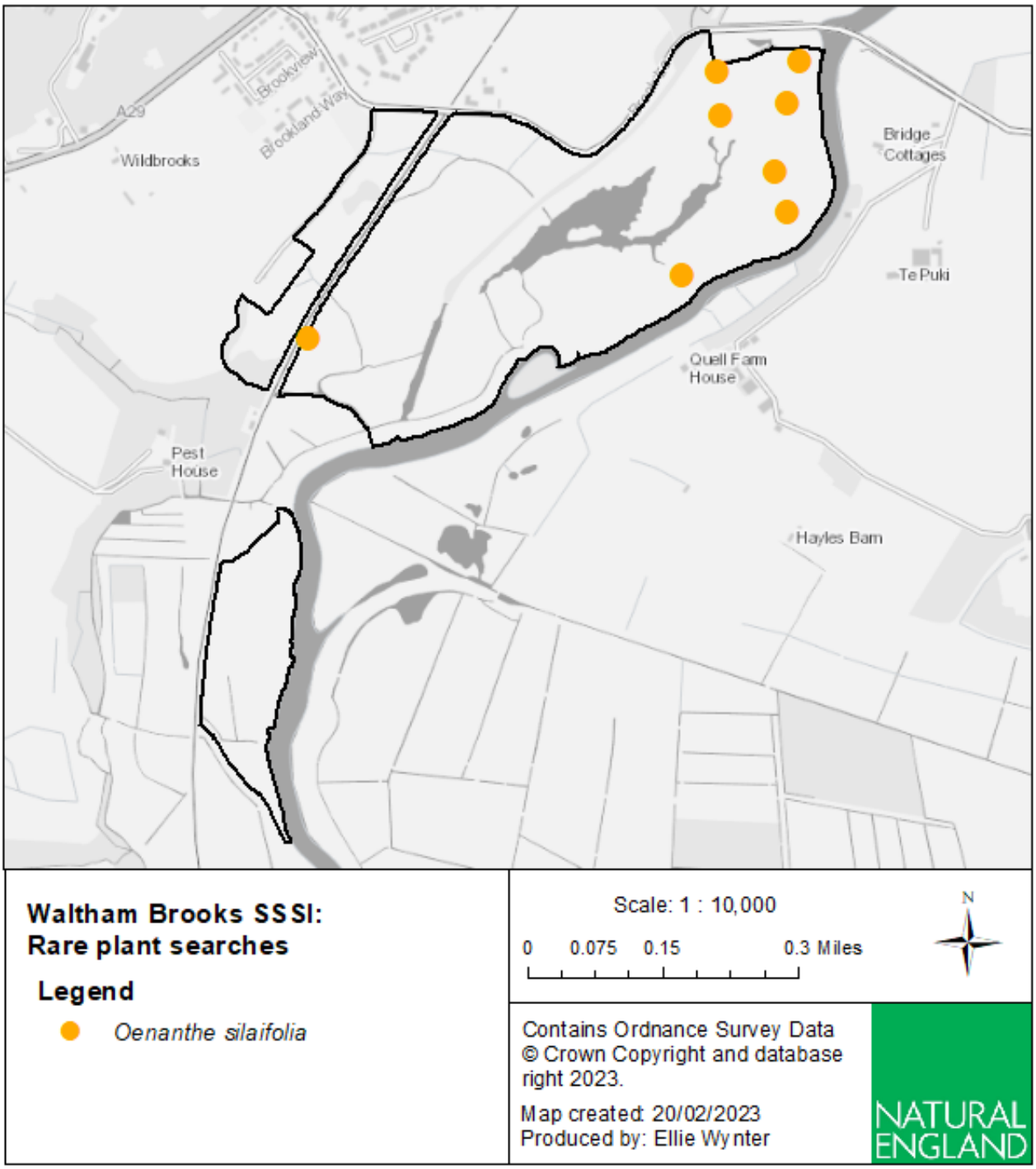


Figure A8.6 Map of Waltham Brooks SSSI, detailing the approximate search locations for rare plant species. This includes *Oenanthe silaifolia* (Orange dots).

Percentage cover of plant species or groups of species

Summary: visual assessment of frequency/cover of rare/scarce species at sample points chosen to represent their known distribution during a structured walk to estimate the percentage cover of listed species. Also estimate population size (if possible) of notified plant species for each SSSI.

Method:

1. Follow the method for the structured walk as for the wet grassland habitat type as detailed above.
2. At each stop, estimate the cover of the listed species using the % boundaries listed in the recording form: existing populations of rare/scarce species:

- *Thelypteris palustris*
- *Oenanthe silaifolia*
- *Comarum (Potentilla) palustris*

3. If possible, record a count of functional individuals and presence of 'young' and 'mature' plants for the following notified species:

- Amberley Wild Brooks SSSI: *Leersia oryzoides, Carex vulpina, Potamogeton acutifolius, Oenanthe silaifolia, Sium latifolium, Persicaria minor* (= *Polygonum minus*).
- Pulborough Brooks SSSI: *Potamogeton acutifolius, Oenanthe silaifolia, Sium latifolium*
- Waltham Brooks SSSI: *Leersia oryzoides, Potamogeton acutifolius, Oenanthe silaifolia, Sium latifolium, Thelypteris palustris, Potamogeton trichoides, Persicairia minor* (= *Polygonum minus*)

Condition Assessment targets.

Amberley Wild Brooks SSSI

Table A8.10 Site specific targets and measures for the wet grassland feature at Amberley Wild Brooks SSSI. Currently, this feature (and all attributes outlined below) are not assessed as a monitored interest feature within the MS for this SSSI. These will be revised in line with updates below in the near future (subject to Natural England resources).

Attribute/Feature	Target
Habitat extent	No net loss greater than 5% of 304 ha aerial photos or field survey. Habitat extent = circa 304 ha of grazing marsh. (estimated from 2000 aerial photograph together with 2006 NVC survey). No net loss, subject to change. Maintain the area of habitats that are used by breeding and over wintering birds within acceptable limits.
Sward structure: bare ground	No more than 15% in May-early June or no more than 10% in mid-June-July. Record extent of bare ground (not rock) distributed through the sward, visible without disturbing the vegetation, e.g. from the seasonal effects of flooding. Record in period May - July (before hay cut in meadows). Also record sometimes in aftermath grazing period in hay meadows. Species such as Lapwing and Redshank require areas of bare ground.
Sward structure: average height	Site should have mosaic of vegetation structures: 70% of site should have sward structure that covers range from short (5cm) to longer (up to 100cm) (excluding *Juncus* spp.). Snipes require areas of taller vegetation (20-100cm) over wetter areas. Redshank, Shoveler, Teal requires patches medium to tall vegetation (20-50cm), Lapwing shorter vegetation (between 5 and 15cm), Wigeon <5cm throughout areas used for feeding.

Attribute/Feature	Target
	Record sward height in period May - July (before hay cut in meadows) for breeding birds, autumn/winter months for overwintering birds. Note: habitat suitability considerations are particularly important when the bird numbers are not present above threshold levels; as a way of identifying possible reasons why and appropriate measures and remedies that could be undertaken on the site. Should not be considered Unfavourable if not meeting targets.
Sward composition	We are proposing to revise this target based on specialist advice. The current monitoring specification does not include the amended target, it will be added when the specification is revised in the near future (subject to Natural England resources). Abundance of seed-bearing plants around fresh waters - [>25% cover] of one or more target species, e.g. *Polygonum, Ranunclus, Eleocharis*. Non-breeding Teal. Note: habitat suitability considerations are particularly important when the bird numbers are not present above threshold levels; as a way of identifying possible reasons why and appropriate measures and remedies that could be undertaken on the site. Should not be considered Unfavourable if not meeting targets.
Sward composition: negative indicator species	No species more than occasional throughout the sward or singly or together more than 5% cover. Record the frequency and % cover of 'negative indicator species') in mid-May to late July. Species include: *Anthriscus sylvestris, Cirsium arvense, Cirsium vulgare, Galium aparine, Plantago major, Pteridium aquilinum, Rumex crispus, Rumex obtusifolius, Senecio jacobaea, Urtica dioica*. Invasive species chosen to indicate problems of eutrophication and disturbance from various sources when outside target e.g. poaching, stock feeding. Record the frequency and % cover of all tree and scrub.

Attribute/Feature	Target
Water area/depth	Large open areas of water (feeding, roosting) - One or more water body >10ha. Bewick's swan. Extensive shallow water - <25cm over >50% of water area. Teal, Pintail, Shoveler. Extensive shallow water - <1m over >50% of water area. Bewick's swan.

Table A8.11 Amberley Wild Brooks SSSI condition assessment table of the Vascular Plant Assemblage based on 2021 surveys. Currently, the *Sium latifolium, Potamogeton acutifolius* and *Oenanthe silaifolia* features are not assessed as monitored interest features within the MS for this SSSI, they will be added when the specification is revised in the near future (subject to Natural England resources).

Feature	Attribute	Target
Vascular Plant Assemblage	Population	Presence of species in a defined number of subpopulations or site sectors (spatial target); at least a minimum viable population size present. No loss in population extent > 10%; no decline in the population size category. Species: *Leersia oryzoides, Carex vulpina, Potamogeton acutifolius, Oenanthe silaifolia, Sium latifolium, Persicaria minor* (= *Polygonum minus* (species monitored using habitat guidance)). Population extent is useful when it is difficult to define functional individuals. Baseline information needs to be collected to establish current population size etc.
Vascular Plant Assemblage	Presence/absence	Species should be present. Species: *Leersia oryzoides, Carex vulpina, Potamogeton acutifolius, Oenanthe silaifolia, Sium latifolium, Persicaria minor* (= *Polygonum minus* (species monitored using habitat guidance)).

Feature	Attribute	Target
Vascular Plant Assemblage	Successful regeneration - population	Presence of range of young and old plants; At least a minimum number/proportion of young plants or seedlings or full seed heads or flowers – percentages to be determined. Count: including individually notified species *Leerisa oryzoides* monitored using habitat guidance.
Leersia oryzoides	Population	No loss in population extent > 10%; no decline in the population size category. Mapping; count of functional individual species – species should be present in 10% of ditches. Intolerant of shade.
Leersia oryzoides	Presence/ absence	Species should be present. Present at notification (1984). If all other targets are met but the species cannot be found then the feature should be referred to the Natural England botanical specialist.
Sium latifolium	Population	No loss in population extent > 10%; no decline in the population size category. Mapping; count of colonies - maintain 4 colonies across the site.
Sium latifolium	Presence/ absence	Species should be present. Present in select locations (mapped). Can grow alongside tall fen vegetation, but requires more open habitat to set seed, and for juvenile growth, intolerant of heavy grazing shading, frequent cutting, ditch clearance.
Potamogeton acutifolius	Population	No loss in population extent > 10%; no decline in the population size category. Mapping; count of functional individuals. Species should be present in 20% of ditches surveyed.

Feature	Attribute	Target
		Tends to disappear and reappear according to ditch cycle.
Potamogeton acutifolius	Presence/ absence	Species should be present. Widespread in northern section of the site, last full survey -2005. Requires high water quality, shallow; species-rich drainage ditches; calcareous mesotrophic water, tends to disappear and reappear according to ditch cycle.
Oenanthe silaifolia	Population	No loss in population extent > 10%; no decline in the population size category. Mapping; count of functional individuals. Species should be present in 20% of ditches surveyed.
Oenanthe silaifolia	Presence/ absence	Species should be present. Last known survey (Abraham et al,1998).
Carex vulpina	Population	Species should be present. Present at notification (1984). If all other targets are met but the species cannot be found then the feature should be referred to the Natural England botanical specialist.
Carex vulpina	Presence/ absence	Niche availability - sufficient area of suitable habitat to maintain population. No loss of extent of suitable habitat (mapping - area or, in case of ditch/river margin, length). Bare ground - 10-30% bare ground in its usual ditch/pond margin habitats (not in flood plain grassland). Shading - Only light shade present if plant occurs in woodland or shaded ditch No scrub encroachment on flood plain grassland.

Pulborough Brooks SSSI

Table A8.12 Site specific targets and measures for the wet grassland feature at Pulborough Brooks SSSI.

Attribute/ Feature	Target
Habitat extent	No net loss, subject to change. Maintain the area of habitats that are used by breeding and over wintering birds within acceptable limits. Habitat extent = circa 159 ha of grazing marsh (Estimated from aerial photograph, WebMap 2003-2010). Temporary reductions related to natural variation in hydrological conditions should be noted as such where information allows.
Sward structure: bare ground	No more than 15% in May-early June or no more than 10% in mid-June-July. Record extent of bare ground (not rock) distributed through the sward, visible without disturbing the vegetation, e.g., from the seasonal effects of flooding. Record in period May - July (before hay cut in meadows). Also record sometimes in aftermath grazing period in hay meadows. Species such as Lapwing and Redshank require areas of bare ground.
Sward structure: average height	Site should have mosaic of vegetation structures: 70% of site should have sward structure that covers range from short (5cm) to longer (up to 100cm) (excluding *Juncus* spp.). Snipes require areas of taller vegetation (20-100cm) over wetter areas. Redshank, Shoveler, Teal requires patches medium to tall vegetation (20-50cm), Lapwing shorter vegetation (between 5 and 15cm), Wigeon <5cm throughout areas used for feeding. Record sward height in period May - July (before hay cut in meadows) for breeding birds, autumn/winter months for overwintering birds.

Attribute/ Feature	Target
	Note: habitat suitability considerations are particularly important when the bird numbers are not present above threshold levels; as a way of identifying possible reasons why and appropriate measures and remedies that could be undertaken on the site. Should not be considered Unfavourable if not meeting targets.
Sward composition	We are proposing to revise this target based on specialist advice. The current monitoring specification does not include the amended target, it will be added when the specification is revised in the near future (subject to Natural England resources). Abundance of soft-leaved plants - [>25% cover] of one or more target species, e.g. *Glyceria, Agrostis, Alopecurus* spp and other grasses such as *Poa* spp. Non-breeding Wigeon. Abundance of seed-bearing plants around fresh waters - [>25% cover] of one or more target species, e.g. *Polygonum, Ranunclus, Eleocharis*. Non-breeding Teal. Abundance of soft-leaved plants - [>25% cover] of one or more target species, e.g. *Glyceria, Agrostis, Potomageton* spp. Non-breeding Pintail. Note: habitat suitability considerations are particularly important when the bird numbers are not present above threshold levels as a way of identifying possible reasons why and appropriate measures and remedies that could be undertaken on the site. Should not be considered Unfavourable if not meeting targets.
Sward composition: negative indicator species	No species more than occasional throughout the sward or singly or together more than 5% cover. Record the frequency and % cover of 'negative indicator species') in mid-May - late July. Species include: *Anthriscus sylvestris, Cirsium arvense, Cirsium vulgare, Galium aparine, Plantago major, Pteridium aquilinum, Rumex crispus, Rumex obtusifolius, Senecio jacobaea, Urtica dioica*.

Attribute/ Feature	Target
	Invasive species chosen to indicate problems of eutrophication and disturbance from various sources when outside target eg poaching, stock feeding. Record the frequency and % cover of all tree and scrub.
Water area/ depth	Large open areas of water (feeding, roosting) - One or more water body >10ha. Bewick's swan. Extensive shallow water - <25cm over >50% of water area. Teal, Pintail, Shoveler. Extensive shallow water - <1m over >50% of water area. Bewick's swan.

Table A8.13 Pulborough Brooks SSSI condition assessment table of the Vascular Plant Assemblage based on 2021 surveys. Currently, the *Sium latifolium, Potamogeton acutifolius,* and *Oenanthe silaifolia* features are not assessed as a monitored interest features within the MS for this SSSI, they will be added when the specification is revised in the near future (subject to Natural England resources).

Feature	Attribute	Target
Leersia oryzoides	**Population**	No loss in population extent > 10%; no decline in the population size category. Mapping; count of functional individual species – species should be present in 10% of ditches. Intolerant of shade. Recently found at Pulborough Brooks SSSI (2011, 2 plants).
Leersia oryzoides	**Presence/ absence**	Species should be present.
Sium latifolium	**Population**	No loss in population extent > 10%; no decline in the population size category. Mapping; count of colonies - maintain 4 colonies across the site.

Feature	Attribute	Target
Sium latifolium	**Presence/ absence**	Species should be present. Present in select locations (mapped). Can grow alongside tall fen vegetation, but requires more open habitat to set seed, and for juvenile growth, intolerant of heavy grazing shading, frequent cutting, ditch clearance.
Potamogeton acutifolius	**Population**	No loss in population extent > 10%; no decline in the population size category. Mapping; count of functional individuals. species should be present in 20% of ditches surveyed. Tends to disappear and reappear according to ditch cycle.
Potamogeton acutifolius	**Presence/ absence**	Species should be present. Widespread in northern section of the site, last full survey - 2005. Requires high water quality, shallow; species-rich drainage ditches; calcareous mesotrophic water, tends to disappear and reappear according to ditch cycle.
Oenanthe silaifolia	**Population**	No loss in population extent > 10%; no decline in the population size category. Mapping; count of functional individuals. species should be present in 20% of ditches surveyed.
Oenanthe silaifolia	**Presence/ absence**	Species should be present. Last know survey: Arun Valley Ditch Plant Survey and Invertebrate Survey (1997).

Waltham Brooks SSSI

Table A8.14 Site specific targets and measures for the wet grassland feature at Waltham Brooks SSSI. All sites were within unit 2.

Attribute/Feature	Target
Habitat extent	Currently, this attribute is not assessed within the MS for this SSSI, it will be added when the specification is revised in the near future (subject to Natural England resources). No net loss greater than 5%. No increases in area of these open communities beyond 35 ha. Habitat extent = circa 35 ha of fen, marsh, swamp, and grassland (estimated from 2000 aerial photograph and unit areas). Supporting habitat includes areas of open water, subject to change in extent.
Sward structure: bare ground	No more than 15% in May-early June or no more than 10% in mid-June-July. Record extent of bare ground (not rock) distributed through the sward, visible without disturbing the vegetation, e.g. from the seasonal effects of flooding. Record in period May - July (before hay cut in meadows). Also record sometimes in aftermath grazing period in hay meadows. Record extent of bare ground (not rock) distributed through the sward, visible without disturbing the vegetation, e.g. from the seasonal effects of flooding. Record in period May - July (before hay cut in meadows). Also record sometimes in aftermath grazing period in hay meadows.
Sward structure: average height	Site should have mosaic of vegetation structures: 70% of site should have sward structure that covers range from short (5cm) to longer (up to 100cm) (excluding *Juncus* spp.). Snipes require areas of taller vegetation (20-100cm) over wetter areas. Redshank, Shoveler, Teal requires patches medium to tall vegetation (20-50cm), Lapwing shorter vegetation (between 5 and 15cm), Wigeon <5cm throughout areas used for feeding.

Attribute/Feature	Target
	Record sward height in period May - July (before hay cut in meadows) for breeding birds, autumn/winter months for overwintering birds. Note: habitat suitability considerations are particularly important when the bird numbers are not present above threshold levels; as a way of identifying possible reasons why and appropriate measures and remedies that could be undertaken on the site. Should not be considered Unfavourable if not meeting targets. Sward height above upper target shows that habitat is not being managed sufficiently e.g., lack of or insufficient grazing or if below lower target, is being overgrazed.
Sward composition	Proposing to revise this target based on specialist advice. The current monitoring specification does not include the amended target, it will be added when the specification is revised in the near future (subject to Natural England resources). Abundance of seed-bearing plants around fresh waters: [>25% cover] of one or more target species, e.g. *Polygonum, Ranunculus, Eleocharis*. Non-breeding Teal.
Sward composition: negative indicator species	No species more than occasional throughout the sward or singly or together more than 5% cover. Record the frequency and % cover of 'negative indicator species') in mid-May - late July. Species include: *Anthriscus sylvestris, Cirsium arvense, Cirsium vulgare, Galium aparine, Plantago major, Pteridium aquilinum, Rumex crispus, Rumex obtusifolius, Senecio jacobaea, Urtica dioica*. Invasive species chosen to indicate problems of eutrophication and disturbance from various sources when outside target e.g., poaching, stock feeding. Record the frequency and % cover of all tree and scrub.

Attribute/Feature	Target
Water area/ depth	Large open areas of water (feeding, roosting) - One or more water body >10ha (Bewick's swan). Extensive shallow water - <25cm over >50% of water area (Teal, Shoveler), <1m over >50% of water area (Bewick's swan).

Table A8.15 Waltham Brooks SSSI condition assessment table of the Vascular Plant Assemblage based on 2021 surveys. Currently, the *Oenanthe silaifolia* feature is not assessed as a monitored interest feature within the MS for this SSSI, it will be added when the specification is revised in the near future (subject to Natural England resources).

Feature	Attribute	Target
Vascular Plant Assemblage	**Habitat extent**	Maintain the area of ditch systems that support invertebrate and Vascular Plant Assemblage - no reduction in length of ditches and any consequent fragmentation greater than 1%. Habitat extent = circa 1450m of ditch (estimated from 2000 aerial photograph and most recent OS 1:10,000 map).
Vascular Plant Assemblage	**Presence/ absence**	Species should be present, including the following species: Marsh Fern (*Thelypteris palustris*), Sharp-leaved Pondweed (*Potamogeton acutifolius*), Narrow-leaved Water-dropwort (*Oenanthe silaifolia*), Greater Water-parsnip (*Sium latifolium*), True Fox-sedge (*Carex vulpina*). Narrow-leaved Water-dropwort recorded on site (Lyons, 2012). All other species not recorded at Waltham for many years, but all (apart from *Carex vulpina*) have been recorded within the Arun Valley Ramsar either/or at Pulborough Brooks or Amberley Wild Brooks SSSIs. All other species not recorded at Waltham for many years, but all (apart from *Carex vulpina*) have been

		recorded within the Arun Valley Ramsar either/or at Pulborough Brooks or Amberley Wild Brooks SSSIs.
Vascular Plant Assemblage	**Population**	No loss in population extent > 10%; no decline in the population size category. Mapping; count of functional individual species.
Leersia oryzoides	**Population**	No loss in population extent > 10%; no decline in the population size category. Mapping; count of functional individual species – species should be present in 10% of ditches.
Leersia oryzoides	**Presence/ absence**	Species should be present. *L. oryzoides* not recorded on site since 1987.
Oenanthe silaifolia	**Population**	No loss in population extent > 10%; no decline in the population size category. Mapping; count of functional individuals.
Oenanthe silaifolia	**Presence/ absence**	Species should be present.

Appendix 9 – *Anisus vorticulus* survey methodology and targets: floodplain sites

There have been concentrated efforts made to better understand and monitor the SAC species on both Amberley Wild Brooks and Pulborough Brooks SSSIs, including but not limited to several historic and more recent surveys conducted by expert malacologists (specialists in molluscan identification and study). This collection of information and data has been reviewed for use in this condition assessment where appropriate and involves data from specific surveys undertaken between 2020-2022 (unpublished Natural England commissioned survey report by expert mollusc consultant Dr. Martin Willing, available on request). Below lists a timeline of the additional historical unpublished data and evidence that has been considered as part of this review.

Amberley Wild Brooks – Previous *A. vorticulus* surveys

1. **1996/97** – *A. vorticulus* surveys conducted at Amberley Wild Brooks SSSI (AWB) showed positive presence of the species in 16 ditches (Killeen & Willing, 1997 and Willing & Killeen, 1998).
2. **2004** – *A. vorticulus* survey conducted at AWB indicated significant loss of the species, compared to 1997/98 assessments.
3. **2005** – *A. vorticulus* survey conducted at AWB indicated that all previously recorded *A. vorticulus* sites within the western half of SAC had been lost. However, surveyors did record the presence of the species in an interlinked section of ditch towards the eastern end of SAC (Rackham).
4. **2005/08** – *A. vorticulus* surveys conducted at AWB recorded presence of the species in previously recorded interlinked ditch section at eastern end of SAC (Rackham). The surveyors also recorded throughout this period, no recovery of *A. vorticulus* populations in western end of SAC.
5. **2009/15** – *A. vorticulus* surveys recorded no presence of the species in any of the ditches previously inhabited within AWB, indicating potential on-site extinction.
6. **2015/16** – Most inclusive molluscan survey conducted at AWB (undertaken by Dr. Martin Willing) assessing a total of 142 ditches located within the SSSI. The results of this survey recorded a positive presence of the species (a few, small live specimens) in a small ditch section at the eastern end of SAC (Rackham).
7. **2021** – Commissioned *A. vorticulus* survey (undertaken by Dr Martin Willing) on all previously recorded inhabited ditch sections at AWB (n=16). The results of this survey recorded a low presence (a few, small live specimens) in previously recorded (2015/16) ditch section at the eastern end of SAC (Rackham).
8. **2022** – Secondary commissioned *A. vorticulus* survey (undertaken by Dr. Martin Willing) assessing another 16 ditch sections located immediately adjacent to the last positive *A. vorticulus* site, recorded in 2021 survey. The results of this survey reconfirmed the presence of the species at the previous years (2021) positive site and recorded a positive presence of *A. vorticulus* in three additional adjoining ditch

sections. There were no other positive recordings of the species at any other sites in AWB.

Pulborough Brooks – "Back From The Brink" overview

1. **2016/17** – Identification and implementation of management techniques on 20 ditch sections for use as *A. vorticulus* habitat throughout the "Back From The Brink*"* (BFTB) trial. This involved the managing of ditch vegetation as to be staggered cleared (n=6), half-width cleared (n=6), central cleared (n=4) and ends uncleared (n=4). In addition to this, further BFTB trials were to include the creation of one new ditch section, new adjoining ditch spurs (n=10) and identification of potential "receptor" ditches (n=5) in the southern part of the reserve.
2. **2018** – Initial BFTB *A. vorticulus* survey undertaken at Pulborough Brooks SSSI (PB), sampling for presence of the species in habitat managed ditches (n = 20), new ditch section (n=1) and adjoining spurs (n=10).
    a. All habitat managed ditches found to show presence of *A. vorticulus* at varying levels.
    b. New section of ditch found to have no recorded presence of *A. vorticulus*.
    c. Adjoining ditch spurs (n = 6 and 4, North and South) surveyed with low volumes of *A. vorticulus* recorded in one ditch section, dug during the survey and believed to have transported the species on breach of water. No other ditches recorded presence of *A. vorticulus*.
    d. Potential "receptor" ditches assessed and determined to be inappropriate habitat for *A. vorticulus*.
3. **2019** – Secondary BFTB *A. vorticulus* survey undertaken at PB, sampling for presence of the species in habitat managed ditches (n = 20), new ditch section (n=1) and adjoining spurs (n=10).
    a. All habitat managed ditches found to show presence of *A. vorticulus* at varying levels, observing a 57.03% increase in the number of the species captured from the previous year (2018).
    b. New section of ditch showed the presence of *A. vorticulus* colonising from each end.
    c. Adjoining ditch spurs (n = 6 and 4, North and South) surveyed with low volumes, 5 and 4 respectively being recorded in 2 sections (northern area of reserve). No other ditches recorded presence of *A. vorticulus.*
4. **2020** – Tertiary BFTB *A. vorticulus* survey undertaken at PB, sampling for presence of the species in habitat managed ditches (n = 20), new ditch section (n=1) and adjoining spurs (n=6).
    a. All habitat managed ditches found to show presence of *A. vorticulus* at varying levels, observing a 15.30% increase in the number of the species captured from the previous year (2019).
    b. New section of ditch showed a significant increase in the number of *A. vorticulus* present, recording > 800 specimens.
    c. Adjoining ditch spurs (n = 6, North) surveyed with low volumes of *A. vorticulus* being recorded, with the exception of one section which presented > 200 specimens. The spurs located in the southern area of the reserve were not surveyed.

   d. Total number of *A. vorticulus* recorded on site increased by 83.82% between 2018 and 2020.
5. **2020** – Quality assurance survey of *A. vorticulus* populations at PB, following the BFTB trial (Undertaken by Dr. Martin Willing), to sample for the presence of the species in a portion of management trial ditches (n=10).
   a. All except from one habitat managed ditch surveyed showed the presence of *A. vorticulus* in "good numbers".
   b. No consistent pattern was apparent between the presence of *A. vorticulus* within the cleared or uncleared surveyed sections.
   c. None of the management techniques undertaken throughout the BFTB trial were reported to have caused loss of *A. vorticulus* at PB.
   d. The majority of *A. vorticulus* recorded in this survey had shells < 2 mm (millimetre) diameter, indicating potential unreliability of "field-only" sampling.

Condition Assessment targets.

Currently, the SAC feature is not assessed as a monitored interest feature within the MS for Amberley Wild Brooks SSSI, it will be added when the specification is revised in the near future (subject to Natural England resources).

Table A9.1 Condition assessment table of the *Anisus vorticulus* interest feature based on 2021 surveys for the two relevant sites, Amberley Wild Brooks and Pulborough Brooks SSSIs.

Attribute/ Feature	Target
Population	Estimate of population size in each ditch. At densities between 5 to 100 per metre. No loss of >20% of baseline population density.
Presence/ absence	Species should be present, identification of species. This attribute is to be assessed through specialist survey - requires a licence.
Population extent	At least 10% of the ditches surveyed supported the snail. No decrease of >20% of baseline extent.
Successful regeneration	The presence of a range of juvenile and adult snails. At least the minimum number/proportion of juveniles should be recorded per adult (e.g., >2-5 juveniles per adults).

Appendix 10 – Water quality survey methodology: floodplain sites

Sampling determinants

There were three types of sampling undertaken as part of this programme:

- Calibration sampling – water samples sent off for laboratory analysis to obtain TN: Nitrate and TP:Phosphate ratios. This data is required to assess against CSMG nutrient targets within the relevant MSs for condition assessing the SSSIs. This sampling occurred across nine locations in total.
- Surveillance monitoring - using leased EA sondes, continuous monitoring measuring a range of water quality parameters was undertaken at two sites, one at Amberley Wild Brooks and one at Pulborough Brooks SSSIs (a third site at Waltham Brooks SSSI was not possible due to access, and health and safety issues). This data was accessible in real-time online. The data provides a comprehensive dataset and will help give an indication of diurnal and seasonal changes in water quality.
- In field test kit sampling – additional locations sampled (as well as the calibration site locations) using water quality handheld probes and test kits. The purpose being to investigate potential sources of water quality issues, pick up seasonal impact events and other land drainage issues that may be affecting aquatic environments within the SSSIs. This equipment was also used to sample the calibration sites to compare against the laboratory analysed data, for validation purposes of the in-field monitoring.

Calibration water quality sampling determinands analysed in-lab:

- TN - Total Nitrogen (the sum of nitrate, nitrite, ammonia, and organic nitrogen expressed as N)
- TP - Total Phosphorus (the sum of inorganic orthophosphate, polyphosphate, and organic phosphorus)

Water quality sampling determinands to be analysed using in field test kit equipment and/or the surveillance monitoring equipment (sonde):

- Phosphate
- Nitrate
- pH
- Conductivity (derived salinity)
- Temperature
- Dissolved Oxygen
- Turbidity

Timing

Locations were routinely (monthly) sampled, for 12 months. There was one calibration sample site per ditch, where samples were sent to the lab for TP and TN analysis (two ditches on Waltham Brooks SSSI, four ditches on Amberley Wild Brooks SSSI, and four ditches on Pulborough Brooks SSSI). This equates to 10 sites in total, more sites were sampled using in field equipment method. As explained above, surveillance monitoring was undertaken using a multi-parameter sonde at Amberley Wild Brooks and Pulborough Brooks SSSIs one site within each SSSI, for three months at a time (to ensure each site is monitored across all four seasons).

As reactive phosphorus is used at higher rates by macrophytes and algae in warmer months, it was essential to ensure that TP was calculated via lab analysis at regular intervals to ensure that the correct orthophosphate to Total P ratio is used. If measurements of orthophosphate are taken in summer and use TP readings from the winter to estimate TP, then we could underestimate the amount of phosphate in the system. Similarly, the amount of nitrogen stored in different forms fluctuates. Therefore, it would be necessary to take samples to record TN monthly. Surveys were undertaken from June 2021 to June 2022.

Sampling locations

All sample locations required permission for access and required risk assessment to ensure safe access and effective sampling was achieved. Health and safety considerations were included in training.

Key aspects in considering the locations for sampling were as follows, with a detailed overview of each sampling allocation given under the relevant SSSI:

- Presence of important interest features such as notable aquatic and riparian plant species and ditch invertebrate communities.
- Specifically, where the Little Whirlpool Ramshorn snail *Anisus vorticulus* is currently present and was historically present (excluding Waltham Brooks SSSI as it has never been found on this site).
- Connectivity to the river (Figure A10.1 below) and potential influences from groundwater.
- Existing water quality monitoring sample locations (sampling points from Environment Agency's water quality database and historical RSPB water quality program (on Pulborough Brooks SSSI only).
- Investigative sites, sampling to better understand potential issues (raised by landowners, land managers, in field sampling only).
- Year-round accessibility.

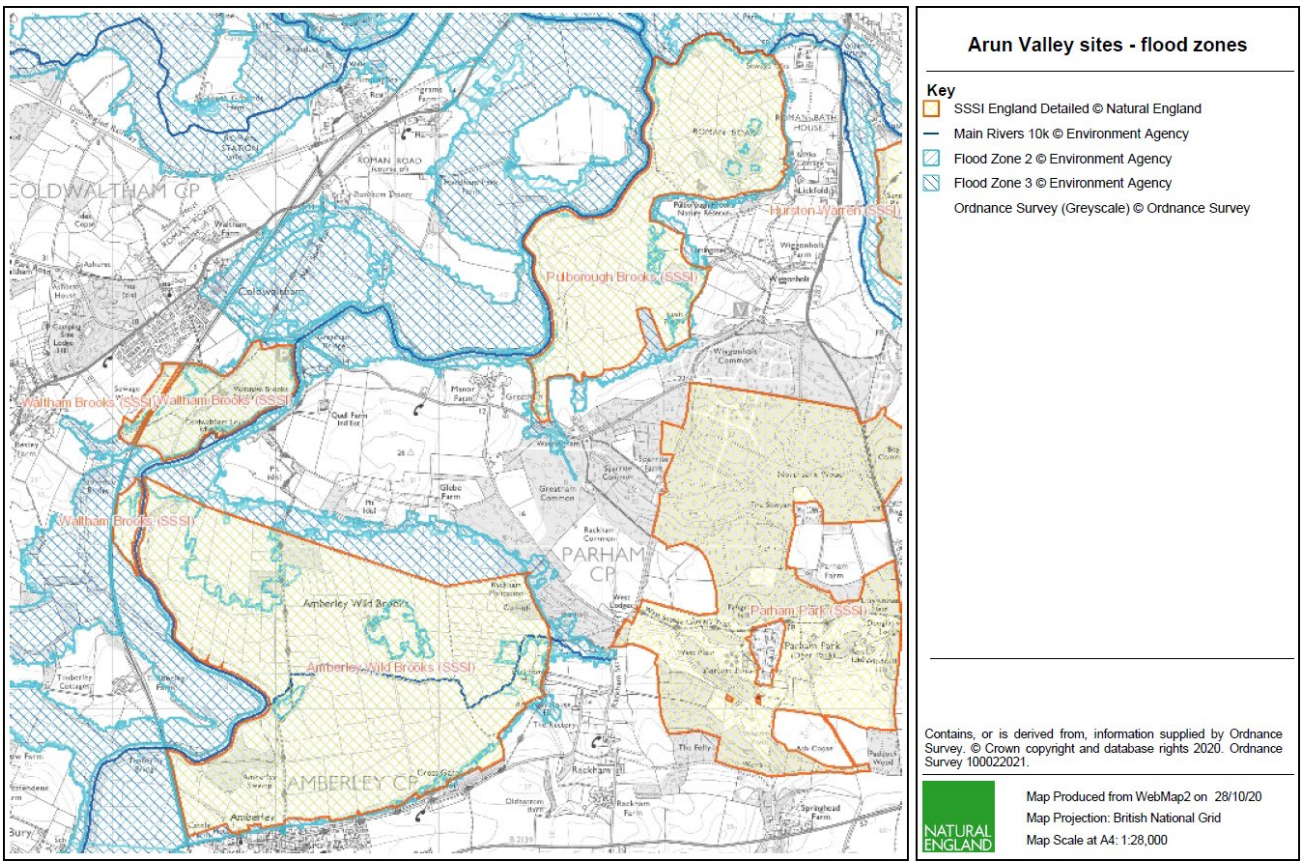


Figure A10.1 Map of Arun Valley designated sites (SSSI boundaries – Orange outline), detailing the main river network (River Arun – Dark Blue line) and the areas impacted as highlighted within the Environment Agency flood zones (Flood zones 2 and 3 – Light Blue diagonal lines). This is reflective of land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (Flood zone 2), and land having a 1 in 100 or greater annual probability of river flooding (Flood zone 3).

2021 Survey locations

Amberley Wild Brooks SSSI

Calibration sites

The sampling sites (A-D) indicated in Figure A10.2 required monthly water samples for lab testing plus monthly in field sampling using water quality equipment. Sampling sites were allocated in relation to the following:

- Site A – Recorded presence of key aquatic plant species: *Leersia oryzoides, Potamogeton natans, Potamogeton acutifolius, Potamogeton trichoides,* and *Persicaria minor* (Hicks *et al.,* 2019). Also included due to a historically inhabited location of SAC feature *Anisus vorticulus* (now absent from location, Willing, 2015; 2022*).

- Site B – Representative of central site conditions with inflows from the North and East. Recorded presence of key aquatic plant species: *Leersia oryzoides, Potamogeton acutifolius* and *Lemna minor* (Hicks *et al.,* 2019). Also included due to a historically inhabited location of SAC feature *Anisus vorticulus* (now absent from location, Willing, 2016; 2022*).
- Site C – Representative of marginal site conditions. An area possessing the greatest diversity of plant species (Hicks *et al.*, 2019). Also included due to a historically inhabited location of SAC feature *Anisus vorticulus* (still present in location, Willing, 2016; 2022*).
- Site D - Observed presence of key aquatic plant species *Potamogeton acutifolius* and *Lemna minor* (on-site allocation).

In field test kit sites

The sampling sites (1 and 2 – Blue dots) indicated in Figure A10.2 were the additional sites sampled monthly using in field sampling water quality equipment only. These in field sampling sites take into consideration potential water quality influences from groundwater and river connectivity. The purpose being to investigate potential sources of water quality issues, pick up seasonal impact events and other land drainage issues that may be affecting aquatic environments within the SSSIs.

Sonde sites

The first site for the sonde (Figure A10.2, Red star point 1) has provided data on any water quality influences relative to the upstream catchment likely to impact calibration site C (close to where *Anisus vorticulus* has been found present). The sonde was moved to the western end of the site (Middle Gutter, Figure A10.2, Red star point 2) to monitor any issues influenced by river connectivity. The sonde was moved again to a new location on the northern side of the Wild Brook lower sluice (Figure A10.2, Red star point 3) to pick up influences at the western end of the Wild Brook system that is connected to the wider site. The sonde was at Amberley Wild Brooks SSSI in the locations and dates indicated in Table A10.1.

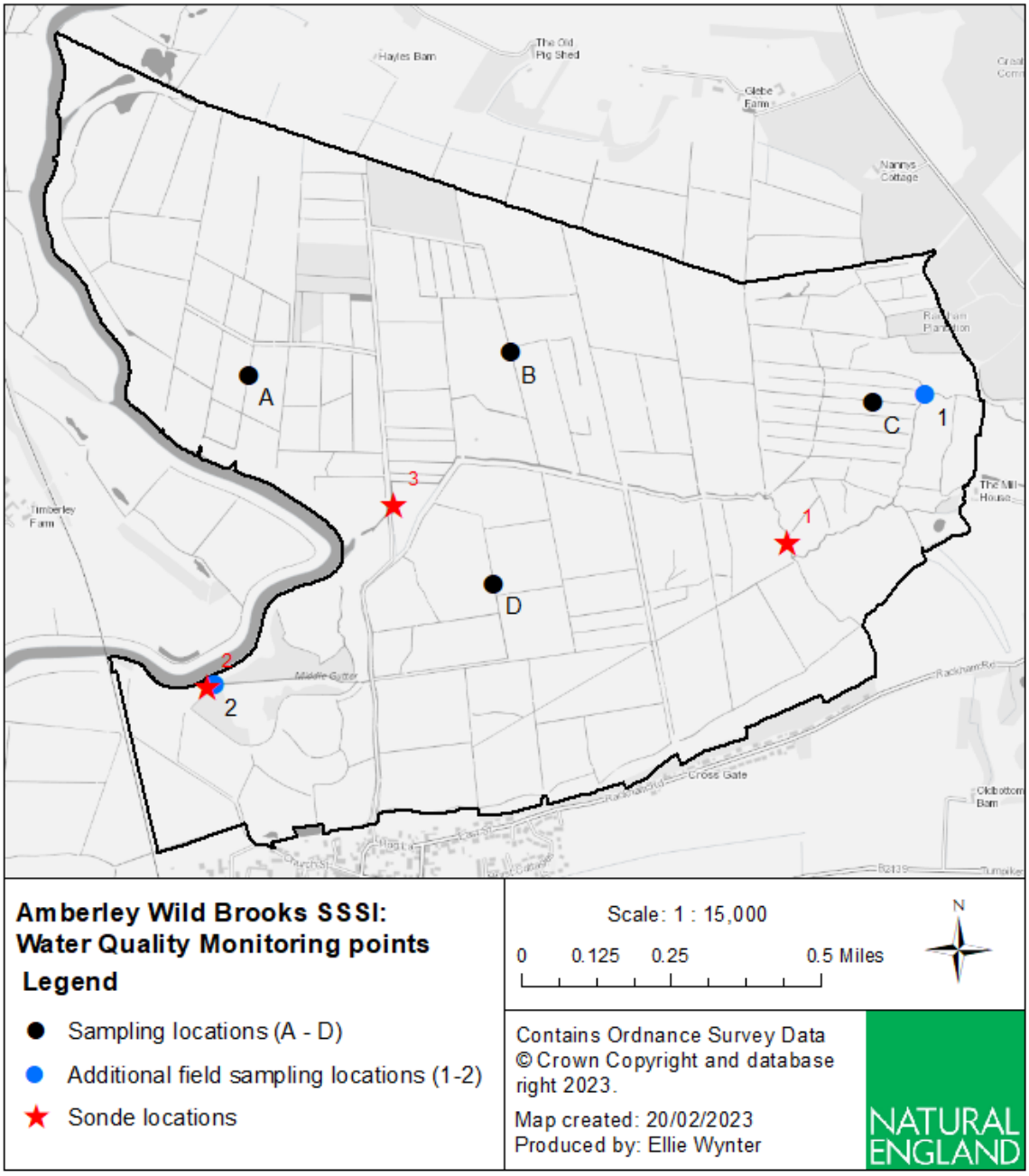


Figure A10.2 Map of Amberley Wild Brooks SSSI, detailing the approximate sampling locations used for water quality monitoring (Black dots were the sites that were fully monitored (with in-field equipment and samples taken for lab analysis), Blue dots were additional locations only surveyed using in-field equipment, and Red stars were locations utilising SONDE equipment.

Table A10.1 Grid reference locations and dates of deployment of the sonde at Amberley Wild Brooks SSSI.

Location (grid reference)	Dates deployed
TQ 04163 14052	06/09/21 – 24/10/21
TQ 02599 13666	17/01/22 – 11/03/2022
TQ 03100 14153	17/05/22 – 08/08/2022

Water quality data from the Natural England's 2021 surveys

Table A10.2 Determinants of water quality assessed at sampling sites at Amberley Wild Brooks SSSI.

Determinant	Site A	Site B	Site C	Site D	Site 1	Site 2
pH	7.22	7.09	7.18	6.94	Unassessed	Unassessed
Temp (°C)	12.94	13.27	12.93	12.72	11.89	12.88
Pressure (mmHg)	759.1	759.2	759.3	759.3	766.9	759.3
DO (%)	73.68	73.49	85.29	49.46	93.47	90.23
DO (mg/l)	7.85	7.83	9.05	5.37	10.36	9.61
Conductivity (SPC)	319.61	258.88	300.22	275.26	389.95	433.88
Salinity (psu)	0.153	0.124	0.139	0.135	0.175	0.211
Turbidity (NTU)	28.25	42.56	50.48	15.77	11.52	23.35
TP (mg/l)	0.106	0.220	0.149	0.186	Unassessed	Unassessed
Phosphate (mg/l)	0.0798	0.0893	0.0448	0.134	Unassessed	Unassessed
TN (mg/l)	0.866	1.655	0.917	1.921	Unassessed	Unassessed
Ammonia N (mg/l)	0.103	0.251	0.0763	0.0982	Unassessed	Unassessed
Nitrate as N (mg/l)	0.218	0.397	0.214	0.416	Unassessed	Unassessed

Nitrite as N (mg/l)	0.0113	0.0146	0.00666	0.00555	Unassessed	Unassessed

Pulborough Brooks SSSI

Calibration sites

The sampling sites A-D (Figure A10.3) required monthly water samples for lab testing plus monthly in field sampling using water quality equipment.

Sampling sites were allocated in relation to the following:

- Site A – Recorded presence of key aquatic plant species *Hydrocharis morsus-ranae, Lemna minor* and *Lemna trisulca*. Also included due to a historically inhabited location of SAC feature *Anisus vorticulus* (still present in location, Willing, 2015a; 2022).
- Site B – Representative of central northern site conditions with inflows from ditches in the North and East. Also included due to a historically inhabited location of SAC feature *Anisus vorticulus* (still present in location, Willing, 2015a; 2022).
- Site C – Close to the outfall in the south of the site, representative of on-site conditions relating to high water residency time and potential impacts resulting from increased connectivity with the River Arun. Recorded presence of plant species *Hydrocharis morsus-ranae, Lemna minor, Equisetum fluviatile and Myosotis scorpiodes.* Also included due to a historically inhabited location of SAC feature *Anisus vorticulus* (now absent from location, Willing, 2015a; 2022).
- Site D – Representative of marginal site conditions and previous surveys (Southern Water, 2019). Recorded presence of high diversity plant species.

In field test kit sites

The sampling sites (1 and 2 – Blue dots) indicated in Figure A10.3 were the additional sites sampled monthly using in field sampling water quality equipment only. These in field sampling sites take into consideration potential water quality influences from groundwater and river connectivity. The purpose being to investigate potential sources of water quality issues, pick up seasonal impact events and other land drainage issues that may be affecting aquatic environments within the SSSIs.

Sonde sites

The Red star site for the sonde (Figure A10.3) has provided data on any water quality influences from river connectivity. This location is the key outflow to the river for most of the watercourses in the north of the brooks. The sonde was at Pulborough Brooks SSSI in the one location, the dates are indicated in Table A10.3.

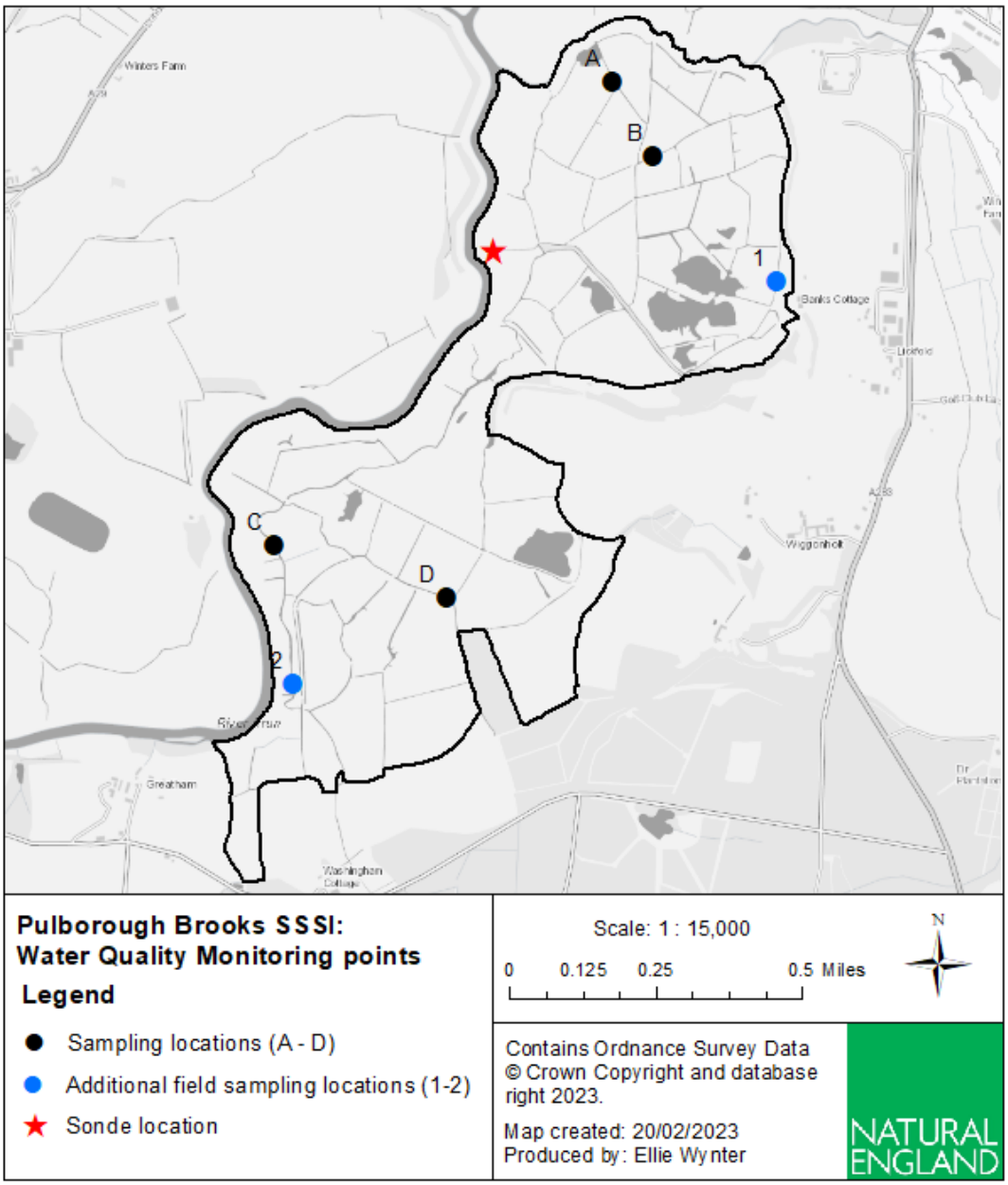


Figure A10.3 Map of Pulborough Brooks SSSI, detailing the approximate sampling locations used for water quality monitoring (Black dots were the sites that were fully monitored (with in-field equipment and samples taken for lab analysis), Blue dots were additional locations only surveyed using in-field equipment, and the Red star is the location utilising SONDE equipment.

Table A10.1 Grid reference locations and dates of deployment of the sonde at Pulborough Brooks SSSI.

Location (grid reference)	Dates deployed
TQ 05313 17500	21/06/21 – 24/08/21

TQ 05313 17500	28/10/21 – 17/01/22
TQ 05313 17500	11/03/2022 – 17/05/2022

Water quality data from Natural England's 2021 surveys

Table A10.2 Determinants of water quality assessed at sampling sites at Pulborough Brooks SSSI.

Determinant	Site A	Site B	Site C	Site D	Site 1	Site 2
pH	7.30	7.33	7.08	6.85	Unassessed	Unassessed
Temp (°C)	12.61	12.38	13.90	12.97	11.84	13.83
Pressure (mmHg)	761.93	761.98	761.77	761.79	762.11	760.8
DO (%)	47.79	58.82	72.98	57.55	55.17	73.71
DO (mg/l)	5.24	6.52	7.65	6.36	5.98	7.78
Conductivity (SPC)	352.12	368.47	229.39	175.60	327.92	287.58
Salinity (psu)	0.161	0.166	0.109	0.081	0.155	0.122
Turbidity (NTU)	9.53	7.48	42.47	37.84	19.79	55.18
TP (mg/l)	0.415	0.388	0.220	0.245	Unassessed	Unassessed
Phosphate (mg/l)	0.300	0.279	0.0952	0.179	Unassessed	Unassessed
TN (mg/l)	1.789	1.848	2.120	1.497	Unassessed	Unassessed
Ammonia N (mg/l)	0.175	0.119	0.167	0.107	Unassessed	Unassessed
Nitrate as N (mg/l)	0.255	0.238	0.759	0.408	Unassessed	Unassessed
Nitrite as N (mg/l)	0.00233	0.00970	0.0106	0.0574	Unassessed	Unassessed

Waltham Brooks SSSI

Calibration and in field test kit sites

As shown in Figure A10.4, sampling site A required monthly water samples for lab testing plus monthly in field sampling using water quality equipment. An additional site (B) was added to the monthly water samples for lab testing and in field sampling in October 2021, following high readings of nitrate during additional in field sampling in September 2021. This site is just south of the Coldwaltham Treatment Works discharge.

Sampling sites were allocated in relation to the following:

- Site A – Potential presence of *Oenanthe silaifolia* and *Euglesa pseudosphaerium* (Formerly *Pisidium pseudo-sphaerium*) as previously recorded in molluscan surveys by Southern Water (M. Willing, 2015a).
- Site B – Added part-way through assessment (October 2021) following high readings of nitrate during additional field sampling in September 2021.

The sonde was not used at Waltham Brooks SSSI as there were no suitable sites following discussion with Sussex Wildlife Trust (for access, health and safety reasons).

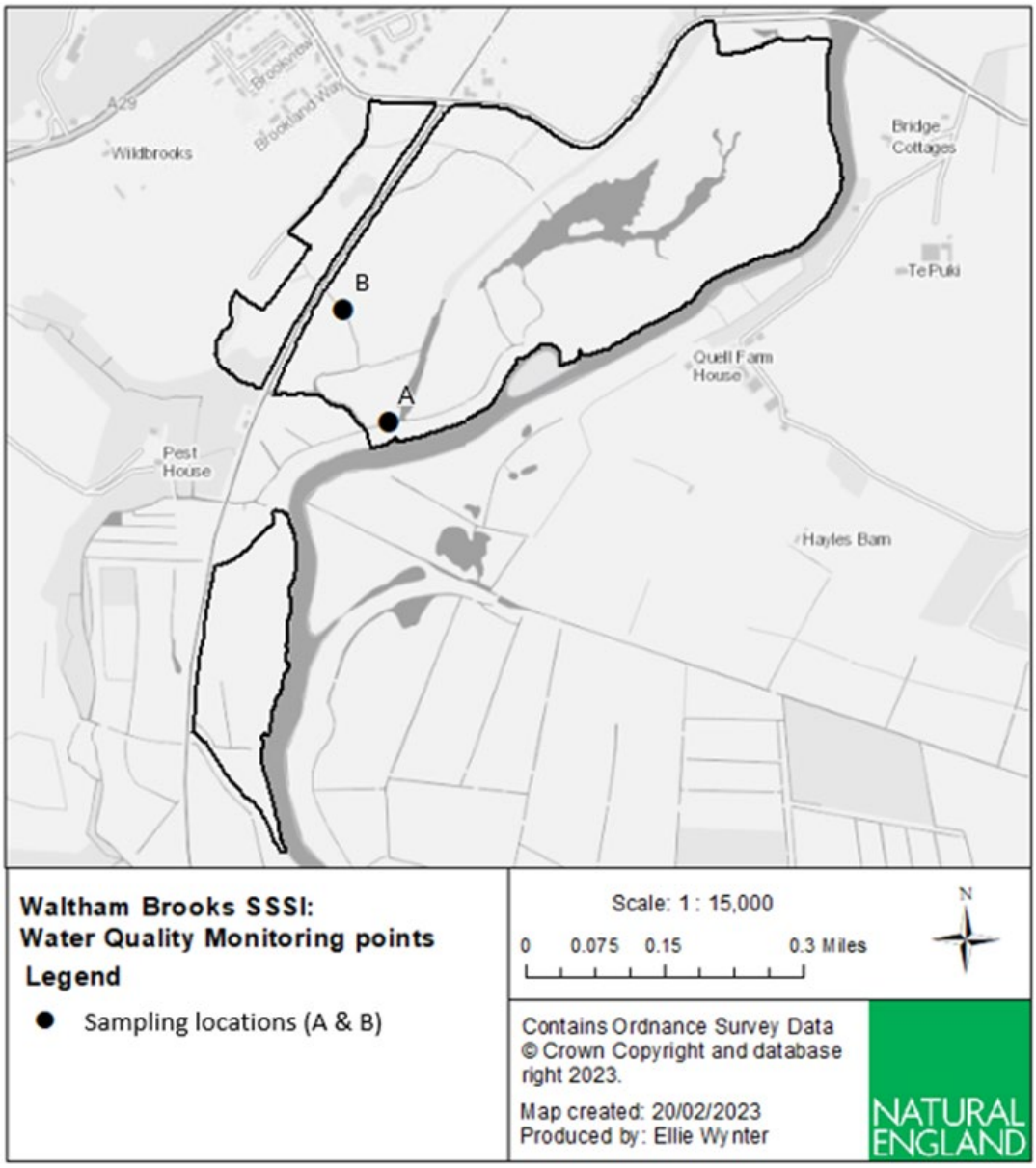


Figure A10.4 Map of Waltham Brooks SSSI, detailing the approximate sampling locations used for water quality monitoring (Black dots are the sites that were fully monitored with in-field equipment and samples taken for lab analysis).

Water quality data from Natural England's 2021 surveys

Table A10.3 Determinants of water quality assessed at sampling sites at Waltham Brooks SSSI.

Determinant	Site A	Site B
pH	7.11	7.14
Temp (°C)	12.95	13.39

Pressure (mmHg)	759.45	760.14
DO (%)	63.49	50.16
DO (mg/l)	7.380	5.196
Conductivity (SPC)	228.63	602.34
Salinity (psu)	0.109	0.286
Turbidity (NTU)	13.90	87.66
TP (mg/l)	0.132	5.722
Phosphate (mg/l)	0.057	0.363
TN (mg/l)	1.858	20.034
Ammonia N (mg/l)	0.117	3.807
Nitrate as N (mg/l)	1.029	15.638
Nitrite as N (mg/l)	0.159	0.441

Handling of samples and biosecurity

Attention was paid to:

- Labelling of sample bottles.
- Samples were collected within the recommended storage timeframe, stored on site within a refrigerator and transported by the lab's courier. Samples were kept cool for the duration of the sampling exercise via using cool boxes and ice packs.
- Sufficient volume of sample for laboratory analysis.
- No detergents or soap were used to clean any of the sampling equipment, as these often contain phosphorus.
- Due to movement of volunteers and equipment between sites, special attention was paid to biosecurity measures to prevent the transport of INNS and disease which would cause harm to biodiversity (biosecurity guidance - check, clean, dry).

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