PART 2

5. Biodiversity

5.1 Introduction

5.1.1 This chapter of the Environmental Statement (ES) assesses the likely significant effects of the Proposed Development with respect to biodiversity. The chapter should be read in conjunction with the development description presented in **Chapter 3: The Project and its Alternatives**, and with respect to relevant parts of other chapters (**Chapter 6: Noise and Vibration, Chapter 7: Geoenvironmental Impacts and Surface Water Quality**, and **Chapter 9: Long-term Radiological and Non-radiological Impacts**), where common receptors[1] have been considered and where there is an overlap or relationship. The biodiversity assessment has assessed the likely significant effects arising from the Proposed Development.

5.1.2 This chapter describes: the methodology used for the Environmental Impact Assessment (EIA) to assess the likely significant effects; provides an overview of the baseline conditions at the Trawsfynydd site; presents the datasets used to inform the assessment; identifies any likely significant effects; and describes how these will be mitigated, and if there will be any significant residual effects.

5.1.3 This chapter addresses Works Phase impacts only. Potential long-term impacts on ecology are addressed in **Chapter 9: Long-term Radiological and Non-radiological Impact**.

5.2 Relevant planning policy, legislation and technical guidance

5.2.1 **Appendix 5A** identifies the relevant national and local policy, legislation and guidance that has informed the scope of the assessment relevant to biodiversity.

5.3 Data gathering methodology

Study Area

5.3.1 In preparation of this assessment, the following Study Area for the collation of baseline data was established:

- European sites within 10km of the Application Site (see Figure 5.1);
- Sites of Special Scientific Interest (SSSIs) within 2km of the Application Site (see Figure 5.2);
- Other statutory and non-statutory sites designated for their nature conservation interest within 3km of the Application Site (see Figure 5.2);

[1] In line with Chartered Institute of Ecology and Environmental Management (CIEEM) best practice guidelines, in this chapter ‘receptors’ are referred to as ‘ecological features’ (habitats, species or ecosystems).

- Habitats of Principal Importance (HPI) for the purpose of maintaining and enhancing biodiversity in relation to Wales and other conservation-notable species recorded within 3km of the Application Site;
- Legally protected species and Species of Principal Importance (SPI) for the conservation of biodiversity, or other conservation-notable species recorded within 2km of the Application Site.
- Bat roosts within 5km of the Application Site, recorded within the last 10 years;
- Waterbodies within approximately 500m, identified from 1:10,000 and 1:25,000 scale Ordnance Survey (OS) maps[2], the Multi Agency Geographical Information for the Countryside (MAGIC) website[3] and aerial photography[4]. A distance of 500m is towards the upper limit of the distance that great crested newts (GCN) generally disperse from waterbodies where they breed[5], although this species more commonly remains within 250m of these waterbodies[6]; and
- Watercourses potentially affected by the Proposed Development.

Desk study

5.3.2 The principal data sources used to inform this chapter are reported in an ecological desk study and survey report prepared by Wood in 2020[7]. The scope of work detailed in this study comprised:

- A desk-based review of relevant existing ecological data undertaken in 2019. Sources for the desk study data are provided in Table 5-1. Additionally, reference was made to previous site surveys reported in:
  - British Nuclear Group (2007). Trawsfynydd Decommissioning Site and Maentwrog Power Station. Biodiversity Action Plan. 2007 – 2012[8];
  - Cartmel, S. (October 2008). Bat Survey at Trawsfynydd Nuclear Power Station, Gwynedd. Report for Magnox[9];

[2] Ordnance Survey (2016). *Ordnance Survey maps*. [Online] Available at: https://osmaps.ordnancesurvey.co.uk/ [Accessed 05 December 2023].
[3] Department for the Environment, Food and Rural Affairs (2022). *Magic Maps*. [Online] Available at: https://magic.defra.gov.uk/magicmap.aspx [Accessed 05 December 2023].
[4] Google (2022). *Google maps*. [Online] Available at: https://www.google.co.uk/maps [Accessed 05 December 2023].
[5] English Nature (2001). *Great Crested Newt Mitigation Guidelines*. [Online] Available at: https://webarchive.nationalarchives.gov.uk/ukgwa/20140605121141/http://publications.naturalengland.org.uk/publication/810429?category=30014 [Accessed 25 July 2024].
[6] Langton T; Beckett, C and Foster, J (2001). *Great Crested Newt Conservation Handbook*. [Online] Available at: https://www.froglife.org/wp-content/uploads/2013/06/GCN-Conservation-Handbook_compressed.pdf [Accessed 25 July 2024].
[7] Wood (2020). *Decommissioning of Trawsfynydd site. Desk Study (Ecology), Phase 1 Habitat Survey and Preliminary Bat Roost Assessment*. Report for Magnox. Wood; Newcastle.
[8] British Nuclear Group (2007). *Trawsfynydd Decommissioning Site and Maentwrog Power Station. Biodiversity Action Plan. 2007 – 2012*. British Nuclear Group; Warrington.
[9] Cartmel, S. (2008). *Bat Survey at Trawsfynydd Nuclear Power Station, Gwynedd*. Report for Magnox

- Eryri Ecology (2011). Trawsfynydd Otter and Phase 1 Habitat Survey. Report for Magnox[10];
- Cartmel, S. (October 2013). Bat Survey at Trawsfynydd Nuclear Power Station, Gwynedd. Report for Magnox[11];
- Cartmel, S. (November 2013). Survey of a small area of Woodland at Trawsfynydd Nuclear Power Station. Report for Magnox[12];
- Cartmel, S. (December 2021). Trawsfynydd Power Station Ecology Surveys 2021. Report for Magnox[13]; and
- Middlemarch (2022). Preliminary Ecological Appraisal. Trawsfynydd, Gwynedd. Report for Magnox and Mitie[14].

- A Phase 1 Habitat Survey of the Trawsfynydd site and a 50m buffer beyond the Application Site was undertaken in July 2019 (see Figure 5.3). As the standard Phase 1 Habitat survey methodology is largely concerned with vegetation communities only, the survey was 'extended' to include:
  - preliminary searches for evidence of protected or conservation-notable species/species-groups (including dormice; bats; GCN; badger; water voles; reptiles; and otters), and for habitats or features likely to support them if direct evidence is absent; and
  - the identification of other constraints (e.g. non-native invasive plant species) that may be present.
- A Preliminary Bat Roost Assessment of buildings at the Trawsfynydd site undertaken in June and July 2019.
  - In accordance with good practice[15], the buildings and trees were categorised according to their suitability for roosting bats.

Table 5-1 Sources of desk study information

Aspect	Data	Sources
Statutory sites	• Boundaries • Citations	• MAGIC[3] • Joint Nature Conservation Committee (JNCC)[16]

[10] Eryri Ecology (2011). *Trawsfynydd Otter and Phase 1 Habitat Survey*. Report for Magnox. Eyri Ecology; Snowdonia.
[11] Cartmel, S. (2013). *Bat Survey at Trawsfynydd Nuclear Power Station, Gwynedd*. Report for Magnox
[12] Cartmel, S. (2013). *Survey of a small area of Woodland at Trawsfynydd Nuclear Power Station*. Report for Magnox
[13] Cartmel, S. (2021). *Trawsfynydd Power Station Ecology Surveys 2021*. Report for Magnox
[14] Middlemarch (2022). *Preliminary Ecological Appraisal. Trawsfynydd, Gwynedd*. Report for Magnox and Mitie
[15] Collins, J (2016) *Bat Surveys for Professional Ecologists. Good Practice Guidelines (3rd Edition)*. Bat Conservation Trust, London.
[16] JNCC (2019). *UK Protected Areas*. [Online] Available at: https://jncc.gov.uk/our-work/uk-protected-areas/ [Accessed 25 July 2024].

Aspect	Data	Sources
		• Natural Resources Wales (NRW)[17]
Non-statutory sites	• Boundaries • Citations	• Local Biodiversity Records Centre (COFNOD – North West Wales Environmental Information Service.) – June 2019
Other sites and habitats	• Boundaries • Ancient woodland • HPI	• MAGIC[3] • Local Biodiversity Records Centre (COFNOD – North West Wales Environmental Information Service.) – June 2019 • Wales Biodiversity Partnership – July 2019[18]
Species records	• Location data	• Local Biodiversity Records Centre (COFNOD) – June 2019 • Royal Society for the Protection of Birds (RSPB) – August 2019 • British Ornithology Trust (BTO)* (Raptor Study Group and Barn Owl Data) – June 2019 • NRW (Barn Owl Data) – June 2019

Note: BTO* see 'Additional Information' Section 2.2.2[19]– single barn owl record.

Surveys

5.3.3 Surveys undertaken to inform the assessment comprised the following:

- Woodland survey;
- Bat surveys; and
- Aquatic surveys.

5.3.4 The surveys are reported in WSP (2023): Trawsfynydd Ponds Complex Demolition and Disposal EIA Report of 2022 Biodiversity Studies (see **Appendix 5B**).

[17] Natural Resources Wales (2022). *Lle A Geo-Portal for Wales*. [Online] Available at: http://lle.gov.wales/home [Accessed 05 December 2023].
[18] Wales Biodiversity Partnership (2019*). Environment (Wales) Act*. [Online] Available at: https://www.biodiversitywales.org.uk/Environment-Wales-Act [Accessed 25 July 2024].
[19] See section 2.2.2 BTO (2019). *Raptor Study Group and Barn Owl Data*.

Woodland survey

5.3.5 A botanical survey of the woodland within, immediately surrounding, and up to 50m from the Trawsfynydd site was undertaken in June 2022. The objective of the survey was to determine the National Vegetation Classification (NVC) community of the woodland present and to assess whether the woodland is representative of a Section 7 HPI under *The Environment (Wales) Act 2016*[20] (see **Appendix 5A**).

Bat survey

5.3.6 A series of bat surveys, comprising building, transect and static detector surveys were undertaken on and around the Trawsfynydd site in 2021. The 2021 surveys identified a bat flight path along the south-western edge of the Application Site which has not been previously assessed. Therefore, given the proximity of this flight path to the Proposed Development, two static bat detectors (SM4 full spectrum) were placed on the south-western edge of the Application Site boundary/woodland edge to determine the value of this flight path for bats and to inform any necessary lighting mitigation proposals.

5.3.7 The detectors were placed for a minimum of 5 nights per month between June and October 2022. Survey dates are presented below and locations illustrated on **Figure 3.1** in **Appendix 5B**:

- 8 – 12 June 2022;
- 25 – 29 July 2022;
- 1 – 5 August 2022;
- 5 - 12 September 2022; and
- 3 October 2022.

5.3.8 The data collected have been analysed using BatExplorer PRO software.

Aquatic surveys

5.3.9 The Gwylan stream and Afon Tafarn-helyg, which both flow into the Afon Dwyryd, are identified as receptors in **Chapter 7: Geoenvironmental Impacts and Surface Water Quality**. Aquatic surveys of the watercourses immediately surrounding the Proposed Development have therefore been undertaken.

5.3.10 A scoping survey was undertaken on 15 December 2021 to define appropriate survey locations for each survey type, which comprise:

- River habitat survey (RHS);
- Aquatic macroinvertebrate survey; and
- Aquatic macrophyte survey.

5.3.11 Wherever possible the locations for each survey were coincident.

5.3.12 The survey methods for the individual survey types are presented in detail in **Appendix 5B** but are summarised in the following sections.

[20] *Environment (Wales) Act 2016*. [Online] Available at: https://www.legislation.gov.uk/anaw/2016/3/contents/enacted [Accessed 25 July 2024].

River habitat survey

5.3.13 A total of three RHS surveys were undertaken in May 2022. All surveys were undertaken by an accredited RHS surveyor, following the methodology described in the RHS guidance manual[21]. The survey locations are presented in **Table 5-2** and are indicated on **Figure 4.1** of **Appendix 5B.**

5.3.14 Each survey was carried out over a 500m stretch (unless indicated otherwise) and recorded the physical attributes of the banks and channel (such as material present, modification, flow types) and also information about the riparian habitat.

5.3.15 Habitat Quality Assessment (HQA) scores and Habitat Modification Scores (HMS) have been calculated and are presented in **Appendix 5B**.

Table 5-2 Approximate coordinates for RHS sampling stations

Sample Station	Start Coordinate	Stop Coordinate
RHS1	SH689385	SH689387
RHS2	SH693383	SH693382
RHS3	SH688384	SH687382

Aquatic macroinvertebrates

5.3.16 A single three-minute kick / sweep sample was collected at each site of the six sample sites (see **Table 5-3** and **Figure 4.1** of **Appendix 5B**) following the standard protocol for collecting and analysing macroinvertebrate samples[22]. Each kick / sweep sample encompassed all the in-stream habitats present at the sampling location in proportion to their occurrence over the three-minutes sampling time. Additionally, a further one-minute hand search of submerged stones, woody debris, plants, tree roots and other structures was performed to capture any macroinvertebrates that might have evaded the kick / sweep sample. Habitat metrics were also recorded in order to calculate biotic indices.

Table 5-3 Approximate coordinates for macroinvertebrate sampling stations

Sample Station	Coordinate
MI1	SH688383
MI2	SH689385
MI3	SH689386
MI4	SH689387
MI5	SH693383
MI6	SH693383

5.3.17 Samples were collected in spring (May) and autumn (September) 2022, as for the standard approach taken by Environment Agency[21].

[21] Environment Agency, (2003). *River Habitat Survey in Britain and Ireland*. [Online] Available at: https://www.riverhabitatsurvey.org/wp-content/uploads/2018/04/RHS_Manual_2003_V1_opt.pdf [Accessed 25 July 2024].

[22] WFD- United Kingdom Technical Advisory Group (UKTAG) (2021). *UKTAG River Assessment Method Benthic Invertebrate Fauna*. [Online] Available at: http://wfduk.org/sites/default/files/River%20Invertebrates%20WHPT%20UKTAG%20Method%20Statement%20-%20updated%20May%202021.pdf [Accessed 25 July 2024].

5.3.18 Samples were preserved in 90 percent Industrial Methylated Spirits solution at the Trawsfynydd site. All macroinvertebrate samples were then processed and identified to species level.

5.3.19 A series of biotic indices were calculated from the data collected. These include:

- **Biological Monitoring Working Party (BMWP) indices.** BMWP score and Number of scoring BMWP Taxa (NTAXA) are indices of overall biological quality using macroinvertebrate families. Average Score Per Taxon (ASPT) is a biotic index of organic pollution.
- **Walley Hawkes Paisley Trigg (WHPT) ASPT and WHPT NTAXA indices**. The WHPT method[23] is an index of overall biological quality using macroinvertebrates similar to the BMWP index. WHPT ASPT responds to the same environmental pressures as BMWP, though unlike BMWP it is abundance-sensitive and it can detect moderate changes in water quality that would previously have been undetected. WHPT NTAXA also responds to the same environmental pressures as BMWP NTAXA. WHPT ASPT and WHPT NTAXA are the current indices used to determine Water Framework Directive (WFD) status during classifications for macroinvertebrates and are useful for distinguishing the direct effects of hydrological modification from the effects of water pollution.
- **Lotic Invertebrate index for Flow Evaluation (LIFE)[24]**. LIFE is the average of abundance-weighted flow groups that indicate the preferences of each taxon for higher water velocities and clean gravel/cobble substrata or slow/still water velocities and finer substrata. LIFE is used to index the effect of flow variations on macroinvertebrate communities and is calculated at both family (LIFE_F) and species level (LIFE_S).
- **Proportion of Sediment-sensitive Invertebrates** (**PSI**[25]). The PSI index gives further insight into potential impacts associated with fine sediment inputs and is considered potentially useful in describing the baseline condition of the river.

Aquatic macrophytes

5.3.20 Surveys were undertaken following the LEAFPACS approach developed for and adopted in the assessment of macrophytes for WFD[22].

5.3.21 Each survey section (see **Table 5-4** and **Figure 4.1** in **Appendix 5B**) covered 100m stretches of the target streams and aquatic macrophytes and macroalgae within the zone flooded for at least 50 percent of the year were recorded with their abundance scored on a 10-point scale. As this upper limit of survey is usually quite difficult to estimate, recording often extended higher up the bank than this. As a result, a significant number of non-

[23] UKTAG (2021). *Invertebrates (General Degradation) Walley Hawkes Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT).* Water Framework Directive – United Kingdom Technical Advisory Group (WFD-UKTAG).
[24] Extence. C, Balbi. D. M and Chadd. R (1999). *River Flow Indexing Using British Benthic Macroinvertebrates: A Framework for Setting Hydroecological Objectives*, Regulated Rivers Research & Management 15(6), 545-574.
[25] Extence. C, A, Chadd. R. P, England. J, Dunbar. M. J, Wood. P. J and Taylor. E. D (2011). *The Assessment of Fine Sediment Accumulation in Rivers Using Macro-Invertebrate*, River Research & Applications 29(1), 17-55.

aquatic species have been included in the lists. However, this does not affect the LEAFPACS scores as these are based on a shortlist of strictly aquatic species.

Table 5-4 Approximate coordinates for RHS sampling stations

Sample Station	Start Coordinate	Stop Coordinate
MP1	SH693383	SH693382
MP2	SH689385	SH689386
MP3	SH688386	SH689387
MP4	SH689387	SH689387
MP5	SH688383	SH687382

5.3.22 Several scores are used in the LEAFPACS method to summarise the macrophyte data. These comprise River Macrophyte Nutrient Index (RMNI), Number of aquatic taxa (N_ATAXA-R), Number of functional groups (N_RFG) and Algal cover (ALG-COV). Additionally, although it is not one of the standard LEAFPACS metrics the cover of macrophytes, including algae, was also recorded.

5.3.23 A number of physical parameters were also recorded. Unlike the plant survey, these were assessed in relation to the actual water level at the time of survey.

5.4 Baseline conditions

Current baseline

5.4.1 The ecological information for the Trawsfynydd site and current baseline is summarised in **Table 5-5**.

Table 5-5 Identified ecological features and summary of baseline condition

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
Statutory sites	Desk study	July 2019	There are six statutory biodiversity sites of international importance (European Sites) within 10km, including five Special Areas of Conservation (SAC) and one Special Protection Area (SPA). There are 15 statutory biodiversity sites of national or local importance within 5km, including 9 SSSIs and 6 National Nature Reserves (NNRs). The nearest designated site is a component of the Meirionnydd Oakwoods and Bat Sites SAC, located approximately 0.9km south-west.
Non-statutory sites	Desk study	July 2019	There are no non-statutory biodiversity sites within 3km.
Notable habitats and plant species	Desk study	July 2019	There are 11 different HPI for the purpose of maintaining and enhancing biodiversity in relation to Wales either within the Study Area or within 3km. Additionally, there are 109 Ancient Woodland Inventory (AWI) Sites within 3km of the Trawsfynydd site, including Ancient Semi-Natural Woodland Sites (57), Restored Ancient Woodland Sites (23), Plantation on Ancient Woodland

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
			Sites (25) and Ancient Woodland Site of Unknown Category (4). Two of these are within the Trawsfynydd site: Plantation on an Ancient Woodland Site to the north-west; and Ancient Semi Natural Woodland Site to the east of the access track, near to the A470. A further Ancient Semi-Natural Woodland site is located within 31m of the Trawsfynydd site – east of the A470. The desk study returned 33 records of notable plant species comprising one tree, two flowering plants, four mosses, eight liverworts and 18 lichens.
Phase 1 Habitat survey	Extended Phase 1 Habitat survey	July 2019	Fifteen habitat types were defined within the Phase 1 habitat survey area. Of these, six were assessed as being potential Section 7 habitats[31]: • Broadleaved woodland – semi natural (Wet woodland); • Broadleaved woodland – plantation (Wet woodland); • Dwarf shrub heath – acid (upland heathland); • Marshy grassland (upland flushes, fens and swamps); • Standing water (dystrophic lakes); and • Running water (rivers).

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
			Broadleaved woodland is the only potential Section 7 habitat present within the Trawsfynydd site, although no broadleaved woodland is present within the Application Site. The results of the assessment of woodland habitat in the context of HPI status are presented below. Running water is noted as present outside the Application Site.
Woodland National Vegetation Classification	Report of 2022 Biodiversity Studies: NVC Survey	2022	The woodland communities do not qualify as HPI. The woodland parcels surveyed exhibited characteristics in keeping with plantation woodland.
Bats	Desk study/ Extended Phase 1 Habitat survey and Preliminary Bat Roost Assessment Trawsfynydd Power Station Ecology Surveys	July 2019 2021	The Trawsfynydd site is situated between constituent parts of Meirionydd Oakwoods and Bat Sites SAC and is located approximately 0.9km from the nearest component of the SAC, which is primarily designated for lesser horseshoe bats. A total of 10 bat species have been recorded within 5km of the Trawsfynydd site: soprano pipistrelle, common pipistrelle, brown long-eared, whiskered, Brandt's, Natterer's, Daubenton's, greater horseshoe, lesser horseshoe and noctule. The Study Area also has the

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
	Report of 2022 Biodiversity Studies: Static detector surveys (**Appendix 5B**)	2022	potential to support Nathusius' pipistrelle. There are a total of 76 bat roost records within 5km of the Trawsfynydd site (within the last 10 years). The Preliminary Roost Assessment undertaken of the buildings on and around the Trawsfynydd site in 2019 concluded that three main buildings within the Ponds Complex (B8, B13 and B22 – see **Figure 5.3**) had very low roost suitability. The other two small buildings (B14 and B15 – see **Figure 5.3**) had negligible roost suitability. Bat activity surveys in 2021, using both manual and static detectors (located north and west of the Proposed Development), recorded 8 species, with numbers dominated by common and soprano pipistrelle and Myotis sp. Very low numbers of lesser horseshoe bats, that may be associated with nearby SAC sites, were recorded. The buildings on Trawsfynydd site were subject to Preliminary Roost Assessment in 2019 (as indicated above), re-checked in 2021, and then emergence surveys were

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
			undertaken based on the roost 2021 roost suitability. No bat roosts were identified in any of the buildings on the Trawsfynydd site. Additionally, it was noted in 2021 that the two reactor buildings (B10 and B11) were classed as high roost potential - based on possible access points and on the fact that individual dead bats have been found in the building in previous years. The circular holes present and all other vents were found on inspection to have narrow gauge mesh fitted internally which would prevent any wildlife getting into the buildings. All windows are sealed and gaps have been closed up since bat surveys in 2008 and 2013. The reactor buildings have over the last few years had all windows and doors closed up and cracks filled in, such that there is now no apparent route for bats to gain access. Internally the reactor buildings are dark and cold and do not offer suitable conditions for summer roosting bats. However, there is a soprano pipistrelle maternity roost in the Pump House, which is approximately 200m from the Application Site

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
			boundary. Within this roost a maximum of 149 bats were counted. Additionally, a small soprano pipistrelle roost was identified in the Old Conference Centre, which is approximately 350m from the Application Site. There are no trees within the Application Site boundary that have potential roost features. Based on results from five months of survey (June-October 2022 inclusive), bats do not make extensive use of the full extent of the woodland edge immediately adjacent to the hardstanding adjacent to the ponds complex as a flightline. A significantly greater number of bats were present a few metres back into the woodland from the woodland boundary edge, therefore exposure to light spill from security lighting at the Trawsfynydd Site is not expected to be significant. Lesser horseshoe bats were present in very low numbers.
Birds	Desk study/ extended Phase 1 Habitat survey	July 2019	The desk study identified at least 32 bird species within 3km of the Trawsfynydd site. A peregrine perched on the northern reactor

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
	Trawsfynydd Power Station Ecology Surveys Applicant feedback 2024	2021 -	building was recorded in August 2008, after the breeding season, however, it was not known whether the reactor buildings were being used as a breeding site at that time[26]. Ospreys have previously been seen over Llyn Trawsfynydd[27] which forms the southern edge of the Trawsfynydd site. On 27 June 2019 BTO provided a single record of a barn owl approximately 0.5km away. A breeding bird survey in 2021 recorded a total of 48 species within 100m of the Trawsfynydd site; 41 of these were breeding within the Study Area, although none were nesting on or in any of the buildings of the Ponds Complex. Nine species that were recorded breeding are noted on the Red list of Birds of Conservation Concern[28]. A 2021 raptor survey found peregrine to be irregular visitors to the Trawsfynydd site, with a pair

[26] Cartmel, S. (October, 2008). *Bat Survey at Trawsfynydd Nuclear Power Station, Gwynedd*.
[27] Eryri Ecology (2011). *Trawsfynydd Otter and Phase 1 Habitat Survey*.
[28] Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D., and Win I. (2021). *The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain*. British Birds 114: 723-747.

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
			seen over the Trawsfynydd site on one occasion in April, but thereafter the male of a pair occasionally using the reactor building only as a perch to hunt from. Osprey, buzzards and a sparrowhawk were also recorded over the Trawsfynydd site. However, none of these were recorded nesting on or near to the Ponds Complex. Osprey has nested on the Trawsfynydd lakeside in 2023, however, the nest site is >1km from the Application Site and is hidden from it by an intervening hill.
Badger	Desk study/ extended Phase 1 Habitat survey Trawsfynydd Power Station Ecology Surveys 2021	July 2019 2021	The desk study returned 23 records for badger within 3km of the Trawsfynydd site, with the nearest record being at a distance of 0.17km. No badger setts or evidence of badger activity was found within the Trawsfynydd site and 50m buffer during the extended Phase 1 Habitat surveys. However, badger is a widespread mobile species that could move into the Trawsfynydd site or buffer areas at any time. In 2021 a survey found no evidence of badger within the Trawsfynydd site, although

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
			two latrines were found off-site, suggesting presence of a sett in the vicinity.
Reptiles	Desk study/ extended Phase 1 Habitat survey Trawsfynydd Power Station Ecology Surveys	July 2019 2021	The desk study returned records for common lizard, grass snake and slow-worm within 3km of the Trawsfynydd site. There are anecdotal records (staff) of grass snake, adder, and slow worm on the edge of the broadleaved woodland surrounding the Trawsfynydd site. No evidence of reptile presence was noted. Limited reptile habitat is present within the Application Site, which comprises predominantly buildings, hardstanding and scrub. It is noted, however, that the ponds complex itself comprises buildings and hardstanding only. Surveys in the vicinity of the Proposed Development in 2021 found no reptiles were present.
Great crested newt	Desk study/ extended Phase 1 Habitat survey	July 2019	The desk study returned no records for GCN within 3km of the Application Site. Llyn Trawsfynydd is run as a commercial leisure fishery and is likely to be unsuitable for GCN. No other ponds were identified within 500m of the Application Site.

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
			GCNs are not considered to be present within the vicinity of the access road or the Trawsfynydd site.
Otter	Desk study/ extended Phase 1 Habitat survey Trawsfynydd Power Station Ecology Surveys	July 2019 2021	The desk study returned 35 records of otter within 3km of the Trawsfynydd site, including records of otter activity within and near to the Application Site and including a holt, located on the edge of the Llyn Trawsfynydd, approximately 230m from the Application Site (record from 2002). Although no evidence of this species was observed during the 2019 survey, and there is no suitable habitat within the Application Site itself, otter sightings have been made by staff at Trawsfynydd site in the car park area to the south of the security lodge and the 2021 survey recorded spraints around Llyn Trawsfynydd.
Water vole	Desk study/ extended Phase 1 Habitat survey	July 2019	The desk study returned three records of water vole within 3km of the Trawsfynydd site, nearest record 0.19km. No evidence of water vole was observed during the survey. The watercourse habitats within 50m of

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
			the Trawsfynydd site are likely to be unsuitable for water vole, providing limited burrowing habitat due to the presence of rock outcrops, limited depth and width of fast flowing water; and limited cover of riparian vegetation. Similarly, the wetland vegetation is generally absent around Llyn Trawsfynydd, which mainly comprise of rocky shoreline. Water voles are not considered to be present within the vicinity of the access road or the Trawsfynydd site.
Dormouse	Desk study/ extended Phase 1 Habitat survey	July 2019	There are no records of dormouse within 3km of the Trawsfynydd site. The broadleaved woodland and scrub within and surrounding the Trawsfynydd site are potentially suitable habitat for dormouse, however, it is unknown whether the species is present in the area as this species has a restricted distribution in within north-west Wales. No evidence of this species was observed during the 2019 survey, and there are no suitable habitats within the Application Site itself. This species is therefore considered absent.
Pine marten	Desk study/ extended Phase 1 Habitat survey	July 2019	The desk study revealed no records of pine marten within 3km of the

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
			Trawsfynydd site, however there is an anecdotal record of pine marten from the edge of the broadleaved woodland along the boundary of the Trawsfynydd site. The habitat within the Application Site itself, which mostly comprises buildings and hardstanding, are considered unlikely to support pine marten.
Red squirrel	Desk study/ extended Phase 1 Habitat survey	July 2019	There are no records of red squirrel within 3km of the Trawsfynydd site. However, site staff have reported a red squirrel within broadleaved woodland adjacent to the hardstanding area of the Trawsfynydd site. The habitat surrounding the Trawsfynydd site includes broadleaved woodland, which is suitable for this species. The habitat within the Application Site itself, which mostly comprises buildings and hardstanding, are considered unlikely to support red squirrel.
Terrestrial invertebrates	Desk study/ extended Phase 1 Habitat survey	July 2019	The desk study revealed 11 records of Section 7[31] terrestrial invertebrate species within 3km of the Trawsfynydd site. The habitat within the Application Site itself, which mostly comprises

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
			buildings and hardstanding, are considered unlikely to support notable terrestrial invertebrate species.
Other conservation-notable species	Desk study/ extended Phase 1 Habitat survey	March 2021	Records for Section 7[31] species including hedgehog, brown hare, polecat, stoat, weasel, palmate newt, toad and frog were returned for the 3km Study Area from the Trawsfynydd site. However, none of the species were recorded on-site during the survey and the Trawsfynydd site itself is unlikely to be used by these species due to the absence of suitable habitat. The other conservation-notable species listed are therefore not considered further in this chapter.
Invasive non-native species	Desk study/ extended Phase 1 Habitat survey	July 2019	Legally controlled, invasive non-native species such as Rhododendron, a Schedule 9[29] plant, occurs infrequently within the woodland area surrounding the Trawsfynydd site. Mink, a non-native species, has previously been recorded around Llyn Trawsfynydd. No legally controlled species were recorded within the Application Site.

[29] *Wildlife and Countryside Act 1981*. [Online] Available at: https://www.legislation.gov.uk/ukpga/1981/69 [Accessed 25 July 2024].

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
Aquatic habitats	Report of 2022 Biodiversity Studies: RHS Survey (**Appendix 5B**)	2022	River Habitat Survey (RHS) was undertaken in accordance with the 2003 Environment Agency RHS Survey Manual. The survey was limited by watercourse accessibility and low water levels noting that 2022 was a drought year. In the two locations where survey work was possible it was noted that the headwater streams are severely modified and have moderate habitat diversity with relatively few habitat features that are in common with a natural channel and river corridor.
Aquatic invertebrates	Report of 2022 Biodiversity Studies: Invertebrate Survey (**Appendix 5B**)	2022	Aquatic invertebrate samples were collected from five locations on the same streams sampled for aquatic macrophytes in accordance with the standard Environment Agency Operational Instruction 018_08 (Freshwater macro-invertebrate sampling in rivers) and Common Standards Monitoring Guidance[30]. The results identified a range of pressures acting on the invertebrate communities including poor water quality, low flow and poor habitat quality, albeit these pressures are

[30] Environment Agency (n.d.). *Operational Instruction 018_08 (Freshwater macro-invertebrate sampling in rivers) and Common Standards Monitoring Guidance.*

Ecological feature/survey	Survey/data Sources	Last surveyed	Summary of existing data/baseline
			not consistent across all sampling locations.
Aquatic macrophytes	Report of 2022 Biodiversity Studies: Macrophyte survey	2022	Aquatic macrophyte surveys were undertaken at five locations on the same streams sampled for aquatic invertebrates in accordance with the LEAFPACS survey method. The results revealed Bryophytes to be the main aquatic vegetation due to the high shade cover and small nature of the streams. Species diversity is limited and one site (MP1) had significant amounts of filamentous algae (30%) present. The cover of algae would be expected to be higher in sections of reduced shade coverage. This algal abundance is likely a result of nutrient enrichment, the source of which was not obvious. The survey results concur with those of the invertebrate survey.

5.5 Future baseline

5.5.1 Determining a future baseline draws upon information about the likely future use and management of the Trawsfynydd site in the absence of development, known population trends (for species), climate change and any other proposed developments (consented or otherwise) that may act cumulatively with the Proposed Development to affect ecological features.

5.5.2 In the absence of the Proposed Development, substantial shifts in the baseline conditions by the time of the Works Phase (currently expected in the late 2020s) are not predicted as the ponds complex currently comprises buildings and hardstanding and this is unlikely to change in the absence of development. It is possible in the longer term that there will be changes to habitats surrounding the Application Site. Notably, the woodland is currently managed for log production on a rotational basis. The specific details of future woodland management are unknown at the time of writing however such management works would be unrelated to the Proposed Development. However, for the purposes of the assessment, it is assumed that the woodland is retained (and any fauna it supports) to ensure a reasonable worst case assessment of the likely effects of the Proposed Development has been considered.

5.5.3 On the Trawsfynydd site itself, there will have been a number of changes by the late 2020s when the Proposed Development is expected to take place (see **Chapter 2 Site and Surroundings**). Of relevance to this chapter, this includes:

- The two reactor buildings will have been significantly reduced in height; and
- Crushed concrete from the reactor building height reduction works will have been used to extend the general laydown area, largely outside the Application Site, at the northern end of the Trawsfynydd licensed site. This laydown extension will require the removal of some current vegetation on the site.

5.5.4 The ecological implications of this vegetation removal and any mitigation or compensatory measures would be considered as part of the planning application for the laydown extension area.

5.6 Consultation and engagement

Overview

5.6.1 The assessment has been informed by consultation responses and ongoing statutory engagement.

Scoping opinion

5.6.2 A Scoping Opinion was adopted by the then Snowdonia National Park Authority (SNPA), now Eryri National Park Authority (ENPA), on 23 March

2023. A summary of the relevant responses received in the Scoping Opinion in relation to biodiversity and confirmation of how these have been addressed within the assessment to date is presented in

5.6.3 **Table 5-6**.

Table 5-6 Responses to the Scoping Assessment

Consultee	Consideration	How addressed in this ES
Snowdonia National Park Authority	As noted within the Scoping report (Baseline conditions 5.3), there are various protected sites within various distances to site.	Noted.
	Table 5.7 - Potential biodiversity effects requiring assessment, indicates which sites are to be screened in/out. While the Authority broadly agree with the assessment presented, running water has been screened in due to the potential for contamination of off-site watercourses. As such, it should be noted that hydrologically linked protected sites, and those with water dependent mobile features may be impacted by the proposals (depending on the detailed assessment of ground and surface water), as part of any planning application submitted, avoidance and mitigation measures may be required to safeguard protected sites	Noted. **Chapter 7: Geoenvironmental Impacts and Surface Water Quality** do not indicate effects on surface water quality during the works phase. Therefore, impacts on hydrologically linked designated sites, or sites with water dependent mobile species, during the Works Phase are not considered.
	The Local Authority will need to carry out a test of likely significant effects under Regulation 61 of the Conservation of Habitats and Species	Noted. A Report to Inform Habitats Regulations Assessment has also been prepared and submitted. This addresses both the Works Phase impacts and the long-term impacts.

Consultee	Consideration	How addressed in this ES
	Regulations 2010[31] (as amended). This will be done in consultation with NRW. If the assessment concludes there is likely to be a significant effect upon the conservation status of these sites, the Local Authority will need to carry out an Appropriate Assessment under the Regulations.	
	It is noted that the assessment presented in Section 5 'Biodiversity' with regards to bats, great crested newts, otters, water voles, red squirrels, pine martens, dormice and Invasive Non-Native Species. The majority of these species have been scoped out because they were not identified on site.	Noted.
	Considering the location of the proposed work within an area of hard standing and the nature of the work, we consider these proposals to have low likelihood of direct impact on protected species. As noted in the Protected Sites section, contamination of watercourses may impact on protected species in the vicinity, and this should be considered in future assessments.	Noted. **Chapter 7: Geoenvironmental Impacts and Surface Water Quality** do not indicate effects on surface water quality. Therefore, impacts on hydrologically linked designated sites, or sites with water dependent mobile species, during the Works Phase are not considered.
	As bats have been scoped in, there will be a requirement to produce	Noted. This is addressed in the assessment presented in this chapter.

[31] *Conservation of Habitats and Species Regulations 2010*. [Online] Available at: https://www.legislation.gov.uk/uksi/2010/490/contents [Accessed 25 July 2024].

Consultee	Consideration	How addressed in this ES
	further information about how the delivery of these proposals will avoid any negative impacts on this species. As this work is not located directly where the bats are roosting, we would expect the main focus to be on commuting and foraging individuals. Any assessment should include the prevention of additional, inappropriate lighting of adjacent habitats and also the reduction of existing lighting where possible. Any lighting mitigation for bats will likely benefit other species, but attracting further species into the site would not be desirable	
	The applicant should be mindful that The Snowdonia National Park have a duty under Part 1 Section 6 of the Environment (Wales) Act 2016, TAN 5, LDP policies and biodiversity SPG 6 – Nature Conservation and Biodiversity, to ensure that there is no net loss of biodiversity or unacceptable damage to a biodiversity feature as part of the planning process. Biodiversity enhancement measures are discussed further within the pre-application response.	Noted. However, most of the Application Site area comprises buildings and hard standing.

5.7 Scope of the assessment

Overview

5.7.1 The CIEEM guidelines[32] recognise that an appropriate Ecological Impact Assessment (EcIA) cannot consider in detail every individual species or habitat that may potentially be present at a site or affected by a proposed development. The EcIA process therefore aims to focus the assessment on those ecological features that could be 'significantly' affected by the Proposed Development (i.e. where the effects on the ecological features are of sufficient concern that they could influence the decision about whether or not planning permission should be granted), or for which the Proposed Development could result in the contravention of relevant legislation. The EcIA process therefore includes a 'scoping' stage (which excludes those ecological features that cannot be 'significantly' affected[33]), and a 'detailed assessment' stage, which examines more closely the potential effects of the scheme on those ecological features that could be subject to 'significant' effects. Detailed assessments may also be undertaken where it is considered appropriate to examine the predicted effects on a feature in more detail, for example due to consultee comments. This section summarises the approach to and outcomes of the EcIA scoping stage.

5.7.2 All of the activities and consequent environmental changes associated with the Proposed Development, as set out in **Chapter 3: The Project and its Alternatives** have been considered.

Spatial scope

5.7.3 The spatial scope of the assessment of biodiversity covers the area of the Proposed Development contained within the Application Site (see **Figure 5.3**), together with the Zones of Influence (ZoIs) that have formed the basis of the Study Area described in **Section 5.4**.

5.7.4 Through an understanding of the activities associated with the Proposed Development and the resulting environmental change, it is possible to identify ecological features that cannot be subject to likely significant effects due to an absence of effect pathways, or certainty that incorporated measures will be entirely successful in preventing significant effects occurring. In order to identify such ecological features, all the activities and consequent environmental changes associated with the Proposed Development have therefore been considered.

[32] Chartered Institute of Ecology and Environmental Management (CIEEM), (2018). *Guidelines for Ecological Impact Assessment in the UK and Ireland*. [online] Available at: https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/ [Accessed 25 July 2024

[33] Based on the results of desk-studies; field surveys; consultations; the importance of the ecological feature; the presence (or not) of pathways for effects; and the measures incorporated into the scheme to avoid effects occurring.

5.7.5 The following environmental changes, which have the potential to cause significant effects on ecological features at or near the Trawsfynydd site, may occur due to the works activities for the Proposed Development:

- Permanent or temporary land take / land cover change and building demolition (resulting in habitat loss or degradation and / or loss of fauna);
- Increased noise and vibration (resulting in disturbance / displacement);
- Increased light levels (resulting in disturbance / displacement);
- Pollution events (including the liberation of dust, sediments and chemicals resulting in loss or degradation of fauna and flora);
- Introduction and spread of invasive non-native species (resulting in habitat degradation); and
- Increase in vehicle movements and changes in movement patterns and timings during works (resulting in the potential killing or injury of fauna through road traffic collisions).

5.7.6 Given these environmental changes, the spatial scope of the biodiversity assessment covers the area of the Proposed Development, together with the ZoIs that have formed the basis of the Study Area described in Section 5.4. However, ZoIs differ depending on the type of environmental change (i.e. the change from the existing baseline) as a result of the Proposed Development and the ecological feature being considered.

5.7.7 The most straightforward ZoI to define is the area directly affected by land-take and direct land-cover changes associated with the Proposed Development. This ZoI is the same for all affected ecological features.

5.7.8 By contrast, for each environmental change that can extend beyond the area directly affected by land-take / land-cover change (e.g. increased noise associated with works activities within the land-take / land cover change area), the ZoI may vary between ecological features, dependent upon their sensitivity to the change and the precise nature of the change. For example, a badger might only be disturbed by noise generated very close to its sett, while nesting marsh harrier might be disturbed by noise generated at a much greater distance; other species (e.g. many invertebrates) may be unaffected by changes in noise. In view of these complexities, the definition of the ZoIs that extend beyond Application Site was based upon professional judgement informed as far as possible by a review of published evidence (e.g. disturbance criteria for various species) and discussions with the technical specialists that have undertaken other elements of the EIA.

5.7.9 The spatial extent of the assessment therefore reflects the area occupied by the ecological feature that is being assessed and the ZoI of the changes that are likely to affect it. Where part of a designated site which is considered as an ecological feature for the purposes of this assessment is located within the ecological ZoI relating to a particular biophysical change as a result of the Proposed Development, an assessment would be made of the effects on the designated site as a whole. A similar approach has been taken for areas of notable habitat. For species that occur within the ZoI, the assessment has

considered the total area that is used by the affected individuals or the local population of the species (e.g. for foraging or as breeding territories).

5.7.10 It should be noted that the avoidance of potential effects through design are implicitly taken into account through the consideration of each ZoI.

Temporal scope

5.7.11 The temporal scope of the assessment of effects on biodiversity is consistent with the period over which the Proposed Development would be carried out and as presented in **Chapter3: The Project and its Alternatives.**

Potential ecological features

5.7.12 Following CIEEM guidance[32], the importance of ecological features[34] has been determined using a geographic scale and described in relation to UK legislation and policy, and with regard to the extent of habitat or size of population that may be affected by the Proposed Development.

5.7.13 Wherever possible, information regarding the extent and population size, population trends and distribution of the ecological features has been used to inform the categorisation described in **Table 5-7** and determine importance at the project level. Where detailed criteria or contextual data are not available, professional judgement has been used to determine importance. A justification of all determinations of importance are provided in **Table 5-8** (for 'scoped in' ecological features) and **Appendix 5C** (for all ecological features, both those scoped in and out) to ensure transparency.

[34] The Chartered Institute for Ecology and Environmental Management (CIEEM) refer to biodiversity receptors within technical guidance as ecological features. This term is therefore used in this chapter in place of 'receptors' but for the purposes of the assessment they are the same.

5.7.14

Table 5-7 Importance of the Proposed Development for Ecological Features

Geographic context of importance	Description
International or European	• National site network sites including SACs and SPAs; • Potential SPAs (pSPA), proposed SACs (pSAC) and Ramsar sites (designated under international convention); and • Areas of habitat or populations of species[35] which meet the published selection criteria based on future discussions with NRW (if required) and field data collected to inform the EcIA for designation as a National site Network site or European site, but which are not themselves currently designated at this level.
National (UK context)	• A nationally designated site including SSSIs and NNRs; • Areas (and the populations of species which inhabit them) which meet the published selection criteria guidelines for selection of biological SSSIs, but which are not themselves designated based on field data collected to inform the EcIA, and in agreement with NRW; • HPI and SPI, Red listed and legally protected species that are not addressed directly in Part 2 of the "Guidelines for Selection of Biological SSSIs"[36] but can be determined to be of national importance using the principles described in Part 1 of the guidance; and • Areas of Ancient Woodland e.g. woodland listed within the AWI and ancient and veteran trees.
County (Gwynedd)	• Local Nature Reserves (LNRs) and Non-Statutory Designated sites including: Local Wildlife Sites (LWSs) designated in the county context; and

[35] This includes habitats and species listed under Annex I and Annex II of the Habitats Directive, birds listed under Annex I of the Birds Directive and all regularly occurring migratory birds.
[36] JNCC (2013). *Guidance for selection of SSSIs*. [online] Available at: https://jncc.gov.uk/our-work/guidelines-for-selection-of-sssis/ [Accessed 25 July 2024].

Geographic context of importance	Description
	• Areas which based on field data collected to inform the EcIA meet the published selection criteria for those sites listed above (for habitats or species, including those listed in relevant Local Biodiversity Action Plans) but which are not themselves designated.
Local	• HPI and SPI, Red listed and legally protected species that based on their extent, population size, quality etc are determined to be at a lesser level of importance than the geographic contexts above; • Common and widespread semi-natural habitats occurring within the Study Area in proportions greater than may be expected in the local context; and • Common and widespread native species occurring within the Study Area in numbers greater than may be expected in the local context.
Negligible	• Common and widespread semi-natural habitats and species that do not occur in levels elevated above those of the surrounding area; and • Areas of heavily modified or managed land uses (e.g. hard standing used for car parking, as roads etc.).

5.7.15 Where protected species are present and there is the potential for a breach of the legislation, those species have been considered as 'important' features. With the exception of such species receiving specific legal protection, or those subject to legal control (e.g. invasive species), all ecological features determined to be important at negligible level have been scoped out of the assessment. Further, ecological features of local importance, where there is a specific technical justification, have also been scoped out. This is because a significant effect in EIA terms could not occur. This approach is consistent with that described in CIEEM[32]. Specific justification for the exclusion of these ecological features from detailed assessment is provided in **Appendix 5C**.

5.7.16 All legally protected species and ecological features that are of sufficient importance have been taken through to the next stage of the assessment to determine likely significant effects.

Potential receptors

5.7.17 Ecological features that were scoped into the assessment (i.e. those of sufficient importance occurring within a relevant ZoI) as detailed in the Scoping Report[37] are:

- Broad-leaved woodland;
- Running water; and
- Bats.

5.7.18 However, following review of survey data collected during the assessment and assessments presented in other chapters, broad-leaved woodland and running water are scoped out (see **paragraph 5.7.21**).

5.7.19 Therefore, only bats remain scoped into the assessment, as detailed in **Table 5-8**, along with a summary of the justification for inclusion.

5.7.20 **Appendix 5C** re-presents Table 5.7 from the Chapter 5: Biodiversity of the Scoping Report[37] as this indicates the features considered and scoped out at that stage.

[37] Magnox Ltd (2022). *Trawsfynydd Site Ponds Complex Demolition & Disposal Project Environmental Impact Assessment Scoping Report.* Magnox Ltd, Blaenau Ffestiniog.

Table 5-8 Biodiversity receptors scoped in for further assessment

Ecological feature	Importance Level		Scoped in rationale
	Legislation/Policy	Proposed Development	
Bats	International	Local	A wide variety of bat species has been recorded within the Trawsfynydd site. Buildings and structures included within the scope of the works for the Proposed Development have only low or very low bat roost potential and no roosts were located on the Trawsfynydd site in 2021. However, a soprano pipistrelle maternity roost is present within the pump house, which is approximately 200m from the Application Site. Additionally, there is also a small soprano pipistrelle roost in the Old Conference Centre, which is approximately 350m from the Proposed Development. The woodland habitat immediately outside the Application Site is used by bats for foraging and commuting.

Effects scoped out

5.7.21 The following effects have been scoped out of further assessment for the following reasons:

- Broad-leaved woodland: Effects on broad-leaved woodland were scoped in on a precautionary basis until the feature status (i.e. Section 7 HPI or not) and sensitivity was confirmed. The status of the woodland has now been confirmed and is considered not to be an HPI. Hence, effects on broad-leaved woodland are scoped out of the assessment. Furthermore, based on consultation with an air quality specialist, the woodland which borders the Trawsfynnyd site would be considered to have a low sensitivity to the effects of dust deposition, as defined within the Institute of Air Quality Management (IAQM) guidance[38]. Therefore, whilst the Proposed Development does include dust emitting activities such as concrete crushing, as a worst-case the risk of impacts from demolition works associated with the Proposed Development is medium if no mitigation measures were applied. Existing controls and measures to ensure no adverse effects occur are reported within **Table 5-10**.
- Running water: The potential for contamination of off-site watercourses, which may represent a Section 7[31] HPI, was identified in **Chapter 7: Geoenvironmental Impacts and Surface Water Quality** [37]. However, the assessment presented in **Chapter 7: Geoenvironmental Impacts and Surface Water Quality** of this Environmental Statement has concluded that effects on surface and groundwater quality would be Not Significant. Therefore, effects on the biodiversity of these running watercourses are not considered further in this chapter.

5.7.22 The effect mechanisms detailed in **Table 5-9** have been scoped out from further assessment because the potential effects are not considered likely to be significant.

Table 5-9 Summary of effect mechanisms scoped out of the Biodiversity assessment

Potential effects	Justification
Permanent or temporary land take/land cover change and building demolition	There will be no loss of natural habitats on a temporary or permanent basis as a result of the Proposed Development. Existing habitats within the Application Site that will be affected are predominantly concrete or hard standing. As a result, this potential effect is scoped out.
Pollutant emissions from vehicles and machinery	Effects of pollutant emissions from construction vehicles on both human and ecological receptors were scoped out at the Scoping assessment stage.

[38] Institute of Air Quality Management AQM, (2024). *Guidance on the assessment of dust from demolition and construction*. [online] Available at: https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-Dust-Guidance-Jan-2024.pdf [Accessed 25 July 2024].

Potential effects	Justification
Hydrological changes (flood risk)	Changes in hydrology – **Chapter 8: Flood Risk and Drainage** states '*Given the existing impermeable nature of the ponds complex buildings and hardstanding and that the Proposed Development comprises their replacement with an impermeable capping slab, no change in the quantity and rate of runoff is expected*'. It is therefore scoped out from further assessment in this chapter.
Hydrological changes (water quality)	**Chapter 7: Geoenvironmental Impacts and Surface Water Quality** has concluded that there will be negligible effects on surface and groundwater quality and as such no effects on nearby watercourses, or other biodiversity receptors.
Invasive species introduction and spread	The potential effects of introduction of invasive species were scoped out on the basis that no legally controlled species were recorded within the Proposed Development area and ongoing measures should prevent establishment. The Applicant already monitors for invasive plant species such as Japanese knotweed and this will continue. Should any invasive species be recorded they will be removed immediately, following best-practice guidelines.
Increased vehicle movements leading to collision	Increase in vehicle movements and changes in movement patterns and timings during works (resulting in the potential killing or injury of fauna through road traffic collisions) was scoped out at the scoping assessment stage. This was on the basis that whilst an unmanaged increase in numbers of vehicle movements has the potential to impact mobile species such as badgers and otters via collision, existing traffic calming measures will continue to apply and therefore there is no additional risk as a result of the Proposed Development.

5.8 Existing controls and environmental measures

5.8.1 As part of the design process, a number of existing controls and environmental measures are proposed to reduce the potential for impacts, as detailed in the **Construction and Demolition Environmental Management**

Plan. Those of specific relevance to the assessment of effects on ecological receptors are also summarised in **Table 5-10**.

Table 5-10 Summary of the controls and environmental measures and how these have influenced the biodiversity assessment

Aspect/feature	Potential changes and effects	Controls and measures and influence on assessment
Ecology	Potential disturbance of species	The area to be demolished should be inspected by an ecologist prior to the works commencing to ensure no birds or bats are present. If present, an appropriate course of action will be determined.
Dust control	Pollution events (including the liberation of dust, resulting in loss or degradation of fauna and flora)	The works will be conducted in accordance with: • BRE (2003) Guidance on the Control of Dust from Construction and Demolition Activities; and BRE (2003) Controlling Particulates, Vapours and Noise Pollution from Construction Sites. Control measures will include: • Vehicle speeds on site will be restricted to 10 mph. • Mobile water bowsers will be stationed on site throughout the duration of the operations and deployed to control dust on dry roads as necessary. • Except during wet weather, water mists will be used during the handling (including loading / unloading or processing) of materials with the potential to cause airborne dust levels. • On-site roads will be cleaned of mud/dust deposits if routine monitoring detects increasing turbidity or alkalinity in the storm drains system including the diversion culvert. This will include the use of re-circulating wheel washers

Aspect/feature	Potential changes and effects	Controls and measures and influence on assessment
		and road cleaners as appropriate. • Temporary, secured sheeting of stockpiled material will be adopted to minimise windblown dust.
Light	Increased light levels resulting in disturbance and/or displacement to fauna	• Any new lighting to be installed should be directional lighting. • The use and design of lighting to be directed on the area of the Proposed Development only, unless health and safety requirements dictate otherwise, will minimise the potential effects on bat and bird species in the vicinity of the Application Site.
Noise and vibration	Increased noise and vibration resulting in disturbance and/or displacement or fauna	During the Works Phase, British Standard 5228: Noise and vibration control on construction sites and open sites (BSI, 2014) will be used as guidance for noise control during construction work (and also for demolition work, if still in force at the time). In particular, the following control measures will be applied: • All construction plant and equipment shall comply with EU noise emission limits. • All vehicles and mechanical plant shall be fitted with effective exhaust silencers. • All major compressors, generators etc. shall be 'sound reduced' models. • Machines in intermittent use shall be shut down in the intervening periods between working or throttled down to a minimum. • Where practicable ancillary plant such as generators, compressors and pumps shall be positioned so as to cause minimum noise disturbance.

Aspect/feature	Potential changes and effects	Controls and measures and influence on assessment
		• Regular maintenance of plant and equipment will be undertaken. • No plant or machinery will be left running unnecessarily. • Reversing alarms shall be limited to "Broadband Reversing Alarm" or "White Noise Reversing Alarm". •
Water pollution	Spills and leaks leading to deterioration of the aquatic environment in receiving watercourses	• All temporary fuel storage or tankers will be located, managed/maintained, and operated in accordance with all statutory requirements and best practice. • Mobile plant will follow best practice such as use of drip trays. • Hazardous materials will be stored within bunded areas. • All washing and cleaning operations of other vehicles or plant will be carried out only in designated areas agreed by the site environment team and

5.9 Assessment methodology

Overview

5.9.1 The proposed generic project-wide approach to the assessment methodology is set out in **Chapter 1: Introduction**. However, whilst this has informed the approach used in the biodiversity assessment, it is necessary to align with the standard industry guidance provided by CIEEM[32].

5.9.2 The assessment will be based upon not only the results of the desk study and field surveys that have been undertaken, but also relevant published information (for example on the status, distribution, sensitivity to environmental changes and ecology of the features scoped-in to the assessment, where this information is available), and professional knowledge of ecological processes and functions.

5.9.3 For the scoped-in ecological feature (bats in this case), effects are assessed against the predicted future baseline conditions for that feature during the Proposed Development (which is no future change). Throughout the

assessment process, the initial results of the assessment regarding potentially significant effects will be used to inform whether additional baseline data collection is required, together with the identification of control measures that should be embedded into the proposals to avoid or reduce adverse effects or to deliver enhancements.

5.9.4 Where part of a designated site is located within the Study Area relating to a particular biophysical change as a result of the Proposed Development, an assessment will be made of the effects on the designated site as a whole. A similar approach will be taken for areas of notable habitat.

5.9.5 For species that occur within the Study Area, the assessment will consider the total area that is used by the affected individuals or the local population of the species (e.g. for foraging or as breeding territories).

Significance evaluation methodology

Overview

5.9.6 CIEEM[32] defines a significant effect as one "that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general".

5.9.7 When considering potentially significant effects on ecological features, whether these be adverse or beneficial, the following characteristics of environmental change are taken into account[39]:

- **Extent** – the spatial or geographical area over which the environmental change may occur;
- **Magnitude** – the size, amount, intensity or volume of the environmental change;
- **Duration** – the length of time over which the environmental change may occur;
- **Frequency** – the number of times the environmental change may occur;
- **Timing** – the periods of the day/year etc. during which an environmental change may occur; and
- **Reversibility** – whether the environmental change can be reversed through restoration actions.

Magnitude of change

5.9.8 Although the characteristics described above are all important in assessing effects by using information about the way in which habitats and species are likely to be affected, a scale for the magnitude of the environmental change, as a result of the Proposed Development, has been described in **Table 5-11**

[39] The definitions of the characteristics of environmental change are based on the descriptions provided in CIEEM[32]. Other chapters in this Environmental Statement may use some of the same terms albeit with a different definition.

to provide an understanding of the relative change from the baseline position, be that adverse or beneficial.

Table 5-11 Guidelines for the assessment of the scale of magnitude

Scale of change	Criteria and resultant effect
High	The change permanently (or over the long-term) affects the conservation status of a habitat/species, reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource/species population, a large area of habitat or large proportion of the wider species population is affected. For designated sites, integrity is compromised. There may be a change in the level of importance of the receptor in the context of the Proposed Development.
Medium	The change permanently (or over the long-term) affects the conservation status of a habitat/species reducing or increasing the ability to sustain the habitat or the population level of the species within a given geographic area. Relative to the wider habitat resource/species population, a small-medium area of habitat or small-medium proportion of the wider species population is affected. There may be a change in the level of importance of this receptor in the context of the Proposed Development.
Low	The quality or extent of designated sites or habitats or the sizes of species' populations, experience some small-scale reduction or increase. These changes are likely to be within the range of natural variability and they are not expected to result in any permanent change in the conservation status of the species/habitat or integrity of the designated site. The change is unlikely to modify the evaluation of the receptor in terms of its importance.
Very low	Although there may be some effects on individuals or parts of a habitat area or designated site, the quality or extent of sites and habitats, or the size of species populations, means that they would experience little or no change. Any changes are also likely to be within the range of natural variability and there would be no short-term or long-term change to conservation status of habitats/species receptors or the integrity of designated sites.
Negligible	A change, the level of which is so low, that it is not discernible on designated sites or habitats or the size of species' populations, or changes that balance each other out over the lifespan of a project and result in a neutral position.

Determining significance - adverse and beneficial effects

5.9.9 Conservation status is defined as follows (as per CIEEM[32]):

"For habitats, conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and typical species within a given geographical area;
For species, conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area".

5.9.10 Adverse effects are assessed as being significant if the favourable conservation status of an ecological feature would be lost as a result of the Proposed Development. Beneficial effects are assessed as those where a resulting change from baseline improves the quality of the environment (e.g. increases species diversity, increases the extent of a particular habitat, or halts or slows down an existing decline). For a beneficial effect to be considered significant, the conservation status would need to positively increase in line with a magnitude of change of 'high' as described in **Table 5-11**.

5.9.11 The decision as to whether the conservation status of an ecological feature would alter as a result of the Proposed Development would be made using professional judgement, drawing upon the information produced through the desk study, field survey and assessment of how each feature is likely to be affected.

5.9.12 A similar procedure will be used where designated sites may be affected by the Proposed Development, except that the focus would be on the effects on the integrity of each site; defined as:

> *"The coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified"*[40].

5.9.13 The assessment of effects on integrity will draw upon the assessment of effects on the conservation status of the features for which a site has been designated.

[40] Department for Levelling Up, Housing and Communities (DLUHC) and Ministry of Housing, Communities & Local Government, (2019). *Guidance on the use of Habitats Regulations Assessment*. [online] Available at: https://www.gov.uk/guidance/appropriate-assessment [Accessed 25 July 2024].

5.10 Assessment of effects: bats

Predicted effects and their significance

Overview

5.10.1 The Application Site comprises entirely of buildings and hard standing. There is no suitable habitat for foraging or commuting bats. The buildings will be demolished during the works.

5.10.2 There are no buildings within 30m of the Proposed Development that have any more than very low suitability to support roosting bats. This means that the buildings do not provide the conditions necessary to be used on a regular basis by bats (i.e. they may be used opportunistically by single bats on an occasional basis). Furthermore, no evidence of roosting bats was recorded in any of the buildings onsite. The assessment has been undertaken on this basis.

5.10.3 The nearest recorded roost is in the pump house, approximately 200m south of the Application Site, and in the old Conference Centre, approximately 350m to the south-east. Therefore, any predicted effects are only applicable to small numbers of individually roosting bats. These two roosts however will not be affected by either noise, or vibration from the Proposed Development due to the distance and the woodland habitat that separates the working areas from the roosts.

5.10.4 Of the environmental changes associated with the Proposed Development it is considered that bat species will be potentially vulnerable (i.e. exposed and sensitive) to:

- Disturbance of bat species present within 30m of the Application Site due to increased noise and vibration.
- Disturbance of bat species present within 30m of the Application Site to increased light levels.
- Disturbance of bat species foraging along the margins of the Application Site due to increased noise and vibration.
- Disturbance of bat species foraging along the margins of the Application Site to increased light levels.

5.10.5 The controls and measures detailed in **Table 5-10** are taken into account in the assessment.

5.10.6 Additionally, the assessment of potential presence of bats will be repeated prior to any demolition works taking place to ensure building/structure conditions remain the same in respect of the potential to support roosting bats. Although not expected to be the case, if conditions have changed the update will enable definition of any necessary mitigation at the time.

Disturbance due to increased noise and vibration

5.10.7 If bats are present in buildings within 30m of the Application Site, a worst-case might see individual bats (if present) being temporarily displaced from very low-value opportunistic roosts in the closest buildings, although roosting opportunities are available in other buildings on site and locally.

5.10.8 In respect of effects on foraging bats, the works will predominantly take place during normal working hours (Monday - Friday daytimes (08:00 to 18:00 hrs) and Saturday mornings (08:00 to 13:00 hrs)) and as such foraging and commuting bats will not be present during the working period. Therefore, foraging and commuting bats should not be disturbed by the works.

5.10.9 Due to the adherence to normal best-practice construction measures including controls on working hours, it is considered that the changes in noise levels associated with construction site noise and construction traffic noise will have a negligible effect on the integrity of local bat populations and will be 'not significant' to bats.

Disturbance due to increased light levels

5.10.10 Any temporary disturbance to bats due to increased light levels would be largely prevented with normal best practice construction measures including any new lighting to be installed on the Trawsfynydd site consisting of directional lighting. This will avoid spillage of light beyond the Application Site.

5.10.11 There is a certain amount of existing night-time lighting on the Trawsfynydd site, which is necessary for security purposes. This is generally low level and directional lighting on lamp posts or from lights mounted to the sides of buildings.

5.10.12 Changes to lighting during the Proposed Development will therefore be minor and temporary, and the effect on bats will be negligible. There will be no effect on the integrity of the local bat populations and effects will therefore be 'not significant'.

Summary of effects on bats

5.10.13 Incorporated controls and measures (see **Table 5-10**) will ensure that indirect effects from noise, vibration and light will be prevented or appropriately managed.

5.10.14 Given the short term/temporary, low-level change during the works, the overall magnitude of change on bats is considered to be adverse and negligible, and the resultant effect on the conservation status of local bat populations is 'not significant'.

5.11 Conclusions of significance evaluation

5.11.1 A summary of the results of the biodiversity assessment is provided in **Table 5-12**.

Table 5-12 Summary of the results of the biodiversity assessment

Feature and summary of predicted effect	Importance of feature	Magnitude of change	Significance	Summary rationale
Bats ***Disturbance due to increased noise and vibration***	Legislation/Policy: International Proposed development: Local	Negligible	**Not significant**	Due to the adherence to normal best-practice construction measures including controls on working hours, it is considered that the changes in noise levels associated with construction site noise and construction traffic noise will have a negligible effect on the integrity of local bat populations.
Bats ***Disturbance due to increased light levels***	Legislation/Policy: International Proposed development: Local	Negligible	**Not significant**	Changes to lighting during the Proposed Development will be minor and temporary, and the effect on bats will be negligible. No effect on the integrity of the local bat populations.

Appendix 5A
Relevant planning policy, legislation, and technical guidance

Relevant planning policy, legislation and technical guidance

This Appendix identifies the relevant national and local policy, legislation and guidance that has informed the scope of the assessment relevant to biodiversity.

Planning policy

A summary of the relevant planning policies is given in **Table A-1**.

Table A-1 Planning policy relevant to biodiversity

Policy reference	Policy relevance
National planning policies	
Planning Policy Wales, Edition 12[1] (2024)	"*Paragraph 6.4.2: The Environment (Wales) Act 2016[2] introduced an enhanced biodiversity and resilience of ecosystems duty (Section 6 Duty). This duty applies to public authorities in the exercise of their functions in relation to Wales and will help maximise contributions to achieving the well-being goals.* *Paragraph 6.4.5: Planning authorities must seek to maintain and enhance biodiversity in the exercise of their functions.* *Paragraph 6.4.10: The broad framework for implementing the Section 6 Duty and building resilience through the planning system includes addressing: Diversity, Extent, Condition, Connectivity and Adaptability to change.* *Paragraph 6.4.11: Planning authorities must follow a stepwise approach to maintain and enhance biodiversity, build resilient ecological networks and deliver net benefits by ensuring that any adverse environmental effects are firstly avoided, then minimised, mitigated, and as a last resort compensated for. Enhancement must be secured by delivering a biodiversity benefit primarily on site or immediately adjacent to the site, over and above that required to mitigate or compensate for any negative impact. ;* *Paragraph 6.4.35: The presence of a species protected under European or UK legislation, or under Section 7 of the Environment*

[1] Welsh Government (2021). *Planning Policy Wales Edition 12* . [Online] Available at: https://www.gov.wales/sites/default/files/publications/2024-07/planning-policy-wales-edition-12.pdf [Accessed 25 July 2024].
[2] *Environment (Wales) Act 2016*. [online]. Available at: https://www.legislation.gov.uk/anaw/2016/3/contents [Accessed 25 July 2024].

	(Wales) Act 2016[1] is a material consideration when a planning authority is considering a development proposal, which, if carried out, would be likely to result in disturbance or harm to the species or its habitat and to ensure that the range and population of the species is sustained. *Paragraph 6.4.39: Planning authorities must protect trees, hedgerows, groups of trees and areas of woodland where they have ecological value, contribute to the character or amenity of a particular locality, or perform a beneficial and identified green infrastructure function. Planning authorities should consider the importance of native woodland and valued trees, and should have regard, where appropriate, to local authority tree strategies or SPG[3] and the green infrastructure assessment.* *Paragraph 6.4.42: Permanent removal of woodland will only be permitted where it would achieve significant and clearly defined public benefits. Where individual or groups of trees and hedgerows are removed as part of a proposed scheme, planning authorities must first follow the step-wise approach* *as set out in paragraph 6.4.15. Where loss is unavoidable developers will be required to provide compensatory planting (which is proportionate to the proposed loss as identified through an assessment of green infrastructure value including biodiversity, landscape value and carbon capture).*"
Technical Advice Note (TAN) 5: Nature conservation and planning[4] (2009)	Welsh Governments policy on positive planning for nature conservation and developments affecting designated sites and habitats, along with protected priority habitats and species.
Local planning policies	
Eryri Local Development Plan - 2016 – 2031 Written Statement[5] (2016)	Strategic Policy A states the following with respect to biodiversity: "*i. Give the highest priority to the protection and enhancement of the natural beauty, wildlife and cultural heritage and iv... Conserve and enhance the characteristic biodiversity of Snowdonia."* Development Policy 1 states: "*v. The development will not have an unacceptable adverse impact on the characteristic biodiversity of Snowdonia, particularly habitats and species protected under national and European legislation and vi. The development does not result in the loss of landscape features, including woodland, and Ancient Semi-Natural woodland in particular, healthy trees, hedgerows, dry stone walls or damage any important open space or public view.*"

[3] Supplementary Planning Guidance (SPG)

[4] Welsh Assembly Government (2009). *Technical Advice Note 5: Nature Conservation and Planning*. [online] Available at: https://gov.wales/sites/default/files/publications/2018-09/tan5-nature-conservation.pdf [Accessed 25 July 2024].

[5] Snowdonia National Park Authority (2016). *Eryri Local Development Plan - 2016 – 2031*. [online] Available at: https://www.snowdonia.gov.wales/planning/planning-policy/local-development-plan-ldp [Accessed 25 July 2024].

	Strategic Policy D states: "*The natural resources, biodiversity, geodiversity and 'Special Qualities' of the Snowdonia National Park will be protected from inappropriate development. Where development is deemed acceptable developers will be expected to ensure that the natural environment is protected and enhanced. Proposals should not adversely affect the National Park's biodiversity resources including designated sites from an international through to a local level, as well as wider biodiversity resources e.g. habitats and species outside designated sites. Development proposals which are likely to adversely affect the integrity of European designated sites (either alone or in combination with other plans of projects) will not be permitted unless the requirements of the Conservation of Habitats and Species Regulations 2010[6] have been fulfilled and hence the following criteria can be met:* *i. There is no alternative solution.* *ii. There are imperative reasons of over-riding public interest for the development.* *The following requirements will apply to development affecting nationally and locally designated sites:* *iii. The location, design and construction of the development is such that damage to nature conservation features are mitigated, and opportunities for nature conservation gain are taken.* *iv. Compensatory measures are provided if necessary.* *v. The remaining nature conservation features are protected and enhanced, and provision is made for their management.* *Development will only be permitted within the Undeveloped Coast where it can be demonstrated that a coastal location is essential. Development which harms the unspoilt landscape character or wildlife habitats will not be permitted. Development proposals which are likely to adversely affect habitats and species listed in the Local Biodiversity Action Plan will be subject to the guidelines of the Supplementary Planning Guidance on Local Biodiversity."*

Legislation

The legislation presented in **Table A-2** is relevant to the assessment of the effects on ecological features.

Table A-2 Legislation relevant to biodiversity

Legislation	Relevance
Conservation of Habitats and	The Regulations underpin the designation and protection afforded to international sites, and certain habitats, listed on Annex I, and species listed on Annexes II and IV of the Regulations. Potential effects on European designated sites, Annex I habitats and

[6] *Conservation of Habitats and Species Regulations 2010*. [Online] Available at: https://www.legislation.gov.uk/uksi/2010/490/contents [Accessed 25 July 2024].

Species Regulations 2017[7]	species listed on Annexes II and IV are material considerations in the assessment.
Wildlife and Countryside Act 1981 (as amended)[8]	The Act underpins the notification and protection afforded to nationally designated sites. Potential effects on nationally designated sites are material considerations in the assessment. The Act is the primary piece of legislation for wildlife protection in the UK. Prohibitions include taking, injuring, killing and disturbing. It is also an offence to disturb places used for shelter and protection. Potential effects on animals and plants protected by the Act are material considerations in the assessment. The Act also prohibits the spread of non-native and invasive species that are listed on Schedule 9.
The Environment (Wales) Act 2016[2]	The Act introduced an enhanced duty (the Section 6 duty) for public authorities in the exercise of functions in relation to Wales. The Section 6 duty requires that public authorities must seek to maintain and enhance biodiversity so far as consistent with the proper exercise of their functions and in so doing promote the resilience of ecosystems. To follow the Section 6 duty public authorities should embed the consideration of biodiversity and ecosystems into their early thinking and business planning, including any policies, plans, programmes and projects, as well as their day-to-day activities. The assessment should consider potential effects on Species (or habitats) of "*principal importance for the conservation of biodiversity*" (SPI or HPI) which are those listed by Welsh Government pursuant to Section 7 of the Environment (Wales) Act 2016.
Protection of Badgers Act 1992[9]	This Act makes it an offence to kill, injure or take a badger, or to damage or interfere with a sett unless a licence is obtained from a statutory authority. The assessment should consider potential for effects on badgers.
The Hedgerows Regulations 1997[10]	The Regulations seek to protect important hedgerows in the countryside by controlling their removal. The assessment should consider potential for effects on hedgerows.
National Parks and Access to the Countryside Act 1949 (as amended)[11]	Locally important sites (Local Nature Reserves (LNR)) are designated under the Regulations with the objective of encouraging their use for the study, research or enjoyment of nature. Potential effects on such sites should be assessed.

[7] *The Conservation of Habitats and Species Regulations 2017*. [Online] Available at: https://www.legislation.gov.uk/uksi/2017/1012/contents [Accessed 25 July 2024].
[8] *Wildlife and Countryside Act 1981*. [Online] Available at: https://www.legislation.gov.uk/ukpga/1981/69 [Accessed 25 July 2024].
[9] *Protection of Badgers Act 1992*. [Online] Available at: https://www.legislation.gov.uk/ukpga/1992/51/contents [Accessed 25 July 2024].
[10] *The Hedgerows Regulations 1997*. [online] Available at: https://www.legislation.gov.uk/uksi/1997/1160/contents/made [Accessed 25 July 2024].
[11] *National Parks and Access to the Countryside Act 1949 (as amended).* [online] Available at: https://www.legislation.gov.uk/ukpga/Geo6/12-13-14/97 [Accessed 25 July 2024].

Technical guidance

Table A-3 outlines industry-standard best-practice technical guidance documents relevant to the biodiversity assessment.

Table A-3 Technical guidance relevant to biodiversity

Guidance	Relevance
Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (2018)[12]	Guidelines that provide the industry standard framework for undertaking Ecological Impact Assessment (EcIA).
Guidelines for Preliminary Ecological Appraisal (2017)[13]	Guidelines that provide the industry standard framework for undertaking Preliminary Ecological Appraisals (PEA).
BS 42020:2013 - Biodiversity: Code of practice for planning and development (2013) [14]	A standard that provides clear recommendations and guidance to ensure that actions and decisions taken at each stage of the planning process are informed by sufficient and appropriate ecological information.
Bat Surveys for Professional Ecologists. Good Practice Guidelines (2016)[15]	Industry standard guidelines outlining the level of survey effort required to determine whether, and to what extent, bats make use of a site.
Joint Nature Conservation Committee (JNCC) Handbook for Phase 1 Habitat Survey: A Technique for Environmental Audit (2010)[16]	The Phase 1 Handbook presents a standardised system for classifying and mapping wildlife habitats in all parts of Great Britain, including urban areas.
British Plant Communities Volume 1: Woodlands and Scrub (1991)[17]	Presents the woodland communities included in the National Vegetation Classification (NVC).

[12] Chartered Institute of Ecology and Environmental Management (2018). *Guidelines for Ecological Impact Assessment in the UK and Ireland. Terrestrial, Freshwater, Coastal and Marine (updated September 2019) Edition* [online]. Available at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.1.pdf [Accessed 25 July 2024].
[13] Chartered Institute of Ecology and Environmental Management (2017). *Guidelines for Preliminary Ecological Appraisal, 2nd edition.* CIEEM; Winchester, UK.
[14] British Standards Institution (2013). *Biodiversity. Code of practice for planning and development BS 42020:2013.* BSI; London, UK.
[15] Collins J., (2016). *Bat Surveys for Professional Ecologists. Good Practice Guidelines (3rd Edition).* Bat Conservation Trust; London, UK.
[16] Joint Nature Conservation Committee (2010). *Handbook for Phase 1 Habitat Survey: A Technique for Environmental Audit.* JNCC; Peterborough, UK.
[17] Rodwell, J.S. (ed.) (1991). *British Plant Communities. Volume 1. Woodlands and scrub.* Cambridge University Press.

National Vegetation Classification field guide to woodland (2004)[18]	Field guide to the woodland communities included in the NVC.
Bat Surveys for Professional Ecologists. Good Practice Guidelines (3rd Edition) (2016)[19]	Industry standard guidelines in respect of bat surveys.
Guidance notes for the reduction of obtrusive light: Think before you light – The right amount of light, where wanted, when wanted (2011)[20]	Guidance on site lighting in respect of bats.
Monitoring the Otter. Conserving Natura 2000, Rivers Monitoring Series No. 10 (2003)[21]	Industry standard guidelines in respect of otter surveys.
Surveying for Reptiles (2016)[22]	Guidance on reptile surveys.
Bird Monitoring Methods a manual of techniques of key UK species (1998)[23]	Guidance on common bird census method.
Surveying Badgers. Occasional Publication No. 9, (1989)[24]	Industry standard guidance in respect of badger survey.
Handbook of Biodiversity Methods: Survey, Evaluation and Monitoring (2005)[25]	Guidance on reptile surveys.
Barn Owl Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting (2011)[26]	Industry standard guidance in respect of barn owl survey.

[18] JNCC (2004). *National Vegetation Classification field guide to woodland*. JNCC; Peterborough, UK

[19] Collins, J (2016) *Bat Surveys for Professional Ecologists. Good Practice Guidelines (3rd Edition).* Bat Conservation Trust, London.

[20] Institute of Lighting Professionals (2011) *Guidance notes for the reduction of obtrusive light: Think before you light – The right amount of light, where wanted, when wanted. Guidance Notes for the Reduction of Obtrusive Light GN01:2011*. Institute of Lighting Professionals; Rugby.

[21] Chanin, P (2003) *Monitoring the Otter. Conserving Natura 2000, Rivers Monitoring Series No. 10.* English Nature, Peterborough.

[22] Froglife (2016*) Surveying for Reptiles*. Froglife; Peterborough.

[23] Gilbert, Gibbons and Evans (1998) *Bird Monitoring Methods a manual of techniques of key UK species*. RSPB; Bedfordshire.

[24] Harris s, Creswell, P, Jefferies, D (1989) *Surveying Badgers. Occasional Publication No. 9,* The Mammal Society, London.

[25] Hill, D, Tucker, P, Shaw, P and Shrewry, M (2005) *Handbook of Biodiversity Methods: Survey, Evaluation and Monitoring*, Cambridge University Press, Cambridge.

[26] Shawyer, C (2011) *Barn Owl Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting*, IEEM, Winchester.

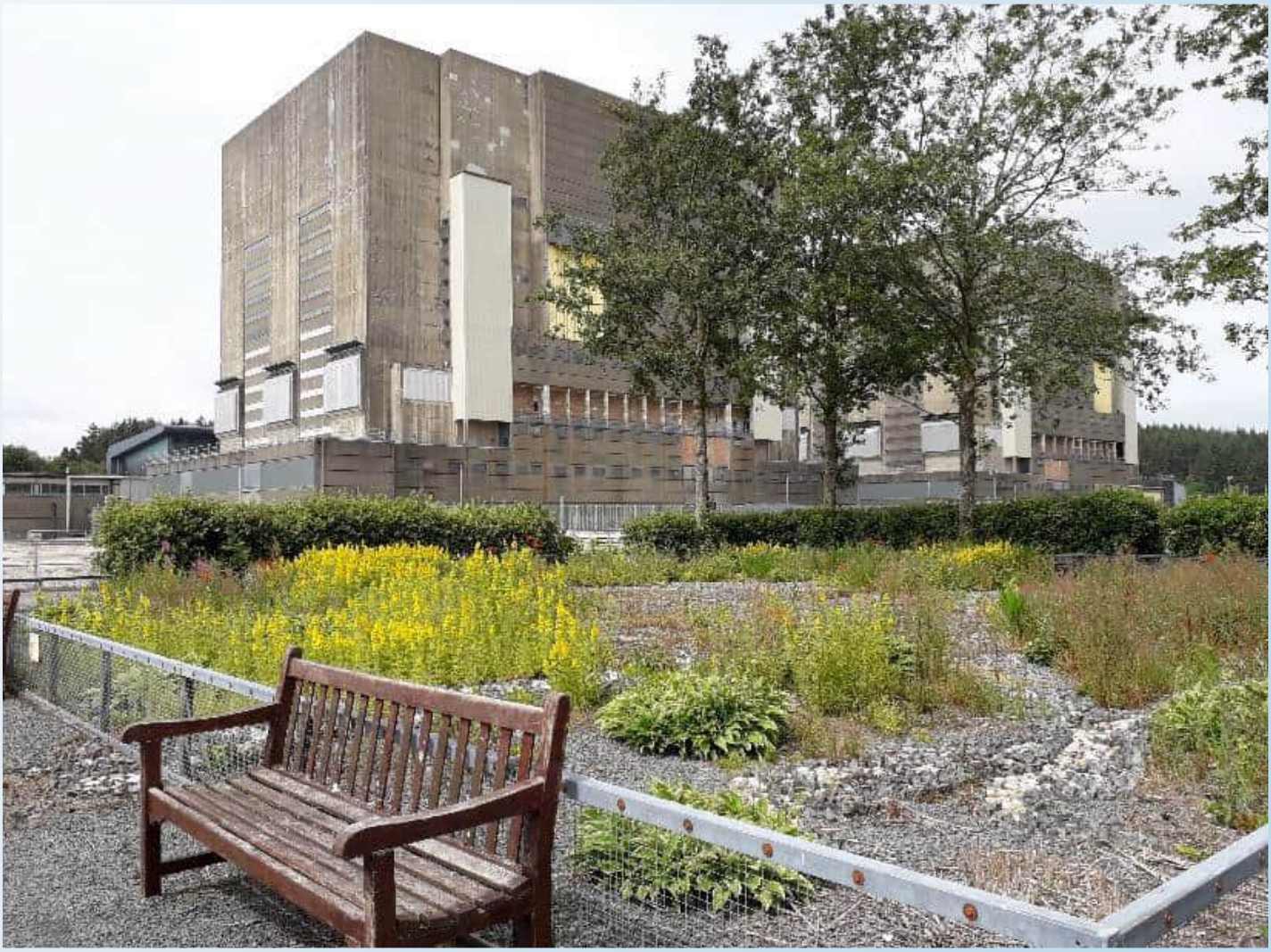
Interpreting and reporting freshwater ecology data. Operational Instruction 387_09 (2011)[27]	Guidance on interpretation of biological metrics used by the Environment Agency to describe the sensitivity of aquatic taxa to environmental pressures.
River Habitat Survey in Britain and Ireland: Field Survey Guidance Manual: 2003 Version (2003)[28]	RHS guidance manual.
UKTAG River Assessment Method: Macrophytes and Phytobenthos. Macrophytes (River LEAFPACS2) (2014)[29]	LEAFPACS survey approach and data analysis guidance.
Invertebrates (General Degradation): Walley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT). UKTAG river assessment method benthic invertebrate fauna (2021)[30]	Riverine invertebrate survey approach and data analysis guidance.
River flow indexing using British benthic macroinvertebrates: A framework for setting hydroecological objectives (1999)[31]	Description of the LIFE metric and how to calculate it.
The assessment of fine sediment accumulation in rivers using macro-invertebrate community response (2011)[32]	Description of the PSI metric and how to calculate it.

[27] Environment Agency (2011). *Interpreting and reporting freshwater ecology data*. Operational Instruction 387_09.
[28] Environment Agency (2003). *River Habitat Survey in Britain and Ireland: Field Survey Guidance Manual: 2003 Version*. Environment Agency; Peterborough.
[29] UKTAG (2014). *UKTAG River Assessment Method: Macrophytes and Phytobenthos. Macrophytes (River LEAFPACS2).*
[30] UKTAG (2021). *Invertebrates (General Degradation): Walley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT). UKTAG river assessment method benthic invertebrate fauna*. Water Framework Directive – United Kingdom Technical Advisory Group (WFD-UKTAG).
[31] Extence C A, Balbi D M and Chadd R P, (1999). *River flow indexing using British benthic macroinvertebrates: A framework for setting hydroecological objectives.* Regulated Rivers: Research & Management. 15: 543-574.
[32] Extence C A, Chadd R P, Dunbar M J, Wood P J and Taylor E D, (2011). *The assessment of fine sediment accumulation in rivers using macro-invertebrate community response.* River Res. Applic. 29(1): 17-55.

Magnox Ltd

Trawsfynydd Ponds Complex Demolition and Disposal EIA

Report of 2022 Biodiversity Studies



WSP Environment & Infrastructure Solutions UK Limited – July 2024

Executive summary

Magnox Ltd (the Applicant) is proposing the demolition of the Ponds Complex and the on-site disposal of the associated radioactive wastes (the 'Proposed Development') within the former Trawsfynydd Nuclear Power Station Site (hereafter referred to as the 'Trawsfynydd site'), located near Blaenau Ffestiniog, Gwynedd.

To inform the biodiversity impact assessment presented in the Environmental Statement (ES) required to support the planning application, a Phase 1 Habitat Survey of the habitats on and immediately surrounding the Proposed Development was undertaken in July 2019[1].

Following a review of the baseline biodiversity information for the Trawsfynydd Site collected between 2019 and 2022, it was recommended that further work be undertaken in three areas:

- Woodland - a National Vegetation Classification (NVC) survey to determine whether the woodland habitat was a Habitat of Principal Importance (HPI) under the Environment (Wales) Act 2016[3];
- Bats – placement of static bat detectors on the south-western edge of the Proposed Development boundary/woodland edge to determine the value of a flight path for bats and to inform any necessary lighting mitigation proposals; and
- Aquatic biodiversity – river habitat, macroinvertebrate and macrophyte surveys of the streams originating to the west and east of the Trawsfynydd Site which were identified as receptors in the Scoping Report[4] (see Chapter 5: Biodiversity Section 5.3).

This report presents the applied methods and results of these surveys, and, in summary, the results indicate that:

- Woodland – The woodland communities do not qualify as HPI. The woodland parcels surveyed exhibited characteristics in keeping with plantation woodland.
- Bats - Based on results from five months of survey (June-October 2022 inclusive), bats do not make extensive use of the full extent of the woodland edge immediately adjacent to the hardstanding adjacent to the Ponds Complex as a flightline. A significantly greater number of bats were present a few metres back into the woodland from the woodland boundary edge, therefore exposure to light spill from security lighting at the Trawsfynydd Site is not expected to be significant. Lesser horseshoe bats were present in very low numbers.
- Aquatic biodiversity:
    - River Habitat Survey (RHS) was undertaken in accordance with the 2003 Environment Agency RHS Survey Manual[24]. The survey was limited by watercourse accessibility and low water levels noting that 2022 was a drought year. In the two locations where survey work was possible it was noted that the headwater streams are severely modified and have

moderate habitat diversity with relatively few habitat features in common with a natural channel and river corridor.

- Aquatic invertebrate samples were collected in accordance with Environment Agency Operational Instruction[42] and Common Standards Monitoring Guidance[28]. The results identified a range of pressures acting on the invertebrate communities including poor water quality, low flow and poor habitat quality. Most sample sites are indicative of good to very good water quality. However, water quality is slightly reduced at MI2 in Spring although less so in Autumn. This site is located downstream of a pipe culvert, and a discharge that carries surface water runoff from the northern, lower lying, parts of the Trawsfynydd site (including the road leading to the sewage works on site and runoff from impermeable areas surrounding the sewage works), shallow groundwater ingress and storm overflow, all discharged through an oil interceptor. Results at MI6 and MI6b are both indicative of poor water quality in both Spring and Autumn sampling seasons. Water quality at MI6b is marginally higher than at MI6, this difference between the two sampling locations is assumed to relate to habitat differences between the sites. Despite this, it is noted that Number of Scoring Taxa (NTAXA) scores at MI6 and MI6b are generally low. These results indicate sub-optimal habitats for invertebrate communities. The sensitivity of the communities present to changes in flow were low to moderate in all but one sample, this being MI4 on the Afon Tafarn-helyg in Spring which suggested a high sensitivity. Overall, samples were indicative of less than good ecological status[30], this is assumed to reflect the headwater nature of the streams and the range of pressures, which include, although not all present at every site, reduced water quality, low flow and poor habitat quality. Of the sample sites surveyed the results indicate that MI4 is the most resilient site, noting that the location of M14 is downstream of the confluence of the two headwater stream systems, including receipt of discharge to the Nant Gwylan from the Gyfynys Dam.
- Aquatic macrophyte surveys were undertaken at five locations on the same streams sampled for aquatic invertebrates in accordance with the LEAFPACS survey method[32]. The results revealed Bryophytes to be the main aquatic vegetation due to the high shade cover and small nature of the streams. Species diversity is limited, site MP4 had the greatest diversity of bryophytes and the highest cover at site MP3 (20% bryophyte cover). The site MP5 is ephemeral. Much of the site was dry at the time of survey. Ecological Quality Ratio (EQR) scores were lower than expected at two sites. At site MP2 the watercourse bed is dominated by soft silt. Site MP1 had significant amounts of filamentous algae (30%) present. The cover of algae would be expected to be higher in sections of reduced shade coverage. This algal abundance is likely a result of nutrient enrichment, the source of which was not obvious. The survey results concur with those of the invertebrate survey which indicate reduced water quality in this reach.

- Overall, the results from the aquatic surveys indicate a range of pressures including modification, poor habitat quality, lower than expected water quality and low flows as observed during the field surveys in 2022.

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1. Introduction

1.1 Overview

1.1.1 Magnox Ltd (hereafter referred to as the Applicant) is proposing the demolition of the Ponds Complex and the on-site disposal of associated radioactive wastes (the Proposed Development) within the former Trawsfynydd Nuclear Power Station Site (hereafter referred to as the 'Trawsfynydd site'), located near Blaenau Ffestiniog, Gwynedd.

1.1.2 The Ponds Complex comprises a series of formerly water-filled ponds (mostly below ground), associated buildings and waste vaults. The ponds were used for the cooling and storage of spent fuel rods during operation prior to their dispatch from the Trawsfynydd site. Structures within the Ponds Complex were also used for effluent treatment, and for the storage of various radioactive wastes, including fuel element debris (i.e. parts of the fuel cladding that were removed before the spent fuel was dispatched from the Trawsfynydd site) and ion exchange resins. The Proposed Development involves the demolition of the Ponds Complex, and the disposal of the resulting ex-situ and residual in-situ radioactive wastes.

1.1.3 To inform the biodiversity impact assessment presented in the Environmental Statement (ES) required to support the planning application, a Phase 1 Habitat Survey of the habitats on and immediately surrounding the Ponds Complex was undertaken in 2019[1], with additional surveys undertaken for the range of species groups in 2021[2].

1.1.4 Following a review of the baseline biodiversity information collected prior to 2022, WSP and Magnox agreed that further work was required in three areas:

- Woodland:
  - The Phase 1 Habitat Survey report[1] indicated that *'Much of the periphery of the active [nuclear licensed] site, within and outside of the boundary to the north, east and west is semi-mature broadleaved plantation woodland. There are also younger areas of broadleaved plantation and naturally regenerating woodland around the edge of the asbestos burial areas to the north of the active [nuclear licensed] site, on a steep embankment to the west and along the track along the western boundary.*' The report also indicated that areas within this broadleaved plantation woodland potentially qualified as Section 7[3] Habitats of Principal Importance (HPI) for the purpose of maintaining and enhancing biodiversity in relation to Wales.

[1] Wood (2020). Decommissioning of Trawsfynydd site. Desk Study (Ecology), Phase 1 Habitat Survey and Preliminary Bat Roost Assessment. Report for Magnox.
[2] Cartmel Ecology Ltd. (2021). Trawsfynydd Power Station Ecology Surveys 2021 (01/12/2021). Cartmel Ecology Ltd.
[3] The Environment (Wales) Act 2016. [Online] Available at: https://www.legislation.gov.uk/anaw/2016/3/contents [Accessed 05 December 2023].

- As a result, it was indicated in the Scoping Report[4] within Chapter 5: Biodiversity, Table 5.7 that *'whilst there will be no direct habitat loss, the surrounding woodland may represent Section 7 HPI and may be sensitive to indirect (dust deposition) effects. Hence, effects on broad-leaved woodland are scoped into the assessment on a precautionary basis until the features status and sensitivity is confirmed.'*
- A National Vegetation Classification (NVC) survey was therefore undertaken in 2022.

- Bats:
  - Bat surveys undertaken in 2021 identified a bat flight path along the south-western edge of the Proposed Development which had not been previously assessed.
  - Given the proximity of this flight path to the Proposed Development, surveys were undertaken in 2022. Two static bat detectors were placed to assess the value of this flight path for bats and to inform any necessary lighting mitigation proposals for the Proposed Development.
- Aquatic biodiversity:
  - The streams originating to the west and east of the Trawsfynydd Site were identified as receptors in the Scoping Report (see Chapter 5: Biodiversity Section 5.3)[3]. These are an unnamed spring fed stream that flows off Craig Gyfynys located approximately 140m west of the Proposed Development and the Nant Gwylan which originates from a valved outlet through the Gyfynys Dam located approximately 500m east of the Proposed Development. Both flow into the Afon Tafarn-helyg. Aquatic studies of the watercourses were undertaken during 2022 as follows:
    - An assessment of the physical structure of the watercourses to determine their naturalness in terms of features present and to record channel dimensions, influences and special features (man-made and natural), in the form of River Habitat Surveys (RHS).
    - Collection of aquatic invertebrate samples, to assess the assemblage and provide an overall indication of the ecological health of the watercourses.
    - Recording of the vegetation in the channels and any riparian vegetation adjacent to them to assess the range of functional habitats that such vegetation may provide for invertebrates and other animals, as well as recording any notable plant species.

1.2 Structure of the report

1.2.1 Biodiversity studies undertaken in 2022 to inform the Environmental Impact Assessment (EIA) are presented in this report and are presented as follows:

[4] Wood (2022). Trawsfynydd Site Ponds Complex Demolition & Disposal Project Environmental Impact Assessment Scoping Report. Wood; Knutsford.

- Woodland NVC survey in **Section 2**;
- Bat survey in **Section 3**;
- River Habitat Survey (RHS) in **Section 4;**
- Aquatic invertebrate survey in **Section 5**;
- Macrophyte survey in **Section 6**; and
- Summary in **Section 7**.

2.

Woodland NVC Survey

2. Woodland NVC Survey

2.1 Method

Study Area

2.1.1 Woodland habitat within a distance of approximately 50-100 m from the Proposed Development boundary was included in the survey.

Field survey

2.1.2 The survey was undertaken on 07 May 2022 in accordance with an adapted version of the NVC methodology described by Hall et al.[5], with interpretation supported by reference to Rodwell[6].

2.1.3 A complete NVC survey involves the collection of 5 plots per habitat parcel. However, given the relatively limited survey area, the areas of homogenous woodland were generally too small to take more than one sample for both the canopy and understory layers. Therefore, the NVC methodology was adapted with 11 plots recorded throughout the survey area that, based on professional judgement, were deemed to be representative of the woodland communities in which they were located. Additional information was collected between plots to aid identification of communities present and to help assess whether habitats could be considered to qualify as a HPI under the Environment (Wales) Act 2016[3]. National Grid References (NGR) for each plot are provided in **Table 2.1** and locations shown on **Figure 2.1**.

2.1.4 Woodland NVC communities and sub-communities were determined by recording the amount of cover of each plant species within each plot. The published NVC methodology[7] for woodland recommends a 50 m x 50 m quadrat size for tree and shrub data and either 4 m x 4 m or 10 m x 10 m quadrats for ground flora (according to the nature of the vegetation). However, more recent guidance has shown that it is possible to classify samples taken using a range of different quadrat sizes[5]. The following methodology was therefore applied for the NVC survey at the Trawsfynydd Site:

- Identification of the area to be sampled, the ‘homogenous stand’, via a walk over the proposed survey area;
- Placement of a 4 x 4 m ground flora plot at the first sampling point;

[5] Hall. J. E, Kirby. K. J, Whitbread. A. M, (2004). National Vegetation Classification: Field guide to Woodland. Vegetation Classification: Users’ handbook. Joint Nature Conservation Committee.
[6] Rodwell. J. S, (1998). British Plant Communities. Vol. 1: Woodlands and scrub. Cambridge University Press.
Rodwell (1998) is used for interpretation of woodland habitats.

- Recording of the frequency and abundance of species present in the ground flora plot; and
- Recording of tree and shrub species presence and cover over the plot and within 20 – 25 m around the plot.

Table 2.1 Location of survey plots

Plot number	NGR
1	SH 69117 38342
2	SH 69025 38393
3	SH 68980 38004
4	SH 69118 37973
5	SH 68911 38106
6	SH 68828 38232
7	SH 68907 38506
8	SH 69081 38410
9	SH 68986 38429
10	SH 68952 38480
11	SH 68857 38265

Assigning frequency

2.1.5 Plant communities are described in terms of frequency and abundance and recorded within floristic tables. In Rodwell[6], frequency is typically determined by the number of plots each species was recorded in, as follows: scarce (1/5 – represented by the Roman numeral I), occasional (2/5 – represented by the Roman numeral II), frequent (3/5 represented by the Roman numeral III),) or constant (4/5-5/5 represented by the Roman numerals IV and V respectively). As 5 plots per representative stand were not recorded (see **paragraph 2.1.3**), guidance by Dring[7] and UK Centre for Ecology and Hydrology (CEH)[8] was followed to calculate relative frequency. This translated to the following frequencies where cover relates to the percentage cover for each species within the plot:

- I if cover <2%;
- II cover 2-5%;
- III cover 5-10%;
- IV cover 10-20%;
- V cover >=20%.

[7] Dring, J.S. (2000). SIMIL: A suite of programs for calculating the similarity between new quadrat data and the units of the National Vegetation Classification.
[8] UK Centre for Ecology and Hydrology (CEH) (2016) Modular Analysis of Vegetation Information System (MAVIS) Version 1.03. [Online] Available at: https://www.ceh.ac.uk/services/modular-analysis-vegetation-information-system-mavis [Accessed 15 March 2024].

Assigning abundance

2.1.6 The abundance of each species relates to the percentage of ground it covers in each plot, as described in the Domin scale[6]:

- 91-100% cover – 10;
- 76-90% cover – 9;
- 51-75% cover – 8;
- 34-50% cover – 7;
- 26-33% cover – 6;
- 11-25% cover – 5;
- 4-10% cover – 4;
- <4% (Many plants) – 3;
- <4% (Several plants)– 2; and
- <4% (Few plants)– 1.

Vegetation descriptions

2.1.7 Each stand was described including key species, vegetation structure, management techniques, and relationship with neighbouring vegetation in order to match it with the closest community type as described by Rodwell[6].

2.1.8 Where relevant, notes were made on the height of vegetation, soil drainage, slope, aspect, grazing-levels, land management, and any other data considered useful in determining the vegetation communities present.

2.1.9 This report uses common species names, only using scientific names for species groups where common names are unavailable, e.g. bryophytes. The nomenclature for the vascular plants follows Stace[9] for both scientific and common names (see **Appendix B**). Identification guides[10,11,12] were used to confirm the identification of species present.

Survey constraints and limitations

2.1.10 There is potential that notable or rare species were present at the survey locations but were not recorded during surveys as they were not clearly visible at the time of survey and/or were outside of the randomly selected survey plots.

[9] Stace, C. A. (2019). New Flora of the British Isles. Fourth Edition. C&M Floristics. Cambridge University Press.
[10] Poland. J, Clement. E. J, (2009). Vegetative Key to the British Flora. Botanical Society of the British Isles.
[11] Rose, F. (2006). The Wild Flower Key – How to identify wild plants, trees and shrubs in Britain and Ireland. Penguin Group, London.
[12] Wallace, H (2021). Grasses: a guide to identification using vegetative characters. Field Studies Council.

2.1.11 However, survey effort was considered to be appropriate for the size and complexities of the habitats surveyed.

Data analysis methods

2.1.12 Each stand was assigned to a community type based on the species present, their relative frequency between plots and how closely they match descriptions of communities described in Rodwell[6].

2.1.13 To assist with assigning communities, a statistical analysis programme – MAVIS software (Ver 1.03)[8] – was used to analyse the floristic table sample size data. Data from groups of plots were entered into MAVIS as constancy (or frequency) tables, matching coefficients were computed between the published synoptic tables and the new field data with the top 3 coefficients displayed. As MAVIS[8] can be prone to misidentifying communities, interpretation of Rodwell[6] was also used to aid classification.

Assessment of conservation importance

2.1.14 NVC communities were assessed to determine their conservation importance as HPIs for the purpose of maintaining and enhancing biodiversity in relation to Wales. These are listed by Welsh Government pursuant to Section 7 of the Environment (Wales) Act 2016[3], which replaces the Natural Environment and Rural Communities Act 2006[13] (as amended) in Wales. These include most of those UK Biodiversity Action Plan (BAP) priority habitats and species that occur in Wales. They are now referred to as 'S.7' habitats or species. Where S.7 species were recorded within the survey area, these are also discussed.

2.2 Results

2.2.1 A summary of each plot is provided in **Table 2.2**, with the results of the woodland NVC shown on **Figure 2.1.**

2.2.2 Floristic tables for all NVC stands are provided in **Appendix C**, with full output from all MAVIS[8] calculations provided in **Appendix D**. Photos of plots and surrounding woodland are provided in **Appendix E**.

2.2.3 The results suggest that these woodlands have at least partially been created by planting and hence they are classed as either broad-leaved plantation or mixed plantation. This is largely in keeping with the Phase 1 Habitat Survey carried out in July 2019[1].

2.2.4 No Section 7 HPIs were identified during the survey. Bluebell was recorded at plot 7, which is a notable plant species and is listed under Schedule 8 of the Wildlife and Countryside Act (1981)[14,15]. No other notable plant species were identified.

[13] Natural Environment and Rural Communities Act 2006. [Online] Available at: https://www.legislation.gov.uk/ukpga/2006/16/introduction [Accessed: 15 March 2024].
[14] Wildlife and Countryside Act 1981. [Online] Available at: https://www.legislation.gov.uk/ukpga/1981/69/contents [Accessed: 15 March 2024].
[15] Protected from intentional picking, uprooting, selling and destruction.

Table 2.2 Summary of NVC communities and conservation importance

Plot	NVC community	Justification	Top MAVIS results (%)	Description and conservation importance
1	No close match to any NVC communities	W10a (*Quercus robur – Pteridium aquilinum – Rubus fruticosus* community; typical sub-community) was the closest MAVIS[8] match (32.66%), although not very close due to a number of trees sharing similar cover (bird cherry, silver birch, sycamore) and hawthorn being the most abundant species in the canopy. In this community oak, hazel and silver birch would be expected to be the most abundant species. Bramble would be expected to be constant throughout, but instead was found to be rare. Bracken would also be expected to be constant but instead was absent. Despite this, the ground layer shared some similarities due to the presence of creeping jenny bramble, deer fern and male fern.	NVC: W10a 32.66 NVC: W10 29.28 NVC: W8e 26.64	Plantation woodland with planting tubes still present and all trees of a similar age (young to semi-mature). Ferns and tutsan dominate the ground layer. Nothing to indicate this woodland is HPI such as semi-natural woodland, long-term management as wood pasture and parkland or characteristics of wet woodland.
2	W16a (*Quercus* spp.-*Betula* spp.-*Deschampsia flexuosa, Quercus robur* sub-community)	W15a (*Fagus sylvatica-Deshampsia flexuosa* woodland, *Fagus sylvatica* sub-community) was the closest MAVIS[8] match (34.78%) to this community due to the high abundance of beech. However, in this community the ground layer would be expected to be largely eliminated with the exception of bryophytes. This was not found to be the case. A relatively diverse mixture of fern species was present.	NVC: W15a 34.78 NVC: W16a 33.90 NVC: W10a 30.86	Dense plantation woodland with planting tubes still present and all trees of a similar age (young to semi-mature). Nothing to indicate this woodland is HPI such as semi-natural woodland, long term management as wood pasture and parkland or characteristics of wet woodland.

		W16a was the next closest match on MAVIS[8] (33.90%) and appears to be a closer match for this community. This is due to oak and bracken being frequent throughout, unlike in W15a woodland and the high cover of silver birch as would be expected in this community. Other species present that would be expected in this community include deer fern, sessile oak and holly.		
3	W10a (*Quercus robur – Pteridium aquilinum – Rubus fruticosus* community; typical sub-community)	W10a (*Quercus robur – Pteridium aquilinum – Rubus fruticosus* community; typical sub-community) was a fairly close MAVIS[8] match (39.22**%**) with oak and silver birch found at the expected frequencies. Bramble was found to be constant as would be expected in this community, where it can become dominant at the ground layer.	NVC: W10a 39.22 NVC: W10 35.64 NVC: W10d 34.81	Young plantation woodland with trees of similar age and some semi-mature sycamore. Nothing to indicate this woodland is HPI such as semi-natural woodland, long term management as wood pasture and parkland or characteristics of wet woodland.
4	No close match to any NVC communities	W10a (*Quercus robur – Pteridium aquilinum – Rubus fruticosus* community; typical sub-community) was the closest MAVIS[8] match (32.36%). This community was not a particularly good fit due to sycamore being largely dominant and many other species having greater cover than oak, such as rowan and hawthorn. Furthermore, bramble would be expected to be constant throughout but instead was found to be rare. Bracken would also be expected to be constant however was absent.	NVC: W10a 32.36 NVC: W10d 30.93 NVC: W10 30.52	Semi-mature plantation woodland with planting lines not immediately evident and some younger trees planted. Ferns dominated the ground layer. Nothing to indicate this woodland is HPI such as semi-natural woodland, long term management as wood pasture and parkland or characteristics of wet woodland.
5	W10d (*Quercus robur – Pteridium*	W10d (*Quercus robur – Pteridium aquilinum – Rubus fruticosus* community; *Holcus lanatus* sub-community) is a fairly close MAVIS[8] match	NVC: W10d 41.57	Woodland with a diverse mixture of broadleaf species, areas of open canopy and tall herb. Planting lines not obvious

	aquilinum – *Rubus fruticosus* community; *Holcus lanatus* sub-community)	(41.57%) for this community due to the prevalence of bramble, bracken and oak, with some silver birch present. This community is described as typical of stands of planted oak with some naturally invading conifer trees. Yorkshire fog is notably absent and was instead replaced with a dense ground cover of bracken, bramble, male fern and rosebay willowherb.	NVC: W10c 37.70 NVC: W10 36.66	although originally plantation with no mature or veteran trees. Nothing to indicate this woodland is HPI such as semi-natural woodland, long term management as wood pasture and parkland or characteristics of wet woodland.
6	No close match to any NVC communities	This woodland was difficult to classify and had no close matches to any communities. Wooded areas contained a dense canopy of sycamore with lower amounts of other broadleaf species such as rowan, alder, beech and goat willow. Alder had a greater prevalence to the north, suggesting the soil may be less free draining in this area or additional inputs of water. Lady fern, soft-shield fern and honeysuckle are considered ancient woodland indicator species in some parts of Britain and their prevalence suggests the ground flora has established over an extended period. Close proximity to nearby ancient woodland can increase the likelihood of these species being present in younger woodland and it is therefore possible that these species have spread from woodland outside of the survey area to the west. Buddleia was locally dominant in places to the detriment of all other species.	NVC: W7c 18.19 NVC: W7a 17.86 NVC: W7 17.67	Woodland with a diverse mixture of broadleaf species, areas of open canopy and tall herb. Planting lines not obvious although originally plantation with no mature or veteran trees. Nothing to indicate this woodland is HPI such as semi-natural woodland, long term management as wood pasture and parkland or characteristics of wet woodland.

7	Most similar to W7(*Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum*) woodland however not a close match to any NVC communities.	This community was difficult to classify and had affinities to W10 (*Quercus robur – Pteridium aquilinum – Rubus fruticosus*), W8 (*Fraxinus excelsior-Acer campestre-Mercurialis perennis*) and W7 (*Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum*) woodland. However, the canopy shared most similarities with W7 woodland due to the prevalence of wetland species, such as willow. The presence of cows grazing in the field is likely to have a significant impact on the composition of the ground flora and regeneration of younger trees, with up to 40% of the ground bare earth. Ground flora was found to be more typical of open communities, with species such as gorse, foxglove, agrimony and hairy bitter-cress. Although they were both rare, the presence of yellow pimpernel and bluebell is notable with these species, and are considered indicators of ancient woodland. This suggests that either this area has been continuously wooded for a long period of time, or its possible these species may have spread from woodland outside of the survey area to the immediate west. It is not possible to tell whether these species would occur in higher abundance if the high levels of disturbance from cattle was reduced.	NVC: W10 32.63 NVC: W8e 32.45 NVC: W7a 32.10	Trees were semi-mature and appeared to be of a similar age, suggesting they may have originated from planting. This woodland does not qualify as Wood pasture and Parkland HPI, despite the presence of grazing animals. In this habitat ancient and veteran trees would be expected, along with signs of long-term management. Wet woodland priority habitat was scoped out for this woodland despite the presence of wetland tree species in the canopy. This is due to the soil appearing to be freely draining, with the limited areas of waterlogged soil present considered to be due to compaction and poaching from grazing cattle, instead of being the result of hydrological features such as flushes, springs or draining. The presence of gorse, which typically occurs in light and free draining soil supports this.
8	W16a (*Quercus* spp.-*Betula*	This woodland showed a strong match to W16a (*Quercus* spp.-*Betula* spp.-*Deschampsia*	NVC: W16a 51.75	Small area of mixed woodland. Scots pine was the dominant tree in the canopy

	spp.-*Deschampsia flexuosa* woodland, *Quercus* robur sub-community)	*flexuosa*, *Quercus robur* sub-community) woodland. This is due to the high cover of silver birch, relatively low diversity of ground flora with a high coverage of bracken and the presence of Scots pine and heather.	NVC: W16 48.35 NVC: W10d 44.85	with younger silver birch also present. The ground flora was typical of acidic conditions with bracken and heather. Nothing to indicate this woodland is HPI such as semi-natural woodland, long term management as wood pasture and parkland or characteristics of wet woodland.
9	W15a *(Fagus sylvatica-Deshampsia flexuosa* woodland, *Fagus sylvatica* sub-community) with similarities to W9 (*Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis*) woodland, not a close match	W15a (*Fagus sylvatica-Deshampsia flexuosa* woodland, *Fagus sylvatica* sub-community) was the closest MAVIS[8] match (35.40%) due to the dominance of beech. In this community, the ground layer would be expected to be largely eliminated with the exception of bryophytes. This was not found to be the case, with a relatively diverse mixture of fern species present, with male fern the dominant species. This is contrary to the expectation of such species being absent in this community. This may be due to the young age of the trees and therefore the absence of a closed dark canopy as would be found in more mature woodland. Although not one of the closest suggestions by MAVIS[8], constant male fern is more in keeping with W9 (*Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis*) woodland. This is further supported by the abundance of silver birch, sycamore, sessile oak in the canopy.	NVC: W15a 35.40 NVC: W16a 33.94 NVC: W10a 31.71	Young broadleaf plantation with a ground layer dominated by ferns. Nothing to indicate this woodland is HPI such as semi-natural woodland, long term management as wood pasture and parkland or characteristics of wet woodland.

10	W15a (*Fagus sylvatica-Deshampsia flexuosa* woodland, *Fagus sylvatica* sub-community)	W15a (*Fagus sylvatica-Deshampsia flexuosa* woodland, Fagus sylvatica sub-community) was the closest MAVIS[8] match due to the high abundance of beech. This is a good match for this community with the canopy dominated by mature beech trees. In this community the ground layer would be expected to be sparse, which was found to be the case with no species having greater than 10% cover at the ground and field layers.	NVC: W15a 38.37 NVC: W14 26.01 NVC: W15 25.17	Mature broadleaf plantation dominated by beech with a sparse ground layer and dense canopy cover. This woodland does not qualify as 'Lowland beech and yew woodland' HPI as outside expected range for this habitat and yew was absent. Nothing to indicate this woodland is HPI such as semi-natural woodland, long term management as wood pasture and parkland or characteristics of wet woodland.
11	W16 (*Quercus* spp.-*Betula* spp.-*Deschampsia flexuosa)* woodland	This woodland was most similar to W16 (*Quercus spp.-Betula spp.-Deschampsia flexuosa*) community. This is due to the presence of oak, silver birch and Scots pine in the canopy. The ground flora was dominated by ferns that would be expected in this community, including broad buckler fern, bracken and deer fern.	NVC: W16 33.02 NVC: W10a 32.87 NVC: W10d 32.16	High coverage of Scots pine outside of its natural range and young broadleaf trees present shows that this is mixed plantation woodland. The canopy was very open in places, with these open areas dominated by rosebay willowherb. Nothing to indicate this woodland is HPI such as semi-natural woodland, long-term management as wood pasture and parkland or characteristics of wet woodland.

2.3 Discussion

NVC communities

2.3.1 In several cases, as identified in **Table 2.2**, it was not possible to closely match the flora present to an NVC community. Where communities do not fit within the community descriptions, this can indicate artificial or man-made habitats such as plantation woodland which can be difficult to fit into described communities.

2.3.2 This survey confirmed that the woodland present is predominantly plantation, as previously indicated in the Phase 1 Habitat Survey[1].

Conservation importance

2.3.3 Wood (2020)[1] indicated there are a total 11 different HPI either within the wider Trawsfynydd Site or within 3 km of the boundary. In respect of woodland, these included wet woodland, upland oak woodland and ancient woodland sites.

2.3.4 However, the communities surveyed in 2022 and reported within **Table 2.2** are not considered to qualify as HPI. The woodland parcels surveyed all exhibited some or all of the following characteristics which are in keeping with plantation woodland:

- Planting lines being visible and tree tubes being present.
- Trees being of a similar age and height. As trees were all planted at the same time this often results in a canopy of trees of the same age and height without a complex canopy.
- A relatively sparse and underdeveloped ground and field flora. Woodland plant communities take long periods of time to become established. It is generally accepted that long-established climax (i.e. botanically stable) woodlands take well over a hundred years to develop from the pioneering stage of early woodland growth. As it takes many years for trees to reach the age and height required to maintain conditions for specialist woodland ground flora, these species are often absent from plantation woodland.
- Absence of deadwood. As trees take a long time to mature and then die or become damaged, deadwood is often absent from woodland areas that just contain young and healthy trees.
- Absence of veteran[16] and ancient[17] trees. As ancient trees grow and mature over long durations, in addition to the long timescales for the development of qualifying features for veteran trees, both are absent from woodland that has been recently planted.

[16] Trees which have reached full maturity and are showing signs of aging with features such as hollowed trunk, wide trunk, and a squat shape
[17] Trees which have reached a remarkably old age for that species, with the exact age varying between species. All ancient trees are veterans

2.3.5 'Lowland mixed deciduous woodland' Section 7 priority habitat is characterised as semi-natural habitat[18] . Semi-natural woodland is characterised by mainly native trees that have not been obviously planted and whose appearance appears to be natural, this is not in keeping with plantation woodland. As all woodlands surveyed showed some or all of the plantation woodland characteristics described in **paragraph 2.3.4**, this priority habitat was scoped out from further consideration.

2.3.6 The Phase 1 Habitat Survey report[1] suggests that there is potential for wet woodland priority habitat within the survey area. Wet woodland is found on floodplains, as successional habitat on fens, mires and bogs, along streams and hill-side flushes, and in peaty hollows. It is characterised by poorly drained or seasonally wet soils, usually with alder, birch and willows as the predominant tree species, but sometimes including ash, oak, pine and beech on the drier riparian areas. Although the woodland areas present within the survey area will likely experience high levels of rainfall given the location on the southern edge of Snowdonia, the soil appeared to be freely draining. Additionally, whilst the community (recorded at plot 7) was described as having similarities to W7 woodland, this was not a close MAVIS[8] match. Limited areas of waterlogged soil were present at this location, but this was considered to be related to compaction and poaching from grazing cattle rather than the result of hydrological features such as flushes, springs or draining. Willow and birch were prominent within the canopy, which are typical of wet woodland, however, collectively did not account for more than 35% of cover, with sycamore dominant and accounting for up to 50% of cover.

[18] BRIG (2010) UK Biodiversity Action Plan: Priority Habitat Descriptions. Lowland Mixed Deciduous Woodland. JNCC, Peterborough.

3.

Bat Surveys

3. Bat Survey

3.1 Method

Activity survey (automated monitoring)

3.1.1 To determine the value of the identified flight path for bats, and to inform any necessary lighting mitigation proposals for the Proposed Development, two static automated bat detectors (SM4 full spectrum) were deployed (see **Figure 3.1**). The first bat detector was deployed at Location 1, to the north-west of the Ponds Complex along the edge of broadleaved woodland directly adjacent to the Proposed Development boundary. The second bat detector was deployed at Location 2, to the south-west of the Ponds Complex, along an extended area of woodland edge with hardstanding adjacent.

3.1.2 The detectors at both locations were deployed at a height of 2m or above and recorded for five full nights[19], over five monitoring periods between June – October 2022, with each detector recording from 30 minutes before sunset until 30 minutes after sunrise.

3.1.3 The monitoring periods at Locations 1 and 2 were as follows:

- 8 June 2022 – 12 June 2022:
- 25 July 2022 – 29 July 2022;
- 1 August 2022 – 5 August 2022;
- 5 September 2022 – 9 September 2022; and
- 3 October 2022 – 7 October 2022.

3.1.4 Weather data for the survey nights are presented in **Table 3.1**.

3.1.5 Analysis of bat recordings was carried out with reference to published guidance to aid species identification[20,21] using BatExplorer PRO software. During the sound analysis process, some records from the automated bat detectors were not identified to species level due to overlapping call parameters. Other records were identified to genus/species group, with the following groups used:

- Nathusius' pipistrelle or common pipistrelle;
- *Myotis* sp. (bat species in the genus *Myotis*); and
- Long-eared (brown or grey long-eared bat).

[19] Dates represent a full night e.g. the night of 08/06/2022 is from 30 minutes before sunset on 08/06/2022 until 30 minutes after sunrise on 09/06/2022.
[20] Russ, J. (2012) British Bat Calls. A guide to species identification. Pelagic Publishing, Exeter.
[21] Middleton, N. Froud, N. and French, K. (2014*)* Social calls of the bats of Britain and Ireland. Pelagic Publishing, Exeter.

3.1.6 The majority of recordings in the genus *Myotis* were grouped together, as these species in particular have widely overlapping call parameters. Similarly, it is difficult to distinguish between the two British species of long-eared bats through flight observations and sound recordings alone, therefore recordings were grouped as ‘long-eared’ rather than identified to species. Where the peak frequency for Nathusius’ pipistrelle or common pipistrelle overlaps (40-42 khz), bat passes were labelled as Nathusius’ pipistrelle or common pipistrelle as the record could be either species.

Survey constraints and limitations

3.1.7 There were no survey constraints.

Table 3.1 Activity survey (automated monitoring) weather data 2022

Night of Date[22]	Sunset (time)	Sunrise (time)	Temperature Max ˚C	Temperature Min. ˚C	Average Windspeed (mph)	Humidity (%)	Precipitation (inches)
08/06/2022	21:37	04:52	18	8	2.8	90	0.2
09/06/2022	21:38	04:51	16	6	3	92	0.06
10/06/2022	21:39	04:51	17	13	5.3	87	0
11/06/2022	21:40	04:50	16	12	4.5	88	0
12/06/2022	21:40	04:50	16	10	1.7	84	0
25/07/2022	21:20	05:24	17	11	2	90	0.07
26/07/2022	21:18	05:25	20	7	1.5	80	0
27/07/2022	21:17	05:27	21	6	1.1	82	0
28/07/2022	21:15	05:28	22	12	0.8	81	0
29/07/2022	21:14	05:30	24	13	1.7	81	0
01/08/2022	21:09	05:35	19	11	1.7	90	0.97
02/08/2022	21:07	05:36	17	17	4.5	98	2
03/08/2022	21:05	05:38	18	15	2.6	94	0.09
04/08/2022	21:03	05:40	21	10	1.4	79	0
05/08/2022	21:02	05:41	20	8	1.3	83	0.03
05/09/2022	19:54	06:34	23	12	2	83	0.51
06/09/2022	19:52	06:35	22	12	1.3	85	0.36
07/09/2022	19:50	06:37	21	13	1	88	0.20
08/09/2022	19:47	06:39	19	13	0.9	87	0.12
09/09/2022	19:45	06:40	22	11	0.9	86	0
03/10/2022	18:47	07:21	17	7	1.7	89	0
04/10/2022	18:45	07:23	15	13	4.4	96	1.14
05/10/2022	19:46	07:25	15	8	4.2	92	0.03

[22] Sunrise and sunset data for location from Time and Date (www.timeanddate.com). Weather data from nearest weather station (www.wunderground.com) Ty'n Ddol, Rhyd -IPENRH3 (approximately 6.4km north-west).

06/10/2022	18:40	07:27	15	8	4.2	92	0.03
07/10/2022	18:38	07:28	15	9	3.5	91	0.47

3.2 Results

Activity survey (automated monitoring)

3.2.1 At least seven species or species groups were confirmed to be present including:

- Common pipistrelle;
- Soprano pipistrelle;
- Nathusius' pipistrelle;
- Noctule;
- *Myotis* species;
- Long-eared; and
- Lesser horseshoe bat.

3.2.2 Additional species may also have been recorded, where some ambiguous calls were allocated to groupings such as *Myotis* species or long-eared.

3.2.3 **Table 3.2** and **Graphic 3.1** present the total number of bat passes at each detector location with the average number of bat passes per night (over 5 nights) at Location 1 and 2 presented in **Table 3.3**. **Table 3.4** presents the total number and percentage of bat passes by species at each location and **Table 3.5** presents a comparison of the distribution of species between Location 1 and 2 (total passes and percentage of passes) and this is represented graphically in **Graphic 3.2**. It should be noted that the results are intended to give an indication of relative levels of bat activity at each location and do not represent actual number of bats.

Table 3.2 Number of bat passes at Location 1 and 2

Monitoring Period	June 08/06/2022 – 12/06/2022		July 25/07/2022- 29/07/2022		August 01/08/2022- 05/08/2022		September 05/09/2022- 09/09/2022		October 03/10/2022- 07/10/2022	
Location	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Common pipistrelle	1443	45	1490	41	745	9	409	83	18	0
Soprano pipistrelle	1786	327	1763	431	1039	139	952	495	114	29
Nathusius' pipistrelle	0	0	4	0	2	0	0	0	0	0
Nathusius' pipistrelle / common pipistrelle	0	0	9	0	0	0	2	0	0	0
Lesser horseshoe	2	0	1	0	0	0	1	0	0	0
Long-eared	0	0	1	0	0	0	4	0	0	0
Myotis sp.	48	1	191	6	109	6	104	5	30	8
Noctule	14	14	580	39	78	15	66	31	3	0

Table 3.3 Average number of bat passes per night (over 5 nights) at Location 1 and 2

Monitoring Period	June 08/06/2022 – 12/06/2022		July 25/07/2022- 29/07/2022		August 01/08/2022- 05/08/2022		September 05/09/2022- 09/09/2022		October 03/10/2022- 07/10/2022	
Location	1	2	1	2	1	2	1	2	1	2
Common pipistrelle	288.6	9	298	8.2	149	1.8	81.8	16.6	3.6	0
Soprano pipistrelle	357.2	65.4	352.6	86.2	207.8	27.8	190.4	99	22.8	5.8
Nathusius' pipistrelle	0	0	0.8	0	0.4	0	0	0	0	0
Nathusius' pipistrelle/ common pipistrelle	0	0	1.8	0	0	0	0.4	0	0	0
Lesser horseshoe	0.4	0	0.2	0	0	0	0.2	0	0	0
Long-eared	0	0	0.2	0	0	0	0.8	0	0	0
Myotis sp.	9.6	0.2	38.2	1.2	21.8	1.2	20.8	1	6	1.6
Noctule	2.8	2.8	116	7.8	15.6	3	13.2	6.2	0.6	0

Table 3.4 Total number and percentage of bat passes by species at each separate location

Location and data set	Common pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Nathusius' pipistrelle/ common pipistrelle	Lesser horseshoe	Long-eared	Myotis sp.	Noctule	Total
Number of bat passes	4,105	5,654	6	11	4	5	482	741	11,008

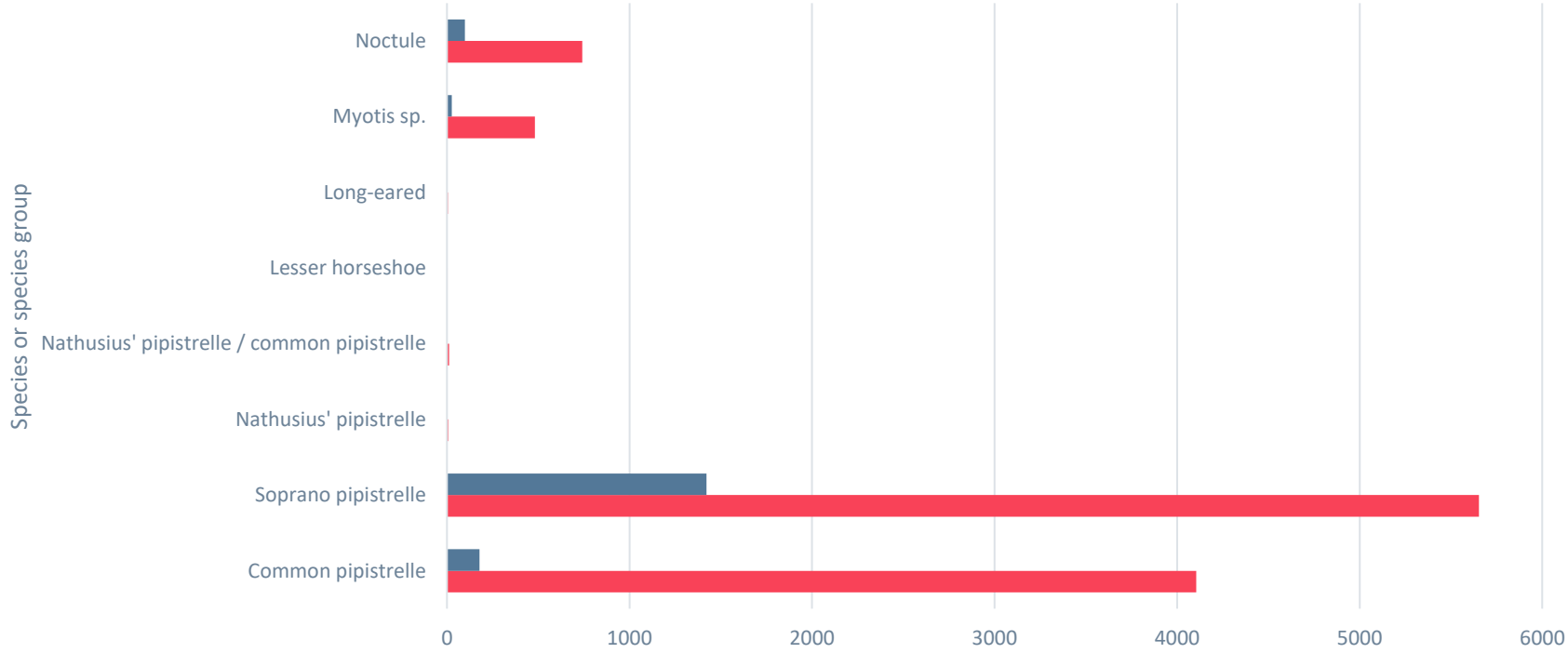
at Location 1									
Percentage of bat passes per species at Location 1	37.29%	51.36%	0.05%	0.10%	0.04%	0.05%	4.38%	6.73%	100.00%
Number of bat passes at Location 2	178	1,421	0	0	0	0	26	99	1,724
Percentage of bat passes per species at Location 2	10.32%	82.42%	0	0	0	0	1.51%	5.74%	100.00%

Table 3.5 Comparison of the distribution of species between Location 1 and 2 (total passes and percentage of passes)

Location and data set	Common pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Nathusius' pipistrelle/ common pipistrelle	Lesser horseshoe	Long-eared	Myotis sp.	Noctule
Total number of bat passes recorded at location 1	4,105	5,654	6	11	4	5	482	741
Total number of bat passes recorded at location 2	178	1,421	0	0	0	0	26	99
Overall total bat of passes recorded (location 1 and 2 combined)	4,283	7,075	6	11	4	5	508	840

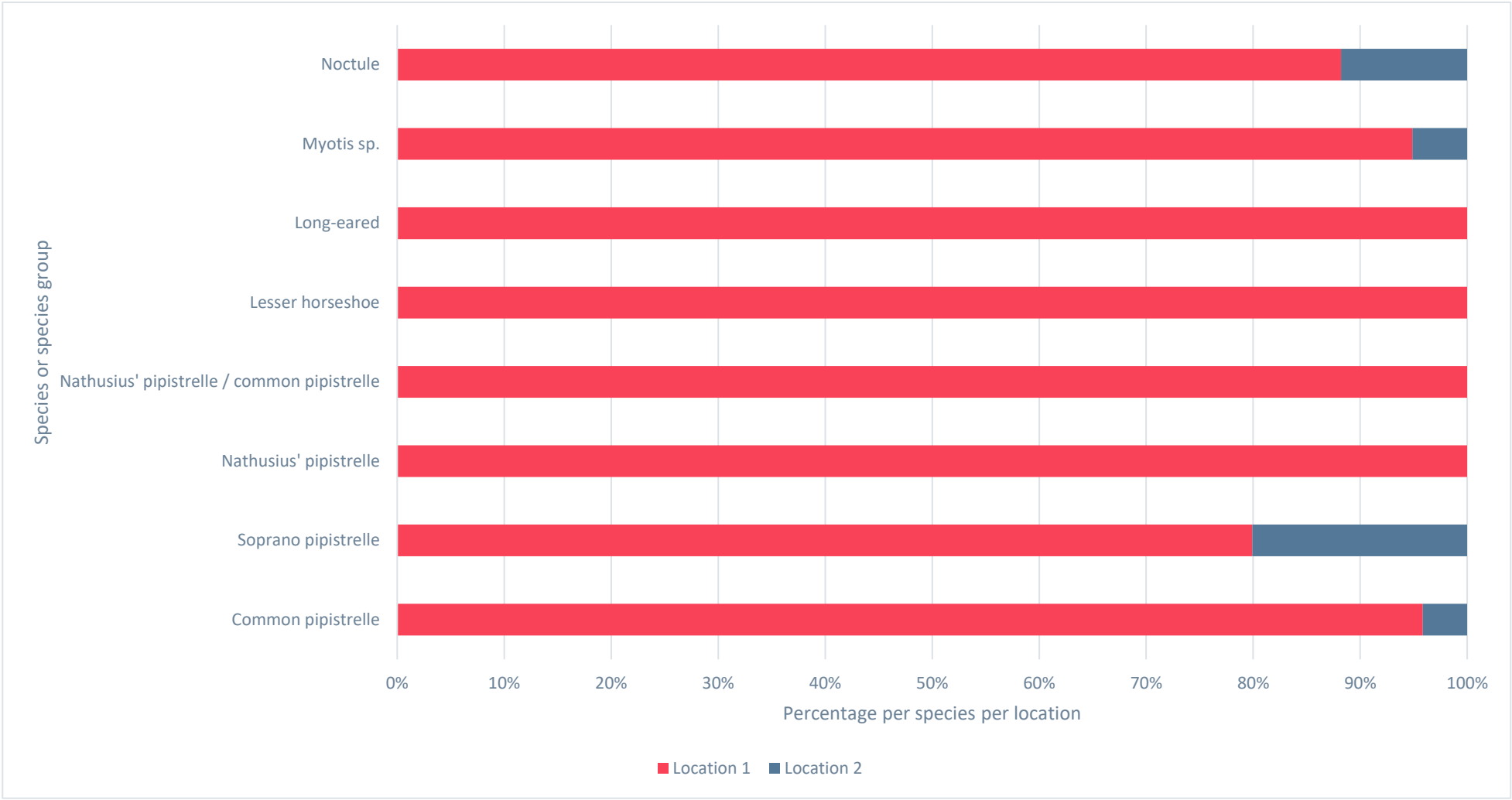
Percentage passes per species at location 1	95.84%	79.92%	100.00%	100.00%	100.00%	100.00%	94.88%	88.21%
Percentage passes per species at location 2	4.16%	20.08%	0.00%	0.00%	0.00%	0.00%	5.12%	11.79%

Graphic 3.1 Total number of bat passes recorded by species and location (with fewest recorded shown first)



	Common pipistrelle	Soprano pipistrelle	Nathusius' pipistrelle	Nathusius' pipistrelle / common pipistrelle	Lesser horseshoe	Long-eared	Myotis sp.	Noctule
Location 2	178	1421	0	0	0	0	26	99
Location 1	4105	5654	6	11	4	5	482	741

Graphic 3.2 Overall percentage of species or species group at Location 1 and 2



Soprano pipistrelle

3.2.4 The most frequently recorded species overall was soprano pipistrelle, with a total of 7,075 bat passes (55.57% of all records) recorded over a combined total of 50 nights for both locations. Soprano pipistrelle bat activity was highest over the months of June and July 2022 at Locations 1 and 2, with a peak count recorded at Location 1 in June 2022 of 1,786 pass passes (an average of 357.2 bat passes per night) and at Location 2 in July 2022 of 431 bat passes (an average of 86.2 bat passes per night), over 5 nights at each location.

Common pipistrelle

3.2.5 The second most frequently recorded species was common pipistrelle, with a total of 4,283 bat passes (33.64% of all records) recorded over a combined total of 50 nights at both locations. A peak count of 1,490 bat passes (an average of 298 bat passes per night) was recorded in July 2022 at Location 1 and a peak count of 45 bat passes (an average of 9 bat passes per night) was recorded in June 2022 at Location 2, over 5 nights at each location.

Noctule

3.2.6 The third most frequently recorded species was Noctule with a total of 840 bat passes (6.6% of all records) recorded over a combined total of 50 nights at both locations. A peak count of 580 bat passes (an average of 116 bat passes per night) was recorded in July 2022 at Location 1 and a peak count in July 2022 of 39 bat passes (an average of 7.8 bat passes per night) was also recorded for Location 2, over 5 nights at each location.

Myotis species

3.2.7 *Myotis* species was the fourth most frequently recorded species group, with a total of 508 bat passes (3.99% of all records) recorded over a combined total of 50 nights at both locations. A peak count of 191 bat passes (an average of 38.2 bat passes per night) was in July 2022 at Location 1, with peak counts being in July and August 2022 with six passes each (an average of 1.2 bat passes per night each) at Location 2, over 5 nights at each location.

Nathusius' or common pipistrelle

3.2.8 There were very limited records for the species group identified as Nathusius' or common pipistrelle (with an overlapping peak frequency range of 40-42 khz), with a total of 11 bat passes (0.09% of all records) recorded over a combined total of 50 nights including all bat passes from both locations, with the passes being recorded only at Location 1. A peak count of 9 bat passes (an average of 1.8 bat passes per night) being recorded in July 2022 at Location 1 (over 5 nights).

Nathusius' pipistrelle

3.2.9 Similarly, there were limited Nathusius' pipistrelle bat passes, with a total of 6 bat passes (0.05% of all records) recorded over a combined total of 50 nights including all bat passes from both locations, with the passes again being recorded

only at Location 1. A peak count of four bat passes (an average of 0.8 bat passes per night) being recorded in July 2022 at Location 1 (over 5 nights).

Long-eared bat

3.2.10 Only five long-eared bat passes (0.04% of all records) were recorded over a combined total of 50 nights including all bat passes from both locations, with passes being recorded only at Location 1. A peak count of four bat passes (an average of 0.8 bat passes per night) being recorded in October 2022 at Location 1 (over 5 nights).

Lesser horseshoe bat

3.2.11 Lesser horseshoe bat was the least recorded species with only four bat passes (0.03% of all records) over a combined total of 50 nights including all bat passes from both locations, with the passes being recorded only at Location 1. A peak count of two passes (an average of 0.4 bat passes per night) being recorded in June 2022 at Location 1 (over 5 nights).

3.3 Discussion

3.3.1 A total of 12,732 bat passes were recorded. This is an average of 254.64 bat passes per night for all five monitoring periods, at two monitoring locations, over a combined total of 50 nights. At Location 1, to the north-west of the Ponds Complex, there was noticeably more bat activity with 11,008 bat passes (440.32 bat passes per night, 86.46% of the total) when compared to Location 2, to the south-west of the Ponds Complex, with a total of 1724 recorded bat passes (68.96 bat passes per night, 13.54%), over a total of 25 nights at each location (over 5 monitoring periods).

3.3.2 Only soprano pipistrelle, common pipistrelle, noctule and *Myotis* species were recorded at both monitoring locations. It is also noted that a soprano pipistrelle maternity roost is present in the Pump House, which is approximately 200m from the Proposed Development boundary. This is likely to have contributed to the number of soprano pipistrelle records made.

3.3.3 All species or species groups recorded were most numerous at Location 1, although lesser horseshoe bat, long-eared, Nathusius' pipistrelle and Nathusius' pipistrelle/common pipistrelle were represented by a very low number of passes at this location. It is notable that lesser horseshoe, long-eared, Nathusius' pipistrelle and Nathusius' pipistrelle/common pipistrelle bat passes were not recorded from Location 2 and that bat activity was much lower in general. This trend indicates that bats do not appear to be making extensive use of the full area of the woodland edge immediately adjacent to the hardstanding alongside the Ponds Complex as a flightline.

3.3.4 A potential reason for this difference is that Location 1 was set within broadleaved woodland and scrub which is exposed to less light spill from the existing security lighting, whilst Location 2 was set on the edge of the Trawsfynydd Site along the woodland edge with existing security lighting. In reviewing 2021 static detector

data[23] there was a similar number of calls from the northern and west static bat detectors as for Location 1, with both bat detectors set back from existing security lighting within woodland habitat with unlit forestry tracks, no hardstanding adjacent and less light spill. This suggests that bats are predominantly migrating through and foraging within the good quality woodland habitat near to the Proposed Development rather than the woodland edge adjacent to the Proposed Development.

3.3.5 The Meirionnydd Oakwoods and Bat Sites Special Area of Conservation (SAC) is located approximately 1 km south-west from the Trawsfynydd Site at its nearest point, with the SAC being primarily designated for lesser horseshoe bats. However, lesser horseshoe bats were the least recorded species overall, present in very low numbers. In total there were only four bat passes (0.03%) over a combined total of 50 nights recording, with the passes being recorded only at Location 1. Lesser horseshoe bats were not recorded to be using the Ponds Complex as a flightline (i.e. flying the entire length from Location 1 to 2 during the monitoring periods). Whilst it cannot be ruled out as a flightline, it can be concluded that the woodland edge along the western boundary of the Proposed Development, is not a frequently used or important flightline for lesser horseshoe bats. Given the very low numbers of lesser horseshoe bats recorded, and hence assumed to be using the area, the Proposed Development is not expected to have any detrimental effects on the Meirionnydd Oakwoods and Bat Sites SAC.

[23] Cartmel Ecology Ltd. (2021). Trawsfynydd Power Station Ecology Surveys 2021 (01/12/2021). Cartmel Ecology Ltd.

4.

River Habitat Survey

4. River Habitat Survey

4.1 Method

Field method

4.1.1 River Habitat Survey (RHS) is a standard walkover survey technique used to assess and quantify physical habitat diversity within and adjacent to river channels. The survey method is defined in the 2003 Environment Agency RHS survey manual[24]. A survey transect 500m in length is undertaken at each chosen survey location. Information is gathered from the whole of the transect (the 'sweep-up') and from 10 cross-sections spaced at regular intervals. However, where RHS transects are less than 500m in length the distance between spot checks can be shortened to ensure that 10 equally spaced spot checks are undertaken and enable subsequent data analysis. Information is recorded from the bank-top or from the channel and entered onto a standard survey form. Within a standard transect, features such as flow, channel and bank substrate type, vegetation structure and complexity, adjacent land-use, anthropogenic impacts, morphological features and signs of notable fauna are recorded using a RHS check-sheet.

4.1.2 A summary of the information gathered during an RHS is summarised in **Table 4.1,** with a list of RHS terms and acronyms presented in **Appendix F**.

Site selection and survey

4.1.3 The watercourses closest to the Trawsfynydd Site were subject to walkover in December 2021 to identify survey locations. The watercourses visited comprised an unnamed spring fed stream that flows off Craig Gyfynys west of the Proposed Development and the Nant Gwylan which originates from a valved outlet through the Gyfynys Dam. Both feed into the Afon Tafarn-helyg (see **Figure 4.1**). During the walkover, it was noted that long reaches of each watercourse were inaccessible due to the presence of dense impenetrable scrub vegetation, and as a result surveys would not be possible in these areas. As a result of the accessibility issues, only three survey locations were identified, however none extended to 500m in length. Nonetheless, it was considered that RHS of the shorter reaches should still be undertaken as useful data could still be collected.

4.1.4 The RHS was carried out on 26 May 2022 and details of the survey transects are provided in **Table 4.2**. It should be noted however that the summer vegetation further restricted access to RHS 3, and additionally the stream was dry except for about 5-10 m and as a result only a single spot check was possible and a full RHS

[24] Environment Agency, (2022). River Habitat Survey in Britain and Ireland. Field Survey Guidance Manual 2022 Version. [Online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/311579/LIT_1758.pdf [Accessed: 15 March 2024].

was not possible and therefore subsequent data analysis was not possible for RHS 3.

Table 4.1 Summary of RHS data collected

Section of form	Parameter recorded
A: Field survey details	For example river name, grid references, adverse conditions, visibility of bed, health and safety.
B: Predominant valley form	Choice of shallow vee, deep vee, gorge, concave/bowl, asymmetrical valley, U-shape valley or no obvious valley sides; presence of flat valley bottom and natural terraces.
C: Number of riffles, pools, and point bars	A total count of riffles, pools, vegetated point bars and un-vegetated point bars in the full survey reach.
D: Artificial features	Records of human influence on the river, including presence of culverts, major, minor or intermediate weirs, bridges, fords, deflectors, outfalls and intakes, and significant impoundment of water or re-sectioning of channel.
E: Physical Attributes	Records of predominant features at 10 spot checks including bank material, modification and features, and channel substrate, flow type, modification and features.
F: Banktop land-use and vegetation structure	Records of bank-top land-use and bank-top and bank-face vegetation structure at each of the ten spot check sites.
G: Channel vegetation	Records of the type and abundance of vegetation in the channel at each of the ten spot checks.
H: Land use within 50 m of banktop	Presence of different types of land use within 50 m either side of the channel.
I: Bank profiles	Presence and extent of natural or artificial bank profiles.
J: Extent of trees and associated features	Estimate of the extent of tree cover, overhanging boughs, exposed roots etc..
K: Extent of channel and bank features	Estimate of the extent of channel features e.g. different flow types, marginal deadwaters, eroding/stable cliffs, mid-channel bars, side bars, point bars, silt deposits etc.
L: Channel dimensions	Measurements taken at a straight uniform section, preferably a riffle.
M: Features of special interest	Presence of unusual features such as braided channels, waterfalls, quaking banks, flushes, wet woodland etc..
N: Choked channel	Is 33% or more of the channel blocked with vegetation?
O: Notable nuisance plant species	Presence of Himalayan balsam, giant hogweed, and Japanese knotweed.
P: Overall characteristics	Keyword description of major impacts, land management, animals and other significant observations.
Q: Alders	Presence of alders, and signs of alder disease (Phytopthera).
R: Field survey quality control	Requirement for cross-checks to be made to ensure accuracy of data recorded in other sections.

Table 4.2 RHS transects

RHS site number	Stream name	Location relative to the Trawsfynydd Site	Length of transect (m)
RHS 1	Unnamed stream	North	350
RHS 2	Nant Gwylan	East	100
RHS 3	Unnamed stream	West	10 (1 spot check possible only)

Data analysis

4.1.5 The RHS data for RHS 1 and RHS 2 have been entered into the CEH Rapid 3.0 database[25], which calculates the Habitat Modification Score (HMS) and Habitat Quality Assessment (HQA) for the data.

4.2 Results

Site description

4.2.1 RHS 1 and RHS 3: The unnamed stream originates from springs on the east face of Craig Gyfynys and flows to the north-east, initially over ground 150 m to the north-west of the Proposed Development boundary. The watercourse then turns east to enter a culvert situated 50 m to the north of the Trawsfynydd site, resurfacing as a pipe discharge into the Afon Tafarn-helyg located downstream of a discharge pipe that carries surface water runoff from the northern, lower lying, parts of the Trawsfynydd Site (including the road leading to the sewage works on site and runoff from impermeable areas surrounding the sewage works), shallow groundwater ingress and storm overflow, all discharged through an oil interceptor. This stream joins the Afon Tafarn-helyg to the north of the Trawsfynydd Site, and continues north from there. The bank of the stream at RHS 1 has been re-sectioned and the channel substrate was recorded as predominantly gravel, pebbles and silt.

4.2.2 RHS 2: The Nant Gwylan originates from a valved outlet through the Gyfynys Dam. It then flows parallel to the National Grid compound, passing through another culvert and joining the upper reaches of the Afon Tafarn-helyg. The transect covered only 100 m of the stream between the dam and culvert referred to. The stream substrate at RHS 2 was recorded as cobble and gravel/pebble and the stream has been re-sectioned, with the banks reinforced by cobbles.

4.2.3 RHS 3: The unnamed stream is described in **paragraph 4.2.1** above. RHS 3 is located upstream of RHS 1. Only a small trickle of water was present over 5-10 m and the stream is very likely to be dry over the whole of this reach in summer. The channel substrate was recorded as cobble at the single sample point.

[25] UK Centre for Ecology and Hydrology (n.d.). Rapid 3.0 Software. [Online] Available at: https://www.ceh.ac.uk/services/rapid-21-software [Accessed: 15 March 2024]

Data analysis

4.2.4 The two key indices, HMS and HQA have been calculated for RHS 1 and RHS 2 and are presented in **Appendix H**.

Habitat Modification Scores (HMS)

4.2.5 HMS is an indication of artificial modification to river channel morphology. To calculate the HMS for a site, points are allocated for the presence and extent of artificial features such as culverts and weirs and also modifications caused by the re-profiling and reinforcement of banks. Greater and more severe modifications result in a higher score. The cumulative points total provides the HMS. A Habitat Modification Class (HMC) protocol has been developed which allocates the condition of the channel in a site to one of five modification classes, based on the total score (1 = near-natural; 5 = severely modified)[26].

4.2.6 RHS 1 and RHS 2 have been re-sectioned and culverts are present on both watercourses surveyed. The HMS indicates that both RHS 1 and RHS 2 are severely modified (see **Table 4.3).**

4.2.7 The HMS categories and the scores are presented in **Table 4.3**.

Table 4.3 HMS score and HMC

Site number	Stream name	HMS	HMC
RHS 1	Unnamed stream	3,040	Severely modified
RHS 2	Nant Gwylan	3,600	Severely modified
RHS 3	Unnamed stream	N/A	N/A

Habitat Quality Assessment

4.2.8 The quality of habitat indicated by the RHS transects has been assessed by calculating a Habitat Quality Score (HQS).

4.2.9 HQA is a broad measure of the diversity and 'naturalness' of the physical habitat structure of each site (including both the channel and the river corridor). It is determined by the presence and extent of habitat features of known wildlife interest recorded during the survey. The presence of rare features (e.g. waterfalls more than 5 m high) increases the score.

HQA scores typically range between 10 and 80 points, where 10 points indicate that a river has very few attributes characteristic of natural rivers and 80 points indicate that a river has many of the attributes indicative of a high degree of naturalness. The HQA scores for RHS 1 and RHS 2 (see **Table 4.4**) indicate

[26] Riverdine Consultancy (2018). River Habitat Survey. [Online]. Available at: https://www.riverhabitatsurvey.org/rhs-doc/habitat-assessment/ [Accessed: 15 March 2024].

moderate habitat diversity and relatively few habitat features in common with a natural channel and river corridor.

Table 4.4 Habitat Quality Assessment scores

Site number	Stream name	HQA score
RHS 1	Unnamed stream	47
RHS 2	Nant Gwylan	33
RHS 3	Unnamed stream	N/A

4.3 Discussion

4.3.1 The RHS survey was hampered by poor watercourse accessibility and also low water levels associated with 2022 being a very dry year, culminating in drought by early September 2022[27].

4.3.2 In the areas surveyed however, these headwater streams are severely modified and have moderate habitat diversity with relatively few habitat features in common with a natural channel and river corridor.

[27]National Resources Wales (NRW), (2022). All Of Wales in Drought Status After Months of Dry Weather. [Online] Available at: https://naturalresources.wales/about-us/news/news/all-of-wales-in-drought-status-after-months-of-dry-weather/?lang=en [Accessed: 15 March 2024].

5.

Aquatic Invertebrates

5. Aquatic invertebrates

5.1 Method

Field method

5.1.1 Sampling was undertaken in accordance with Environment Agency Operational Instruction 018_08 (Freshwater macro-invertebrate sampling in rivers) and with regard to Common Standards Monitoring Guidance[28].

5.1.2 Samples were collected by kick sampling. Habitats were sampled in proportion to their linear predominance along the river reach for a total sampling period of three minutes. Following the three minute sampling, any marginal emergent vegetation and debris were searched for a further period of 30 seconds, collecting specimens that may have been adhering or clinging to the submerged surfaces.

5.1.3 The material collected was transferred into labelled sampling pots and preserved using 70% industrial methylated spirit before being returned to the laboratory for sorting. Samples were collected and sorted with biota fixed into vials following the Environment Agency invertebrate sorting methodology[29]. The invertebrates in each sample were identified to species level and counted to enable further analysis to be undertaken. Where juvenile or damaged specimens were collected, species level identification may not have been possible in some cases; however, this is not considered a limitation to the overall survey results.

Site selection and survey

5.1.4 The watercourses closest to the Trawsfynydd Site were subject to walkover in December 2021 to identify survey locations. The watercourses visited are detailed in **paragraph 4.1.3**.

5.1.5 Sample locations were selected based on accessibility and suitability of the areas for the standard kick/sweep sampling methodology[28] and proximity to sites from which water quality sampling is undertaken.

5.1.6 Six sample locations were identified (see **Figure 4.1**). Macroinvertebrate samples were collected on two sampling occasions, once during Spring (13 May 2022) and again during Autumn (20 September 2022). It was intended that six samples be collected on each occasion. However, a sampling error was made in Spring 2022 where the sample for MI5 was taken too far upstream and has therefore been referred to as MI6b (see **Figure 4.1**), with no sample taken at MI5 in Spring. To account for this, the Autumn 2022 sampling collected a sample from both MI5 and

[28] Joint Nature Conservation Committee (JNCC), (2016). Common Standards Monitoring Guidance for Rivers. [Online] Available at: https://data.jncc.gov.uk/data/1b15dd18-48e3-4479-a168-79789216bc3d/CSM-Rivers-2016-r.pdf [Accessed: 15 March 2024].
[29] Murray-Bligh, J. (2002). 'UK Invertebrate Sampling and Analysis Procedure for STAR Project'. EU STAR Project [Online] Available at: http://www.eu-star.at/pdf/RivpacsMacroinvertebrateSamplingProtocol.pdf [Accessed: 15 March 2024].

MI6b. Additionally, during the Autumn 2022 survey, it was not possible to collect a sample for MI1 due to this part of the stream being dry.

5.1.7 Neither of these issues are considered likely to have made a material difference in respect of description of the macroinvertebrates of these watercourses.

Biological metrics

5.1.8 Invertebrates are used to study the health of rivers as they can indicate environmental stressors, including short or long-term pollution events in waterways that may not be picked up through the standard suite of water quality assessments. The following briefly summarises the biological metrics calculated and what they do.

- Biological Monitoring Working Party (BMWP) – indicates the extent of organic pollution the invertebrates are exposed to based on allocation of sensitivity to organic pollution to each species;
- Average Score Per Taxon (ASPT) – indicates the extent of organic pollution to which the invertebrates are exposed, derived by dividing the BMWP by the Number of Scoring Taxa (NTAXA), which minimises potential effects in relation to sampling duration;
- Community Conservation Index (CCI) – indicates the conservation value of the invertebrate community present;
- Lotic Invertebrate Index for Flow Evaluation – uses the flow preferences and abundances of invertebrates present to assess the flow sensitivity of the macroinvertebrate community present;
- Proportion of Sediment-sensitive Invertebrates (PSI) – uses a fine sediment sensitivity rating (FSSR) and abundance of invertebrates present to assess the degree of sedimentation the invertebrates are exposed to;
- Walley Hawkes Paisley Trigg (WHPT) – The WHPT indices were introduced in 2016 as a basis of classifying the status of UK rivers, under the Water Framework Directive (WFD)[30], using aquatic invertebrates as indicators. As with BMWP, WHPT can be expressed as ASPT and NTAXA scores, however the sensitivity to abundance related effects is increased within WHPT by assigning different ‘weights’ to different abundance categories;
- River Invertebrate Classification Tool (RICT) – The RICT has been developed by the four UK environmental agencies to classify the ecological quality of rivers. It is a web-based tool[31] which generates an expected WHPT (NTAXA and ASPT) which is compared with the observed scores (from the invertebrates actually present in the sample) to create the Ecological Quality

[30] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. [Online] Available at:https://www.legislation.gov.uk/uksi/2017/407/contents/made [Accessed: 15 March 2024].

[31] Freshwater Biological Association (FBA), (2022). River Invertebrate Classification Tool (RICT) [Online] Available at: https://www.fba.org.uk/rivpacs-and-rict/river-invertebrate-classification-tool [Accessed: 15 March 2024].

Ratio (EQR). The further from the expected scores, the lower the environmental quality of the site.

5.1.9 Further details of these metrics and how they are calculated and interpreted are presented in **Appendix I**.

5.2 Results

5.2.1 The aquatic invertebrate taxa recorded from each of the sample sites are detailed in **Appendix I,** specifically in **Tables I.11** and **I.13** for Spring 2022 and Autumn 2022 samples respectively. The biotic indices are presented in detail in **Tables I.12** (Spring 2022) and **I.14** (Autumn 2022). The abiotic factors considered for RICT analysis are presented in **Table I.15** in **Appendix I**.

Spring

5.2.2 **Table 5.1** presents a summary of the detailed results of the macroinvertebrate surveys undertaken during Spring 2022.

Table 5.1 Results of the macroinvertebrates analyses undertaken during Spring 2022

Sample (Stream)	ASPT	CCI	LIFE	PSI	WHPT	EQR WHPT	RICT
MI1 (Unnamed stream)	Very good	Low	Low	Heavily	NTAXA: 7 ASPT: 4.63	n/a	n/a[A]
MI2 (Unnamed stream)	Moderate	Low	Moderate	Heavily	NTAXA: 10 ASPT: 4.25	NTAXA: 0.42 ASPT: 0.75	Bad Moderate
MI3 (Unnamed stream)	Good	Low	Moderate	Heavily	NTAXA: 10 ASPT: 4.81	NTAXA: 0.42 ASPT: 0.71	Bad Bad
MI4 (Afon Tafarn-helyg)	Very good	Low	High	Moderately	NTAXA: 12 ASPT: 4.94	NTAXA: 0.49 ASPT: 0.74	Bad Moderate
MI5 (Nant Gwylan)	Refer to MI6b						
MI6b (Nant Gwylan)	Very good	Moderate	Moderate	Well	NTAXA: 23	NTAXA: 0.79 ASPT:0.73	Moderate Moderate

					ASPT: 5.19		
MI6 (Nant Gwylan)	Moderate	Low	Low	Well	NTAXA: 16 ASPT: 4.58	NTAXA: 0.62 ASPT:0.67	Poor Poor

Table note A = In spring this sample location had very little water. Whilst it was possible to take a sample MI 1 was excluded from RICT analyses as RICT was not developed to include ephemeral watercourses.

Autumn

5.2.3 **Table 5.2** presents a summary of the detailed results of the macroinvertebrate surveys undertaken during Autumn 2022.

Table 5.2 Results of the macroinvertebrates analyses undertaken during Autumn 2022

Sample	ASPT	CCI	LIFE	PSI	WHPT	EQR WHPT	RICT
MI1 (Unnamed stream)	Sample site dry						
MI2 (Unnamed stream)	Good	Low	Moderate	Heavily	NTAXA: 10 ASPT: 4.92	NTAXA: 0.44 ASPT:0.86	Bad Good
MI3 (Unnamed stream)	Moderate	Moderate	Moderate	Heavily	NTAXA: 13 ASPT: 4.65	NTAXA: 0.53 ASPT: 0.71	Poor Poor
MI4 (Afon Tafarn-helyg)	Very good	Moderate	Moderate	Well	NTAXA: 18 ASPT: 5.65	NTAXA: 0.72 ASPT: 0.86	Moderate Moderate
MI5 (Nant Gwylan)	Good	Low	Moderate	Well	NTAXA: 18 ASPT: 4.69	NTAXA:0.84 ASPT:0.80	Moderate Moderate
MI6b (Nant Gwylan)	Good	Low	Low	Heavily	NTAXA: 18 ASPT: 4.56	NTAXA: 0.70 ASPT:0.70	Poor Poor
MI6 (Nant Gwylan)	Moderate	Moderate	Low	Heavily	NTAXA: 13 ASPT: 4.02	NTAXA: 0.54 ASPT: 0.62	Poor Poor

5.3 Discussion

5.3.1 The sampled streams are headwater streams, with generally variable levels of flow and the potential to dry out, as illustrated by the dry channel at MI1 (which overlaps with RHS 3 and MP5) during the Autumn 2022 sampling campaign.

5.3.2 Based on the data collected it is apparent that there are a range of pressures acting on the invertebrate communities at the sample locations, although care is required in interpretation as samples from a single year, such as 2022 which had very low rainfall relative to the long-term average and was reported to be in drought by early September 2022[27], may not be representative of longer term

conditions. Additionally, invertebrate biological metrics were typically developed for perennial watercourses and so may be less reliable in ephemeral situations, such as the location of MI1. Nonetheless, **paragraphs 5.3.3** to **5.3.7** summarise the stream conditions indicated by the metrics calculated from the invertebrate communities during 2022 survey, and where relevant, refer to the channel conditions indicated by the RHS reported in **Section 4**.

5.3.3 Biological water quality is indicated as being good/very good at most sites (based on the quality indicated by the ASPT), however MI2 which overlaps with RHS1 and MP2 on the unnamed stream downstream of a pipe culvert, and a discharge that carries surface water runoff from the northern, lower lying, parts of the Trawsfynydd site (including the road leading to the sewage works on site and runoff from impermeable areas surrounding the sewage works), shallow groundwater ingress and storm overflow, all discharged through an oil interceptor, shows signs of slightly reduced water quality compared to other monitoring sites in Spring although less so in Autumn. Additionally, MI6 (which overlaps with RHS2 and MP1 on the Nant Gwylan) showed signs of reduced water quality in both sampling seasons. The results for MI6b in Spring and Autumn were better than for MI6, but conditions at both MI6 and MI6b deteriorate in Autumn, when both were assessed as indicative of poor status. Given their juxtaposition slight differences between them are assumed to relate to slight differences in habitat quality at the two sites although it is also noted that NTAXA scores, including indicated status, are generally low. This suggests that the habitat present at the sampling locations is also sub-optimal for the invertebrate communities. PSI values are generally indicative of well to heavily sedimented conditions. It is noted however that silt was only recorded at invertebrate sample sites MI2, MI3 and MI4 on the unnamed stream and Afon Tafarn-helyg (**Table I.15 in Appendix I**). These coincide with RHS 1 and MP2, MP3 and MP4, where silt was also recorded. Levels of sediment suggested by the PSI scores at other sites are therefore contradictory to the observed channel conditions and may instead be indicative of generally adverse pressures on the invertebrate communities, such as low flow, rather than high levels of sediment *per se*.

5.3.4 The sensitivity of the communities present to changes in flow were low to moderate in all but one sample, this being MI4 in Spring which suggested a high sensitivity.

5.3.5 Conservation value of the communities present was low or moderate at all sites sampled.

5.3.6 The RICT EQR values indicate that, with one exception, samples were less than good[30] status and this is likely to reflect the headwater nature of the streams and the range of pressures highlighted above, which include, although not all present at every site, reduced water quality, low flow and poor habitat

5.3.7 Review of the data indicates that MI4 (which coincides with MP4) is the most resilient site, probably due to its location downstream of the confluence of the two headwater stream systems, including receipt of discharge to the Nant Gwylan from the Gyfynys Dam, which is provided as a compensatory flow to ensure that the watercourse still receives an input from what was the upper part of its catchment but is now within the reservoir.

6.

Aquatic Macrophytes

6. Aquatic macrophytes

6.1 Method

Field method

6.1.1 The survey used the standard LEAFPACS survey method as set out in Water Framework Directive – United Kingdom Advisory Group[32] and the results are therefore compliant with Environment Agency WFD analyses.

6.1.2 Each section covered a 100 m stretch of watercourse and aquatic macrophytes and macroalgae within the zone flooded for at least 50% of the year were recorded with their abundance scored on a 10-point scale. As the zone was flooded for at least 50% of the year it is usually quite difficult to estimate, recording often extended higher up the bank to ensure appropriate coverage. As a result, a significant number of non-aquatic species have been recorded. However, this does not affect the LEAFPACS scores as these are based on a shortlist of strictly aquatic species.

6.1.3 A number of physical parameters were also recorded to assist with interpretation. These included width, depth, substrate type, habitat type, shade levels, water clarity and bed stability. Unlike the plant survey, these were assessed in relation to the actual water level at the time of survey.

Site selection and survey

6.1.4 The watercourses closest to the Trawsfynydd Site were subject to walkover in December 2021 to identify survey locations. The watercourses visited are detailed in **paragraph 4.1.3**.

6.1.5 Sample locations were selected based on availability of 100 m reaches coinciding with the presence of macrophytes.

6.1.6 Macrophyte surveys were undertaken at five sites (see **Figure 4.1, Appendix A**) on a single occasion, on 20 September 2022.

[32] Water Framework Directive - United Kingdom Advisory Group (WFD-UKTAG), (2014). Uktag River Assessment Methods, Macrophytes And Phytobenthos; Macrophytes (River LEAFPACS2). [Online] Available at: https://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Biological%20Method%20Statements/River%20Macrophytes%20UKTAG%20Method%20Statement.pdf [Accessed 15 March 2024].

Metrics derived from macrophyte data

LEAFPACS

6.1.7 The metrics derived from macrophyte data collected using the LEAFPACS survey method are used by Natural Resources Wales in the classification of watercourses in accordance with the Water Framework Directive[30].

6.1.8 Several scores are used to summarise the macrophyte data[32]. These comprise River Macrophyte Nutrient Index (RMNI), Number of aquatic taxa (N_ATAXA-R), Number of functional groups (N_RFG) and Algal cover (ALG-COV). Although it is not standard LEAFPACS metrics, the cover of macrophytes, including algae, is also recorded and River Macrophyte Hydraulic Index (RMHI) is also calculated as it is a useful indicator of flow sensitivity of the macrophytes present.

6.1.9 These scores are defined as follows:

- River Macrophyte Nutrient Index (RMNI) – Each aquatic species has a score between 0-10 based on their mean nutrient tolerance. This is combined with the abundance in each section to produce a mean nutrient score, with the higher scores indicating higher nutrient levels.
- River Macrophyte Hydraulic Index (RMHI) – Each aquatic species has been allocated a score between 0 – 10 based on their mean association with flow rates. Species with high scores are associated with low energy flow environments. This is combined with the abundance in each section to produce a mean hydraulic score, with the lower scores indicating a macrophyte community with a higher proportion of high flow species.
- Number of aquatic taxa (N_ATAXA-R) – This score is the number of aquatic macrophytes based on a set checklist of taxa used in the LEAFPACS survey.
- Number of functional groups (N_RFG) – This score is based on the life forms of the aquatic species present (e.g. group 1 covers duckweeds and other small free-floating species, group 2 covers stoneworts, group 3 covers blue-green algae and group 4 covers stiff rosette-type vascular plants such as Littorella uniflora, etc.).
- Algal cover (ALG-COV) – This is the percentage cover of macro-algae.

LEAFPACS Environmental Quality Ratios (EQR)

6.1.10 The LEAFPACS model calculates estimated “reference” values for RMNI, N_TAXA, N_FG and ALG based on alkalinity and several geographical features of the river. These are estimations of what these metrics would be expected to be if there were no man-made influences on the river. They are calculated using formulae set out in WFD-UKTAG[32] and Willby et al[33]. These are compared in a ratio with the observed values of these parameters so that they can be classed on a 5-point scale of “bad” to “high” termed “EQR as detailed in **Table 6.1**.

[33] Willby. N, Pitt. J. A, Phillips. G, (2012). The ecological classification of UK rivers using aquatic macrophytes. UK Environment Agency Science Reports. Project SC010080/R1. Environment Agency, Bristol.

Table 6.1 Status bandings of LEAFPACS EQR

WFD status boundary	LEAFPACS EQRs
High	0.8-1.0
Good	0.6-0.8
Moderate	0.4-0.6
Poor	0.2-0.4
Bad	0-0.2

Mean Trophic Rank

6.1.11 Mean Trophic Rank (MTR) scores[34] have also been calculated. MTR is a scoring based on the nutrient range of the species present. Each species has a score of 1-10 with higher scores for species that grow in low nutrient conditions. **Table 6.2** summarises how the MTR scores are interpreted. Since some species can tolerate a broad range of conditions, a confidence assessment is also calculated based on the number of more selective species present. This is given as “a” (high confidence) to “c” (low confidence).

Table 6.2 Interpretation of MTR scores[34]

MTR score	Description
>65	Unlikely to be eutrophic
45 to 65	May be impacted by eutrophication although may be limited by the physical nature of the site
25 to 45	Likely to be impacted by eutrophication
<25	Badly damaged by eutrophication, organic pollution, toxicity or physically damaged

6.2 Results

Survey site characteristics

6.2.1 The streams surveyed, as detailed in **paragraph 4.1.3** and indicated on **Figure 4.1**, are small upland streams, generally 2 to 3 m wide and mostly shallow, up to 25 cm depth of water with only a few deeper areas, and with a mix of substrates. Pebbles and cobbles predominate interspersed with sand and silt, with the exception of site MP2 which is silt dominated. There is mostly a riffle and glide structure with some small areas of rapids.

6.2.2 The survey sites themselves have a number of differences. Site MP1 is partly shaded while MP5 for example has no tree canopy, but parts are subsumed under brambles. The remaining sites are predominantly shaded. MP5 was almost

[34] Holmes, N.T.H., Boon, P. & Rowell, T. (1999). Vegetation communities of British rivers, a revised classification. [Online] Available at: https://data.jncc.gov.uk/data/a974944a-3cd4-4574-9c1a-c977d482c0ed/JNCC-VegetationCommunitiesBritishRivers-SCAN-1999.pdf [Accessed 15 March 2024].

completely dry at the time of survey and is predicted to be ephemerally wet. However, all sites have bryophytes as the main aquatic vegetation.

LEAFPACS metrics

6.2.3 The full suite of survey data is presented in **Appendix J**. A summary of the metrics recorded in 2022 is presented in **Table 6.3**.

Table 6.3 Summary of the LEAFPACS and MTR metrics from 2022 survey

Watercourse	Sample	RMNI	RMHI	NTAXA	NFG	ALG	MTR	MTR confidence
Nant Gwylan	MP1	5.97	6.14	9	6	30	40.9	b
Unnamed stream	MP2	5.42	5.99	3	3	0	66.0	c
Unnamed stream	MP3	4.44	5.36	5	3	0	72.5	c
Afon Tafarn-helyg	MP4	4.81	5.48	6	5	0	75.0	c
Unnamed stream	MP5	4.59	5.13	4	3	3	66.2	c

River Macrophyte Nutrient Index (RMNI)

6.2.4 RMNI varied from 4.4 to 6.0. In upland streams of this type, RMNI scores should typically be below 5.0 based on the experience of the surveyor. Those for MP2 and particularly MP1 are therefore higher than expected. In the latter case this is linked to the rather high cover of algae which is discussed again in **paragraph 6.3.3**.

River Macrophyte Hydraulic Index (RMHI)

6.2.5 RMHI varied from 5.1 to 6.2. As for RMNI, those for MP1 and MP2 are higher than would be expected in streams of this type.

Number of aquatic taxa (N_ATAXA)

6.2.6 The results from the sampled streams vary from 3 to 9. Those at the lower end of this range are rather low but this is mainly due to the small nature of these streams with high levels of shade, reducing the diversity of aquatic species.

Number of functional groups (N_RFG)

6.2.7 The number of functional groups varies from 3 to 6. This is low, likely due to the small size of all the streams and the high level of shade in most of the survey sections.

Algal cover (ALG-COV)

6.2.8 In 2022 algal covers in most sections were very low, however, cover was approximately 30% at MP1. This is significantly higher than would be expected in a stream of this type, especially as some parts of the section are shaded which suppresses the amount of algae within the shade.

Macrophyte cover

6.2.9 Although it is not one of the standard LEAFPACS metrics, the covers of macrophytes excluding algae are also given in **Appendix J**. In addition, because of their different responses to river flows, the macrophytes were also subdivided into three different elements: bryophytes, emergent/terrestrial species and submerged vascular plants.

- (a) Bryophytes
  - Bryophytes are the main component of the aquatic vegetation but these vary in amount and composition between sections. The main species are *Platyhypnidium riparioides* and *Chiloscyphus polyanthos*, except in the drier site MP5, where the more terrestrial *Thuidium tamariscinum* and *Hypnum cupressiforme* form extensive carpets.
- (b) Emergent/terrestrial species
  - The emergent/marginal vegetation is rather limited and mainly comprised of terrestrial wetland and bank species extending into the wet zone, including overhanging brambles. Some sections do have small amounts of swampy species such as *Sparganium erectum, Phalaris arundinacea, Mentha aquatica* and *Rorippa nasturtium-aquaticum*
- (c) Submerged/floating vascular plants
  - These are rare in these sections, but small amounts of *Callitriche stagnalis* and *Potamogeton polygonifolius* were noted.

6.2.10 Summary data for these measures are provided in **Table 6.4**.

Table 6.4 Percentage cover of macrophytes and algae in in survey sections

Watercourse	Sample	% cover of emergents	% cover of bryophytes	% cover of submerged/ floating vascular plants	Total % cover of macrophytes	% cover of filamentous algae
Nant Gwylan	MP1	5	3	0	8	30
Unnamed stream	MP2	5	1	0.5	6	0
Unnamed stream	MP3	5	20	1	25	0
Afon Tafarn-helyg	MP4	5	5	0.1	10	0

Unnamed stream	MP5	30	30	0	60	3

6.2.11 The diversity of submerged and floating plants is low in these watercourses although this is not unexpected given the location, size and depth of these headwater streams.

LEAFPACS EQRs

6.2.12 The EQRs, presented in **Table 6.5**, assess three of the survey sites as "High" status. Sites MP1 and MP2 score less well in comparison. In the case of MP2, this is due to much of the substrate being predominantly soft silt with little for bryophytes to anchor to, resulting in low species diversity. MP1 scores only as "Moderate" status primarily due to the high amounts of algae. MP4 (which overlaps with MI4 and RHS1) is the only sample that was indicative of high WFD status for all metrics.

Table 6.5 EQRs for the Trawsfynydd streams survey sections

Watercourse	Sample	Adjusted RMNI EQR	Adjusted diversity (NTAXA/ NFG) EQR	Adjusted algal ALG EGR	Final EQR	Final status
Nant Gwylan	MP1	0.498	1.732	0.275	0.497	Moderate
Unnamed stream	MP2	0.821	0.467	1.004	0.703	Good
Unnamed stream	MP3	1.024	0.778	1.004	0.942	High
Afon Tafarn-helyg	MP4	0.891	1.040	1.004	0.891	High
Unnamed stream	MP5	0.911	0.972	0.782	0.908	High

Mean Trophic Rank (MTR)

6.2.13 The MTR scores indicated in **Table 6.3** range from 40 to 75. Most of the sections are in the upper part of this range which is around typical for this stream type. However, site MP1 is much lower and supports indicators of lower water quality. The moderate or low confidence rating for the survey results is due to the low diversity of species on which the calculations are based.

6.3 Discussion

6.3.1 The small nature of the surveyed streams and the high amounts of shade in most of the sections means that bryophytes are the main aquatic vegetation in these streams. The diversity of species is quite limited with the greatest diversity of bryophytes at site MP4 (which overlaps with MI4) and the highest cover at site MP3 (which overlaps with RHS1 on the unnamed stream) (20% bryophyte cover). The site MP5 on the unnamed stream appears likely to be ephemeral as the water

is not persistent here and much of the site was dry at the time of survey. This section has been colonised by more terrestrial species, including the more terrestrial bryophytes *Thuidium tamariscinum* and *Hypnum cupressiforme* which form extensive carpets in some areas. Part of this stream is also lost under brambles.

6.3.2 Potential issues were noted at two of the survey sites and this is reflected in the EQR scores and in some of the metrics. Site MP2 (which overlaps with MI2, MI3 and RHS1 on the unnamed stream) is dominated by soft silt. This site is fed from via a pipe culvert, and a discharge which carries discharge from the site (see para 5.3.3), and it is evidently receiving inwashed silt along with this culverted water. The silt has built up over the years. As a result there was very little water in the channel and little for bryophytes to attach to, resulting poor diversity of aquatic species. It is noted that no filamentous algae, which can be expected downstream of a discharge, was recorded at MP2 suggesting that the discharge is having little effect on the macrophyte community.

6.3.3 Site MP1 (which overlaps with MI6, MI6b and RHS2 on the Nant Gwylan) has significant amounts of filamentous algae (30%) and the cover of algae would be expected to be higher if parts of the section were not shaded. The amount of algae present has also reduced the habitat available for bryophytes which would probably have been more extensive. This algal abundance is likely a result of nutrient enrichment, the source of which was not obvious. These results concur with those of the invertebrate survey which indicate reduced water quality in this reach.

6.3.4 It is noted that Site MP4 is located 0.5 km downstream of site MP1 but there is no evidence of raised algal cover here. This may be due to dilution from several tributary streams which join in the intervening stretch.

7.

Summary

7. Summary

7.1.1 Following a review of baseline biodiversity information available for the Trawsfynydd Site collected between 2019 and 2022 it was recommended that further work be undertaken in three areas. The work comprised the following:

- Woodland – The 2019 Phase 1 Habitat Survey[1] of the Trawsfynydd Site indicated that woodland communities present had the potential to qualify as HPI. An NVC survey undertaken in May 2022 indicated that the woodland communities do not qualify as HPI. All woodland parcels surveyed exhibited characteristics of plantation woodland.
- Bats – Bat surveys undertaken in 2021 identified a bat flight path along the south-western edge of the Proposed Development which had not been previously assessed. Therefore, two static bat detectors were placed to assess the value of this flight path for bats and to inform necessary lighting mitigation proposals for the Proposed Development. The results from five months of survey (June-October inclusive) demonstrate that bats do not make extensive use of the full extent of the woodland edge immediately adjacent to the hardstanding alongside the Ponds Complex as a flightline. A significantly greater number of bats were recorded a few metres back into the woodland from the edge, and hence are less exposed to light spill from the existing security lighting at the Trawsfynydd Site, compared to the detector set on the woodland edge. It was noted that lesser horseshoe bats, the key designated feature of the Meirionnydd Oakwoods and Bat Sites SAC located approximately 1 km south-west from the Trawsfynydd Site at its nearest point, were the least recorded species overall, present in very low numbers.
- Aquatic biodiversity. The unnamed spring fed stream and Nant Gwylan, that originate to the west and east of the Trawsfynydd Site respectively and which are headwater streams feeding into the Afon Tafarn-helyg, were identified as receptors in the Scoping Report (see Chapter 5 Biodiversity Section 5.3[3]). Summary details and findings of the aquatic studies of the watercourses undertaken during 2022 are as follows:
  - RHS was undertaken to assess the physical structure of the watercourses to determine their naturalness in terms of features present and to record channel dimensions, influences and special features (man-made and natural). Whilst the survey was limited by watercourse accessibility and low water levels associated with 2022 being a very dry year, in the two locations where conditions were suitable for survey it is apparent that these headwater streams are severely modified and have moderate habitat diversity with relatively few habitat features in common with a natural channel and river corridor.
  - Aquatic invertebrate samples were collected on two occasions (Spring and Autumn) to assess the assemblage and provide an overall indication of the ecological health of the watercourses. The results identify a range of pressures acting on the invertebrate communities at the sample locations. Water quality is indicated as being good/very good at most

sites. However, MI2 which overlaps with RHS 1 and MP2 on the unnamed stream downstream of a pipe culvert, and a discharge that carries surface water runoff from the northern, lower lying, parts of the Trawsfynydd site (including the road leading to the sewage works on site and runoff from impermeable areas surrounding the sewage works), shallow groundwater ingress and storm overflow, all discharged through an oil interceptor, , is indicative of slightly reduced water quality in Spring although less so in Autumn. Additionally, MI6 (which overlaps with RHS 2 and MP1 on the Nant Gwylan) showed signs of reduced water quality comparative to the other monitoring locations in both sampling seasons. The results for MI6b in Spring and Autumn indicated higher water quality than for MI6, but conditions at both MI6 and MI6b deteriorate in Autumn, when both were indicative of poor status. Given their juxtaposition, differences in water quality between them are assumed to relate to marginal differences in habitat quality at the two sites although it is also noted that NTAXA scores, including indicated status, are generally low. This suggests that the habitat present at the sampling locations is sub-optimal for the invertebrate communities. The sensitivity of the communities present to changes in flow were low to moderate in all but MI4 in Spring which indicated a high sensitivity. Overall, samples were indicative of less than good ecological status[30] which is assumed to be reflective of the headwater nature of the streams and the range of pressures, which include, although not all present at every site, poor water quality, low flow and poor habitat quality. Of the sample sites surveyed, MI4 on the Afon Tafarn-helyg, is the most resilient site, due to its location downstream of the confluence of the two headwater stream system. This includes receipt of discharge to the Nant Gwylan from the Gyfynys Dam, which is provided as a compensatory flow to ensure that the watercourse still receives an input from what was the upper part of its catchment but is now within the reservoir.

- Aquatic macrophyte surveys were undertaken at five locations on the same streams as sampled for aquatic invertebrates to assess the range of functional habitats that such vegetation may provide for invertebrates and other animals, as well as recording of any notable plant species. Bryophytes are the main aquatic vegetation in the surveyed streams, this is due to the high shade cover at most of the stream sections and the small nature of the streams. The diversity of species is limited with the greatest diversity of bryophytes at site MP4 (which overlaps with MI4) and the highest cover at site MP3 (which overlaps with RHS 1 on the unnamed stream) (20% bryophyte cover). The site MP5 is ephemeral as the water is not persistent here, and much of the site was dry at the time of survey, as also observed during the invertebrate survey of the same location. At two of the survey sites the EQR scores were lower than expected. At site MP2 (which overlaps with MI2, MI3 and RHS 1 on the unnamed stream) the watercourse bed was dominated by soft silt. This site is fed from a culvert and is receiving inwashed silt along with this culverted water. Site MP1 (which overlaps with MI6, MI6b and RHS2 on the Nant Gwylan) has significant amounts of filamentous algae (30%). The cover of algae would be expected to be higher in sections of reduced shade coverage. The amount of algae present has reduced the habitat

available for bryophytes which were expected to be more extensive. This algal abundance is likely a result of nutrient enrichment, though the source of which is not obvious. These results concur with those of the invertebrate survey which indicate reduced water quality in this reach.

Annex A
Figures

269000

269500

338500

338000

N

7
10
9
8
2
1
11
6
5
3
4

Key

Area of Land Leased by Magnox from the Nuclear Decommissioning Authority

Proposed Development boundary

NVC

W7

W10a

W10d

W15a

W16

W16a

No community assigned

Scrub and tall ruderal not subjected to NVC survey

1 Plot number

0 50 100 150 200 m

Scale at A3: 1:3,500

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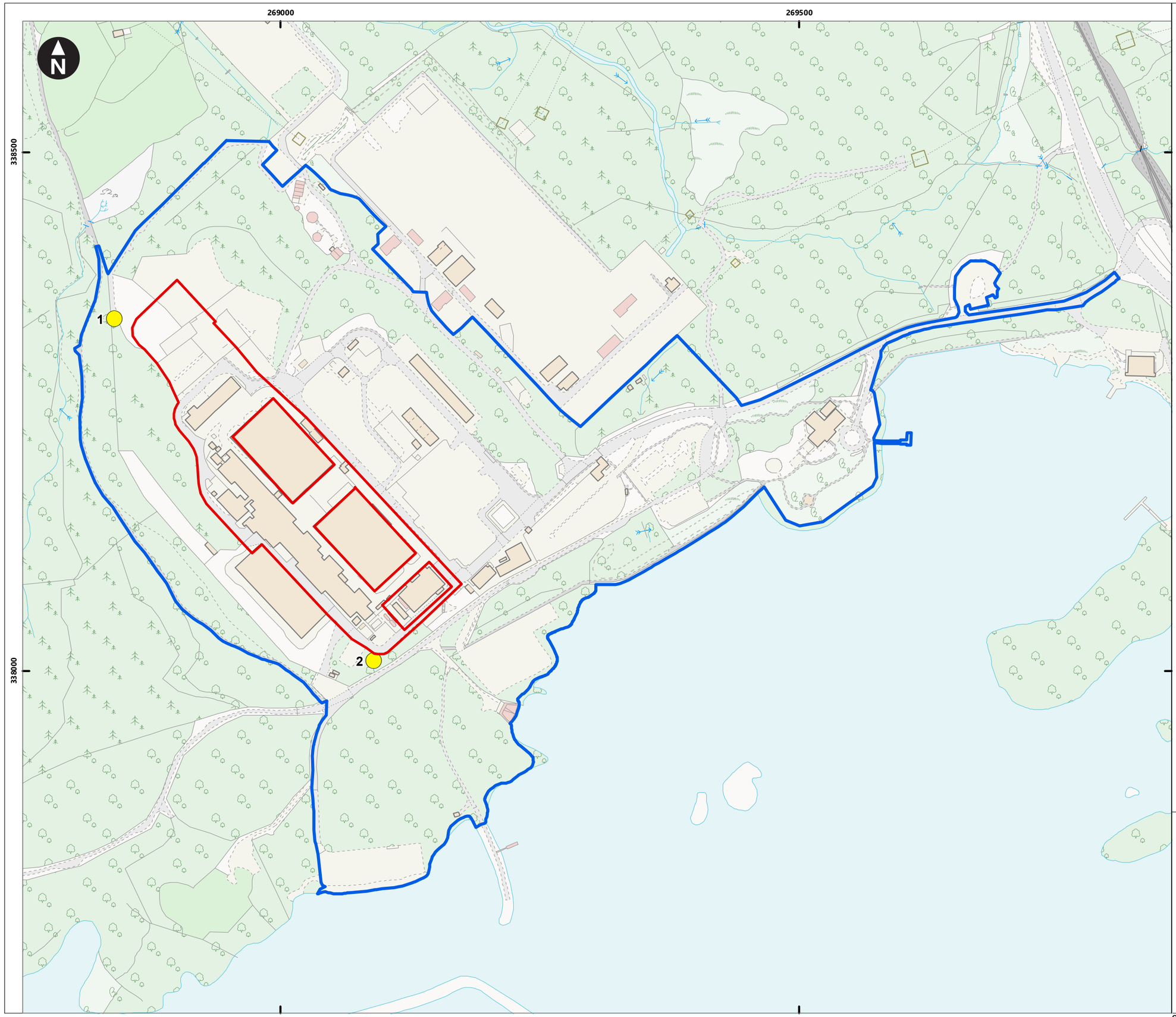
Figure 2.1
Trawsfynydd woodland NVC survey

December 2022

807521-WSPE-XX-XX-FG-OE-00004_S2_P01.2

H:\Projects\807521 Trawsfynydd Site Ponds Complex Demolition and Disposal EIA\Deliver Stage\D Design_Technical\Drawings\GIS\807521-WSPE-XX-XX-FG-OE-00004_S2_P01.2.mxd Originator: jacqui.parkin



Key

- Area of Land Leased by Magnox from the Nuclear Decommissioning Authority
- Proposed Development boundary
- Bat detector location

0 50 100 150 200 m

Scale at A3: 1:3,516

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Figure 3.1
Automated bat detector locations

November 2022

268500
269000
269500
338500
338000
N
Afon Tafarn-helyg
MI4
MP4
MP3
RHS1
MI3
MP2
MI2
MI1
MP5
RHS3
Scottish Power Switching Control Compound
National Grid Compound
Afon Tafarn-helyg
MI5
M16b
RHS2
MP1
MI6
Nant Gwylan
Unnamed stream
Gyfynys Dam
Gyfynys dam
Sluice
Key
Area of Land Leased by Magnox from the Nuclear Decommissioning Authority
Proposed Development boundary
Dam
Aquatic invertebrates sampling sites
River habitat survey transect
Macrophyte transect
Culverted watercourse
Culverted watercourse
Non-culverted watercourse
0 50 100 150 200 m
Scale at A3: 1:4,000

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Decommissioning of Trawsfynydd Ponds Complex
Report of 2022 Biodiversity Studies
Figure 4.1
Site plan showing the aquatic survey locations: aquatic invertebrates, aquatic macrophytes and RHS
February 2023

Annex B
Scientific names

Common name	Scientific name
Adder's-tongue fern	*Ophioglossum vulgatum*
Agrimony	*Agrimonia eupatoria*
Alder	*Alnus glutinosa*
Ash	*Fraxinus excelsior*
Beech	*Fagus sylvatica*
Bell heather	*Erica cinerea*
Bird cherry	*Prunus padus*
Blackthorn	*Prunus spinosa*
Bluebell	*Hyacinthoides non-scripta*
Bracken	*Pteridium aquilinum*
Bramble	*Rubus fruticosus agg.*
Broad buckler-fern	*Dryopteris dilatata*
Broad-leaved nightshade	*Circaea lutetiana*
Buddleia	*Buddleja davidii*
Common gorse	*Ulex europaeus*
Creeping buttercup	*Ranunculus repens*
Creeping Jenny	*Lysimachia nummularia*
Creeping wood sorrell	*Oxalis corniculata*
Deer fern	Blechnum spicant
Feather moss	*Kindbergia praelonga*
Foxglove	*Digitalis purpurea*
Germanders speedwell	*Veronica chamaedrys*
Grey willow	*Salix caprea*
Hairy bitter-cress	*Cardamine hirsuta*
Hart's-tongue fern	*Phyllitis scolopendrium*
Hawthorn	*Crataegus monogyna*
Hazel	*Corylus avellana*
Herb robert	*Geranium robertianum*
Holly	*Ilex aquifolium*
Honeysuckle	*Lonicera periclymenum*
Ivy	*Hedera helix*
Lady fern	*Athyrium filix-femina*
Male fern	*Dryopteris filix-mas*
Narrow buckler-fern	*Dryopteris carthusiana*
Perrenial rye-grass	*Lolium perenne*
Rhododendron	*Rhododendron [spp]*
Rosebay Willowherb	*Chamerion angustifolium*
Rough-stalked meadow-grass	*Poa trivialis*
Rowan	*Sorbus aucuparia*
Scaly male-fern	*Dryopteris affinis*

Scot's pine	*Pinus sylvestris*
Sessile oak	*Quercus petraea*
Sheep's fescue	*Festuca ovina agg.*
Silver Birch	*Betula pendula*
Soft shield-fern	*Polystichum setiferum*
A moss	Squrrosa sp.
Sweet violet	*Viola odorata*
Sycamore	*Acer pseudoplatanus*
Tutsan	*Hypericum androsaemum*
Wild strawberry	*Fragaria vesca*
Wood avens	*Geum urbanum*
Yellow pimpernel	*Lysimachia nemorum*
Yorkshire Fog	*Holcus lanatus*

Annex C
Floristic table

The following colour codes relate to which layer species were recorded in:

Canopy
Shrub
Ground

When present DOMIN values are provided at each location and for each species.

Common name	Scientific name	Plot number										
		1	2	3	4	5	6	7	8	9	10	11
Ash	*Fraxinus excelsior (c)*			3		4						
Alder	*Alnus glutinosa (c)*	3	4		2	4	5					4
Beech	*Fagus sylvatica*		7				5			6	9	
Bird cherry	*Prunus padus (c)*	5										
Grey willow	*Salix caprea (c)*	5		6	2	7	4	5		2	2	7
Hawthorn	*Crataegus monogyna (c)*	6			4							
Hazel	*Corylus avellana (c)*		5		2	4						
Holly	*Ilex aquifolium (c)*		1									
Rowan	*Sorbus aucuparia (c)*				4	2	4	5			2	4
Scot's pine	*Pinus sylvestris (c)*					1			7			8
Sessile oak	*Quercus petraea (c)*	4	4	4	2	6				4		4

Silver Birch	*Betula pendula (c)*	5	8	5	4	2		4	7	6		5
Sycamore	*Acer pseudoplatanus (c)*	5		6	8		7	7	4	6	1	
Ash	*Fraxinus excelsior (s)*	4				2		4				
Beech	*Fagus sylvatica (s)*									2	4	
Blackthorn	*Prunus spinosa*	4										
Buddleia	*Buddleja davidii (s)*	2				2						5
Hawthorn	*Crataegus monogyna (s)*	4						4				
Hazel	*Corylus avellana (s)*								1			
Holly	*Ilex aquifolium (s)*				1							
Rhododendron	*Rhododendron [spp]*	3	2									
Rowan	*Sorbus aucuparia (s)*								4	2		6
Sycamore	*Acer pseudoplatanus (s)*	4										
Adder's-tongue fern	*Ophioglossum vulgatum*	1										
Agrimony	*Agrimonia eupatoria*							2				
Bell heather	*Erica cinerea*								4			
Bluebell	*Hyacinthoides non-scripta*							2				
Bracken	*Pteridium aquilinum*		4			6			9			
Bramble	*Rubus fruticosus agg.*	2		9	3	5		4	3	3		4
Broad buckler-fern	*Dryopteris dilatata*			1	4		4					4

Broad-leaved nightshade	*Circaea lutetiana*			2	1			3				
Creeping buttercup	*Ranunculus repens*							3				
Creeping Jenny	*Lysimachia nummularia*	1										
Creeping wood sorrell	*Oxalis corniculata*							5			1	
Deer fern	*Blechnum spicant*	1	2								1	2
Feather moss	*N/A*	8			6	8				7		
Foxglove	*Digitalis purpurea*			1					1			
Germanders speedwell	*Veronica chamaedrys*							1				
Common gorse	*Ulex europaeus*								4			4
Hairy bitter-cress	*Cardamine hirsuta*							2				
Hart's-tongue fern	*Phyllitis scolopendrium*										1	
Herb robert	*Geranium robertianum*							5				
Honeysuckle	*Lonicera periclymenum*						6				4	
Ivy	*Hedera helix*									5	3	
Lady fern	*Athyrium filix-femina*		2				2			2		
Male fern	*Dryopteris filix-mas*	8	7	4	7	6				8	2	6
Narrow buckler-fern	*Dryopteris carthusiana*				2						2	4
Perrenial rye-grass	*Lolium perenne*							2				
Rosebay Willowherb	*Chamerion angustifolium*	4				4			2			4

Rough-stalked meadow-grass	*Poa trivialis*							3				
Scaly male-fern	*Dryopteris affinis*							2				
Sheep's fescue	*Festuca ovina agg.*						2					
Soft shield-fern	*Polystichum setiferum*						1					
Squrrosa sp.	*#N/A*	4						8				
Sweet violet	*Viola odorata*											
Tutsan	*Hypericum androsaemum*	6	4							2		
Wild strawberry	*Fragaria vesca*	1						1				
Wood avens	*Geum urbanum*				1							
Yellow pimpernel	*Lysimachia nemorum*							5				
Yorkshire Fog	*Holcus lanatus*							3				
Total Species		**23**	**12**	**10**	**16**	**15**	**10**	**21**	**11**	**13**	**12**	**15**

Annex D
MAVIS output

MAVIS output is provided below.

Ellenberg scores for Light, Fertility, Wetness and substrate pH is also provided for each plot based on species recorded.

Plot 1

National Vegetation Classification (NVC)

NVC: W10a 32.66

NVC: W10 29.28

NVC: W8e 26.64

NVC: W10d 26.10

NVC: W6e 24.76

NVC: W10c 24.69

NVC: W10e 24.29

NVC: W7c 24.22

NVC: W21c 23.41

NVC: W16a 23.41

Plot 2

NVC: W15a 34.78

NVC: W16a 33.90

NVC: W10a 30.86

NVC: W16 30.77

NVC: W10d 30.11

NVC: W15 30.09

NVC: W15d 28.24

NVC: W10c 27.69

NVC: W10 27.16

NVC: W16b 25.64

Plot 3

NVC: W10a 39.22

NVC: W10 35.64

NVC: W10d 34.81

NVC: W10c 34.09

NVC: W16a 30.68

NVC: W16 30.51

NVC: W10b 28.95

NVC: W14 28.76

NVC: W6e 28.28

NVC: W10e 27.05

Plot 4

NVC: W10a 32.36

NVC: W10d 30.93

NVC: W10 30.52

NVC: W10c 28.60

NVC: W6e 27.88

NVC: W16 27.32

NVC: W10e 26.40

NVC: W6 26.13

NVC: W10b 25.40

NVC: W4 25.00

Plot 5

NVC: W10d 41.57

NVC: W10c 37.70

NVC: W10 36.66

NVC: W10a 36.46

NVC: W10b 31.19

NVC: W25 29.02

NVC: W10e 28.99

NVC: OV27 27.73

NVC: W6e 27.30

NVC: W16a 27.19

Plot 6

NVC: W7c 18.72

NVC: W7a 18.49

NVC: W7 18.20

NVC: W15a 17.42

NVC: W6e 16.82

NVC: W10c 16.67

NVC: W6 15.94

NVC: W10e 15.91

NVC: W15b 15.45

NVC: W10 15.24

Plot 7

NVC: W10 32.63

NVC: W8e 32.45

NVC: W7a 32.10

NVC: W7c 30.95

NVC: W10d 30.80

NVC: W7 30.71

NVC: W8c 29.94

NVC: W10a 29.88

NVC: W8 29.80

NVC: W10b 29.51

Plot 8

NVC: W16a 51.75

NVC: W16 48.35

NVC: W10d 44.85

NVC: W16b 38.22

NVC: W10a 34.38

NVC: W25b 30.26

NVC: W10 30.24

NVC: W23c 29.17

NVC: OV27a 28.69

NVC: W10c 28.60

Plot 9

NVC: W15a 35.40

NVC: W16a 33.94

NVC: W10a 31.71

NVC: W16 31.17

NVC: W15 30.44

NVC: W14 28.35

NVC: W10d 27.95

NVC: W10 27.67

NVC: W15b 27.37

NVC: W12c 26.75

Plot 10

NVC: W15a 38.37

NVC: W14 26.01

NVC: W15 25.17

NVC: W12 23.47

NVC: W12c 22.47

NVC: W12a 21.91

NVC: W15b 18.29

NVC: W10d 18.26

NVC: W10c 17.93

NVC: W15d 16.90

Plot 11

NVC: W16 33.02

NVC: W10a 32.87

NVC: W10d 32.16

NVC: W16b 32.00

NVC: W16a 31.09

NVC: W4a 30.18

NVC: W6e 28.54

NVC: W10 27.87

NVC: W4 27.24

NVC: W10c 26.39

Annex E
Photos

Plot	Photo
1a	
1b	
2a	

Plot	Photo
2b	
3a	
3b	

Plot	Photo
4	
5a	

Plot	Photo
5b	
6a	

Plot	Photo
6b	
7a	

Plot	Photo
7b	
8	

Plot	Photo
11a	
11b	

Aquatic Invertebrates Survey images

MI1

Plate 1: MI1 site	Plate 2: Looking upstream	Plate 3: Looking downstream
		

MI2

Plate 1: MI2 site	Plate 2: Looking upstream	Plate 3: Looking downstream
		

Plate 1: MI3 site	Plate 2: Looking upstream	Plate 3: Looking downstream
		

MI 3

MI 4

Plate 1: MI4 site	Plate 2: Looking upstream	Plate 3: Looking downstream
		

MI 5

Plate 1: MI5 site	Plate 2: Looking upstream	Plate 3: Looking downstream
		

MI 6

Plate 1: MI6 site	Plate 2: Looking upstream	Plate 3: Looking downstream
		

Annex F
Definitions of Terms used on RHS Forms

PART THREE – DEFINITIONS AND DETAILED GUIDANCE

RHS form page 1: Field Survey Details, Valley Form, Riffles etc. and Artificial Features

SECTION A: FIELD SURVEY DETAILS

Site number

For RHS database entry purposes only. Every site will be given a unique reference number when entered on the RHS database. **Leave blank**. For re-surveyed sites, enter original number (if known) followed by (R) to indicate repeat survey.

Site reference

Surveyors should enter their own unique reference number/name for the site, and replicate it on the left hand corner on each page of the form. Photos should also contain the same reference number.

Spot-checks 1, 6 and end of site grid reference/co-ordinates

In the UK, using a GPS, it is essential to record a 10 figure NGR (national Ordnance Survey grid reference) for spot-checks 1 and 6 (the mid-point); a reminder to do so is given in the spot-check columns on page 2 of the form. The grid reference for spot-check 1 is required to ensure re-surveys start at the same locations as the original surveys. The grid reference for spot-check 6 is required to calculate distance from source, site gradient and other map-derived data. It is also essential to record a grid reference for 50m beyond spotcheck 10 (where the site ends). Use 1:10,000 or 1:25,000 scale maps to provide a cross-check for the grid references and whenever possible annotate the site boundaries on a 1:25,000 scale map.

Alternatively, record latitude and longitude. If there is no GPS signal, or only a poor one, enter an 8-figure reference from a 1:25,000 scale map.

Reach reference (optional).

Record the reference of the reach (if any). Reaches can be defined as part of a sampling strategy for Catchment Flood Management Plans (CFMPs), Catchment Abstraction Management Strategies (CAMS), River Basin Management Plans (RBMPs) or SERCON assessments.

River name

Enter name appearing on River Quality Objective (RQO) map. If not named, or even depicted, on these maps, use name given on 1:50,000 scale maps, or more detailed scale if available. Use the name appearing on the map, including Welsh or Gaelic names. Include alternative names if two are given on the map. Unnamed headwater tributaries should be categorised as such, but refer to the named mainstream watercourse (e.g. tributary of.....Eden). In these cases it is not necessary to enter the words 'Afon' or 'River'.

Date/time

The time of survey, as well as the date, is important because this could be useful regarding significant observations (e.g. pollution) and in relation to gauged river flow information.

Surveyor name/Accredited surveyor Code

All accredited surveyors have an individual code. Surveyor name and code must be entered on the form to comply with the RHS accreditation scheme. Names on the survey forms should match those on the surveyor's accreditation certificate. Only surveys from accredited surveyors will be entered on the RHS database.

Is the site part of a river or an artificial channel?

Artificial channels are canals, dykes, ditches and drains constructed entirely by human activity. Natural rivers that have been extensively modified by human activity should be recorded as 'rivers' (e.g. navigation course of the Thames, concrete-lined urban streams). **Tick one box only**. A1a,b,c,d.

Are adverse conditions affecting survey?

Surveys should not be carried out in spate conditions. Take full account of the risk assessment carried out before embarking on a survey. Do not enter the channel if the water is turbid. Beware too that weather conditions can affect both safety and the accuracy of survey results – examples of conditions adversely affecting survey include: strong winds and heavy rain (affects flow-type assessment and recording on the field sheets); overgrown channels (where vegetation may hide some features). **Tick one box only**.

Is bed of river visible?

A number of factors can affect whether a surveyor can see the bed of the river. Even under low flow conditions, the bed of wide or very deep rivers will only be partially visible, at best. Dense growth of freefloating macrophytes or planktonic algae may similarly obscure the bed from view, even when flows are very low. Use common sense, but as a guide, ✓ the 'barely or not' box if 0-33% of the bed visible; ✓ the 'partially obscured' box if 33-95% visible, and ✓ the '± entirely' box if ≥95% of bed visible. A3a,b.

Is health and safety assessment form attached?

A health and safety assessment must be completed before starting the survey. A separate form must be filled in (see Appendix 1 for details, and form in Section 2). **Tick one box only** – if the 'No' box is ticked, reasons for not completing, and attaching, the form should be given. The icon is shown in this manual to remind surveyors of common health and safety issues.

Photography (general)

A PHOTOGRAPHIC RECORD OF THE SITE IS ESSENTIAL TO AID INTERPRETATION OF DATA, AND AS A RECORD OF THE SITE FOR FUTURE REFERENCE. At least two photos must be taken, and any others for clarification purposes. Sufficient photographs should be taken to illustrate the general character of the site. In more inaccessible sites it may be necessary to seek a vantage point that will provide the most comprehensive view. It may be necessary to take more than two photographs to effectively illustrate general character. Avoid taking photos directly into the sun.

Photographs of channel modifications and special features should also be taken. **It is essential that all 'major' structures are photographed to enable interpretation of potential impacts to be made**.

A good quality digital camera is recommended. The quality of digital photographs required will depend upon their intended use. For inclusion on the RHS database, a 1024x768-pixel picture with a standard JPEG compression (100-150kbyte) is required. For inclusion in printed documents, additional photographs at a higher resolution (e.g. 2048x1536 TIFF or JPEG) are recommended.

☼ If you are unsure about an unusual or unfamiliar feature, take a photograph for reference and make accompanying notes. **Enter the number of photographs taken in the box.** Photographs that include, in the foreground, a chalk-board showing the site reference, will ensure photographs and site survey forms always correspond. **Enter on the form the references used** during survey to ensure the correct photographs are matched with the sites surveyed. **It is the responsibility of the surveyor to check that the photographs and site numbers match.**

Site surveyed from

For wide and deep rivers, surveys might only be able to be carried out from one bank only, although for best results each bank would need to be walked. The same applies for rivers flowing through gorges. For shallow rivers a survey can be carried out easily from both sides of the channel, or by accessing the watercourse. ☠ Beware of health & safety issues. Insert ✓ in one or more boxes to indicate where site has been surveyed from.

SECTION B: PREDOMINANT VALLEY FORM (within the horizon limit)

Profile diagrams are drawn on the form for guidance. **Valley form** refers to the shape of whole valley landform within which the RHS site is situated. It is assessed in the context of the horizon. It is the predominant valley form viewed by the surveyor when looking from the river to the mid-distant horizon. If you are unsure about a particular valley form, photograph and make a note or a sketch with an evaluation of distances. ☼ **Tick one box only.**

Shallow vee

Overall valley side slopes <30° from floor to top (horizon). 📷 B1a,b, E1Pb.

Deep vee

Overall valley side slopes >30° – 80° from floor to top (horizon). 📷 B2a,b, J1b.

Gorge

Steep (>80° to vertical), rocky, valley sides with narrow valley bottom. 📷 B3a.

Concave/bowl

Gently curving slopes that do not have a distinct glaciated U-shape. 📷 B4a.

Asymmetrical valley

Valley sides are different, shallow on one side and steep on the other. 📷 B5a.

U-shape valley

Steep valley sides rising from a flat valley floor that characterises a glacial valley. 📷 B6a, C1a.

No valley-sides obvious

No obvious valley sides in near- to mid-horizon. 📷 B7a,b, A1a.

Distinct flat valley bottom?

Flat area of valley into which water would spill during floods. If not obvious, record 'No'. Always tick 'No' box if no valley sides obvious. 📷 B1a,b, B2a,b, B5a, B6a, B7a,b, B8a,b, M1c.

Natural terraces?

Distinct geomorphological features on a river valley floor forming steps or breaks in slope produced as the river erodes downwards. Characteristic of moraine-filled glaciated valleys. See Figure B1. 📷 B9a,b.

SECTION C: NUMBER OF RIFFLES, POOLS AND POINT BARS

For analytical purposes, the **numbers** of riffles, pools, unvegetated and vegetated point bars need to be recorded. This is best done as a cumulative tally between spot-checks. 💡 Always give the actual numbers, including zero. The tally can be recorded alongside the boxes, or at the top or bottom of page 2, and at the end of the survey the total number is transferred to the relevant boxes in Section C.

Riffle(s)

Habitat feature characterised by:

- shallow, fast-flowing, water with a distinctly disturbed surface, over
- **unconsolidated** gravel-pebble, or cobble, substrate
- predominant flow-type, **'unbroken standing waves'**.

Riffles recorded in Section C must occupy:

- most of the wetted channel width, and
- be no longer than five times the river width.

Riffles create a distinct 'bubbling' sound. 📹 C1a,b,c, E5Db.

💡 Does not include unbroken standing waves associated with bedrock or solid peat/clay substrates.

Continuous 'unbroken standing wave' flow-type does not constitute discrete riffles. 💡 To be recorded as discrete individual features, a contrasting flow-type must separate each riffle. Riffles naturally occur at intervals equivalent to 5-10 times the channel bankfull width.

💡 In well-vegetated streams, aquatic vegetation sometimes creates unbroken standing waves by constricting or obstructing flow, or cause fine sediment deposition that raises the riverbed. **Do not record such examples as riffles**.

Pool(s)

Pools are scour/erosion features.

Habitat feature characterised by:

- distinctly deeper parts of the channel that are usually no longer than **one to three times the channel's bankfull width**.
- where the hollowed river bed profiles are sustained by scouring.

Typical locations for pools include:

- the outside of tight meanders,
- downstream from natural bedrock outcrops (e.g. downstream from waterfalls or chutes where 'plunge pools' are formed), and
- below some weirs, where both downward and lateral erosion creates a typical scour pool.

Due to their self-scouring nature, associated flow-types can vary across the pool, and include upwelling, and even no perceptible flow when there is circulating current. See Figure C1. 📹 C2a,b,c, C1b, E5Bb, I1a, M3a, M4a,b.

💡 Deep water impounded upstream of natural (bedrock), or artificial (weir) obstructions does NOT constitute a pool.

Even where the river bed is visible, pools are difficult to identify with absolute certainty. Do not spend time agonising over detail, but be consistent in your assessment. If in doubt, take photographs and seek advice for future surveys.

Figure B1 Sequence of natural berm and terrace formation

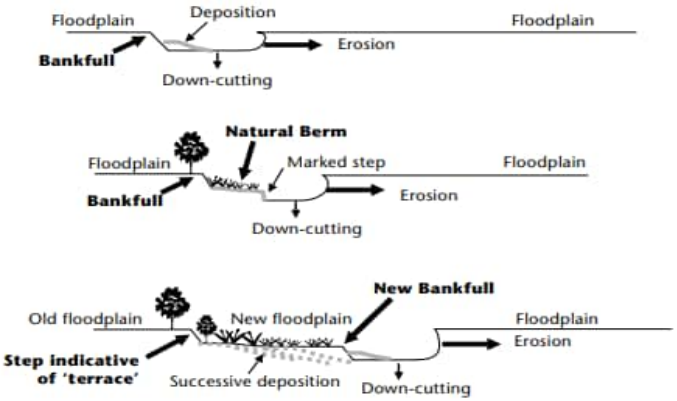
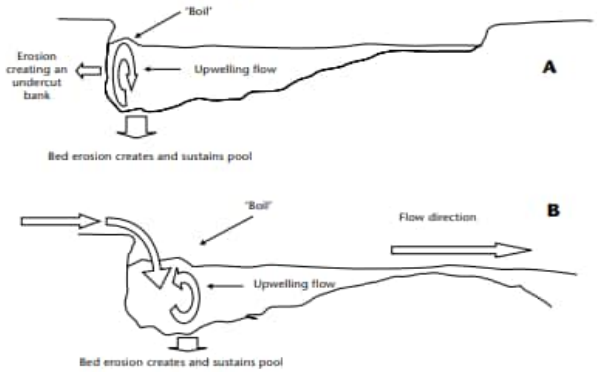


Figure C1 Pool character at:
A: tight meander bend (cross-section);
B: waterfall or weir (long-section)



Unvegetated point bar(s) (PB)

A distinct depositional feature:

- composed of unconsolidated river bed material
- exposed at low flow, usually with a shallow slope into the water.
- characteristically located on the **inside** of tight meanders in actively eroding/depositing rivers.
- classified as 'unvegetated' if <50% of the surface area has plant cover. 📷 B1b, C1b, C3a,b,c, I1a,b.

Constituent material of point bars is primarily sediment that has been transported from upstream; it is generally not derived locally. 💡 This contrasts with slumped banks recorded in Section I.

Vegetated point bar(s) (VP)

A distinct depositional feature:

- composed of consolidating river bed material.
- exposed at low flow, usually with a shallow slope into the water.
- characteristically located on the **inside** of distinct meander bends, usually on rivers that are less active than where 'unvegetated' bars are found.
- classified as 'vegetated' if ≥50% of surface area has plant cover, often showing a successional sequence from bare shingle to even some scrub.

Constituent material as for unvegetated point bars.

Moss cover on bars is included as part of the vegetation cover, as this indicates stability. 📷 C4a,b,c.

In certain circumstances a sequence from unvegetated to vegetated bars may progress further, so that over time they may become 'natural berms' (see E; Marginal and Bank Features).

SECTION D: ARTIFICIAL FEATURES

Indicate the number of artificial features in each category (major, intermediate or minor) occurring within the site. **Use the tally system (as in Section C) and add up the total at the end of your survey, and enter the number in the appropriate box.** 💡 **Insert ✓ in the box to indicate 'none' if no artificial features are present.**

💡 **You should take a photograph of any major or intermediate structure across the channel, with, if possible, a ranging pole alongside.** Take pictures upstream and downstream of the structure if it appears to be causing a significant change in river character (e.g. a dam). If a structure contains features of interest (e.g. fish ladder in major weir), make a note in Section P, as well as taking a photograph. 💡 Photographs of weirs should be taken since the height, design and construction material will determine the impact on the river.

If you are unsure about the nature of a structure, take a picture and send it with the form.

Figure D1 shows in plan-form the range of 'major', 'intermediate' and 'minor' artificial features that need to be recorded.

Weirs and sluices across river channels

Major: any permanent, ±water-tight, fixed (but can be adjustable to control flow), weir/sluice structures. Typically made of concrete, cemented boulders, wood or metal **extending across the entire width of the channel**. Weirs and sluices can be used for controlling water level or water flow, abstracting water or trapping sediment. (**Exclude rubble/loose stone weirs**.) 📷 D1a,b,c,d.

Intermediate: semi-permeable, fixed, structures controlling water levels; **extending across the entire width of the channel but permeable enough to allow some water to flow through them**. Commonly made from loose rubble, inter-locked boulders and, less commonly, logs. 📷 D1e,f.

Minor: small, permeable, and usually temporary structures across the river channel, often made from stones, cobbles or pebbles by children. They often get dislodged by large spates. 📷 D1g.

Composite weirs should be recorded as a single structure. These are a series of weir crests close to each other, and linked with concrete aprons and/or side-walls so that there is no natural bank material between the weir crests. 📷 D1a,d.

Weirs that have completely collapsed, and only extend partially across the channel (and therefore do not control water levels upstream), should be recorded as 'groynes', and a note made in Section P. (📷 D6b).

Culverts

Arched, enclosed or piped structures, constructed to carry water under roads, railways and buildings. Commonly made from concrete, but may be constructed from brick, metal or other building materials. Culverts either carry the full river flow through a single arch, or through multiple arches.

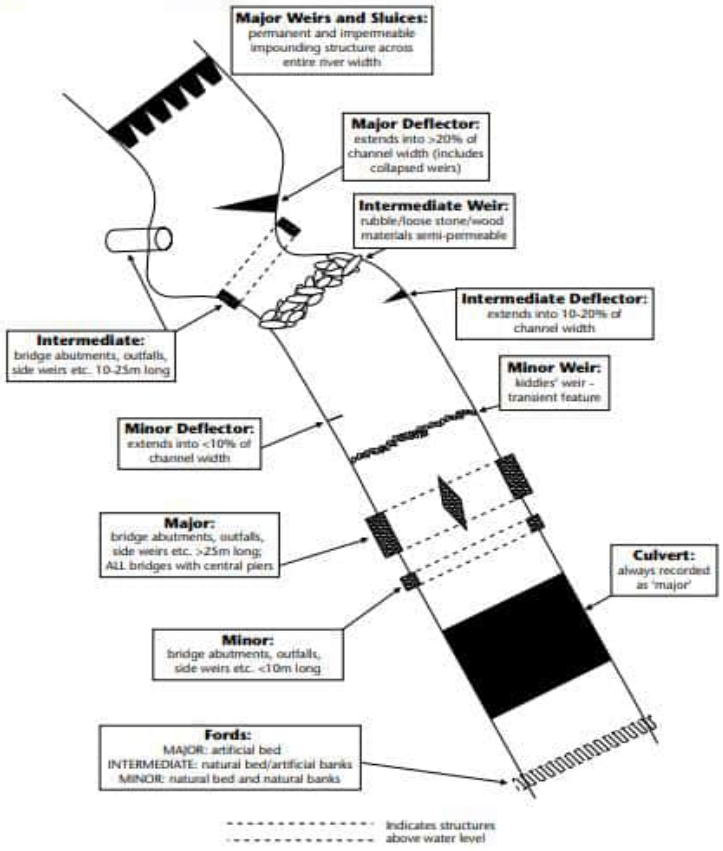
☠ **Do not enter any culverts.**

Some culverts may be a kilometre or more long, passing under fields, roads, residential and industrial areas. In such cases the location of many RHS spot-checks may have to be estimated from maps obtained previously. Entries for spot-checks in a culvert will normally simply enable 'CV' to be recorded as the modification, and the appropriate land-use noted. All other entries should be 'NV' (not visible) or 'NK' (not known) as appropriate unless the culvert is short and a clear view can be gained without entering it, or compromising the safety of the surveyor. 📷 D2a.

Bridges

Major: road or rail bridges of any width, **with one or more in-channel supports, OR** wide bridges with bank abutments extending along ≥25m of bank-length. Banks are often resectioned or reinforced immediately upstream and downstream of a major bridge. Photographs are essential for interpretation of potential impacts of the in-channel supports. 📷 D3a,b, D5b.

Figure D1 Illustrated definitions of artificial features



Intermediate: road or rail bridges **without any in-river supports**, and with bank abutments occupying 10-25m of the bank. 📷 D3c.

Minor: all road/rail bridges lacking in-river supports, and with bank abutments occupying <10m of the bank. Also includes all bridges, irrespective of width, with no abutments on the bank, such as viaducts. 📷 D3d,e, Na.

Outfalls/intakes

Outfalls and intakes mark points of discharge to, or abstraction from, watercourses. They are classified according to size, so this means that associated aprons, wing-walls and bank protection measures are included as part of the structure. Examples include abstraction intakes, sewer discharges, side weirs and sluices.

Major: permanent structures occupying ≥25m of bank-length. 📷 D4a.

Intermediate: permanent structures occupying 10-25m of bank-length. 📷 D4b.

Minor: permanent structures occupying <10m of bank-length. Includes flap valves on feeder streams. 📷 D4c.

☼ Do not include agricultural land drainage pipes (typically <150mm diameter).

Fords

Permanent crossing places for vehicles or machinery. ☼ Do not record sites where animals, but no vehicles, cross a river. 📷 D5e.

Major: crossing place with bed comprising artificial material which causes significant ponding of water upstream. Banks may be natural or artificial. Can be rubble infill (farm track) or a road crossing (e.g. tarmac, concrete). 📷 D5a.

Intermediate: shallow crossing with banks made from artificial material, but bed material is natural. May cause slight ponding of water upstream.

Minor: shallow crossing with no artificial bank or river bed material. Ponding effects will be negligible. 📷 D5c,d.

Deflectors/groynes/croys

Artificial structures that are installed part way across the channel to deflect currents away from eroding banks or help create more in-channel habitat diversity. Most often installed flush with the bank toe to deflect flow from one side of the channel to the other, but may be also installed in mid-channel. Can be made from a variety of materials, including rocks, logs, sheeting, gabions, wooden/heather hurdles, posts and wire, and occasionally wooden stakes. Note: This includes collapsed weirs.

Major: extends across ≥20% of channel width. 📷 D6a,b.

Intermediate: extends across 10-20% of channel width. 📷 D6c,d.

Minor: extends across <10% of channel width. 📷 D6e.

If it is clear that these structures have been installed for habitat/fishing enhancement, note in Section P. **It is recommended that all deflectors are photographed since their impact/ purpose varies greatly according to their height and material, not just their extension across the channel.**

Other

Other structures (e.g. boat moorings, walls, jetties, fishing platforms) should be recorded as follows:

Major: occupying ≥25m of bank-length or ≥ 20% of channel width. D6g.

Intermediate: occupying 10-25m of bank-length or extends across 10-20% of channel width. D6f

Minor: occupying <10m of bank-length or extends across <10% of channel width.

It is important only to record distinct structures as opposed to bank modifications for buildings and revetments (covered in Section E).

Is channel obviously realigned?

Only record 'yes' if you are sure. Common sense is required, but re-aligned channels are typically straight, and exhibit the same characteristics of resectioned (and often over-deepened) channels. See below.

Important – See Technical Update 2009 – Channel Resectioning.

Tick one box only. D7a,b, Na,b – for comparison see B1b, B5a, B6a, B7a, C4a, D7c.

Is channel obviously over-deepened?

Only record 'yes' if you are sure. Channel-deepening is frequently undertaken in tandem with bank resectioning. Diagnostic signs of over-deepened channels include:

1. uniform (and sometimes evenly stepped) bank profile;
2. no trees/uniformly-aged trees or saplings along banktop;
3. bankfull height often atypically high compared with bankfull width: ratio of width to depth commonly <4:1.

Important – See Technical Update 2009 – Channel Resectioning.

Tick one box only. D7a, D8a, D8b, D8c, E2Aa.

Is water impounded by weir/dam?

If a weir or dam is present, indicate if water in the site is affected partly (<33% of its length) or predominantly (≥33% of its length) by artificial channel impoundment. You will need to include the effects of weirs or dams located downstream from the site if appropriate. Effects of impoundment include water velocity reductions (creating ponded water) and increased water depth. **Tick one box only.** D9a, D1b,c, D5a.

RHS form page 2: Sections E, F & G – Spot-checks

It is essential to indicate on the form whether spot-check one (1) is at the upstream or downstream end of the site; tick one box only.

Ten spot-checks must be completed at regular intervals (c50m) along the 500m site.

At each spot-check, stand on the bank and look across the channel and indicate **in each box, in each column**, the material, modifications and features present. In shallow rivers, and **where safe to do so**, surveyors may choose to enter the channel to improve accuracy of recording bed character and features of the opposite bank. **Risk assessment is vital before entering the channel.**

All boxes in sections E and F must be completed (i.e. entries made in ALL boxes in the column representing an individual spot-check) before moving on to the next spot-check. At least one box in Section G must also have an entry for each spot-check. Each entry must be made clearly using the unique abbreviations shown in the spot-check key and described below.

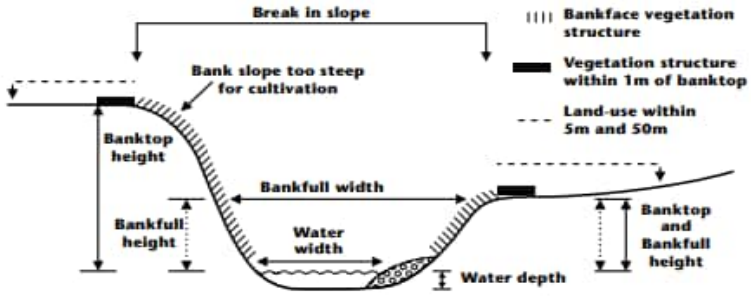
Bank

Permanent side to the river channel. For recording purposes (see Figure E1) the bank starts at the water's edge (and **excludes** marginal depositional features such as bars) and gives way to the 'banktop' where the break of slope allows cultivation or development to take place.

Left and Right banks

'Left' and 'right' banks are determined by facing **downstream**.

Figure E1 Cross-section of channel showing definitions used to define where spot-check recording and channel dimensions measured



For physical attributes (E), use a transect 1m wide at each spot-check across the channel. For land-use, vegetation structure and channel vegetation types (Sections F and G on page 2), use a 10m wide transect, at the same location (see Figure 1).

Only one entry per box is allowed for recording predominant bank material.

More than one channel or bank **feature or modification** can be recorded at a spot-check. In these cases, use a diagonal line to include a further entry in the box.

Only one entry per box is allowed for recording both **predominant channel substrate and flow-type**.

Only one entry per box is allowed for recording **land-use and bank and banktop vegetation structure**.

For **channel vegetation**, occurrences of all types are entered into appropriate boxes.

GPS readings are required at spot-check 1, 6 and 50m beyond spot-check 10.

SECTION E: PHYSICAL ATTRIBUTES OF BANK AND CHANNEL

To be assessed over a 1m wide transect of bank and channel at each spot-check. Refer to spot-check key and Figure 1.

BANK MATERIAL

As boxes are emboldened, only a single entry per box is permissible (i.e. the predominant material of the whole bankface within the 1m wide spot-check).

Not visible (NV)

Self-explanatory. This entry may need to be used for inaccessible far banks on wide rivers, especially when the banks are covered in vegetation, and cannot be given close inspection. Should be also used when a spotcheck is located at a culvert.

Bedrock (BE)

Exposure of solid rock. E1Aa,b, C2b, E5Ab, M3a.

Boulder (BO)

Large rocks ≥256mm in diameter (larger than head size) that can be loose, embedded or interlocked. When boulders are imported, record as 'rip-rap' material (RR), and reinforced (RI) bank modification. E1Ba,b.

Cobble (CO)

Loose rock material 64-256mm in diameter (half-fist to large head size). Often associated with glacial deposits. E1Ca,b.

Gravel/sand (GS)

Combined category. Loose material, comprising: coarse gravel, (including pebbles 16-64mm in diameter); fine gravel (2-16mm in diameter); and sand (<2mm in diameter). Often associated with glacial and fluvial deposits. E1Da,b,c, E3Aa.

Earth (EA)

Soil comprising mainly crumbly loam material, **but not predominantly composed of clays (see clay – CL)**. A jab with a ranging pole will leave no distinct hole, or one with ragged or crumbling edges. E1Ea,b, I1b.

Peat (PE)

Material formed almost entirely of organic matter derived from decayed vegetation under water-logged conditions and therefore usually associated with heaths and bogs. Peat is normally dark brown or black. E1Fa.

Sticky clay (CL)

Distinctive, solid and cohesive soil material. Compared with earth (EA), it is sticky when rubbed between finger and thumb. A jab from a ranging pole will produce a neat, smooth, conical hole. E1Ga, FV1a, I1a, I2a.

ARTIFICIAL MATERIALS

When recorded as bank materials, they will also be noted as reinforced (RI) in bank modifications.

Concrete (CC)

Cemented bankface reinforcement that forms a solid revetment with no gaps or fissures. E1Ha,b, A1c, E2Cb, E7Cc.

Sheet piling (SP)

Vertical, inter-locking, steel sheets protecting the bankface. Includes corrugated iron. E1Ia.

Wood piling (WP)

Wooden poles, or horizontal/vertical planks protecting the bankface (most often the lower half or toe of the bank only). E1Ja,b.

Gabion (GA)

Stones in wire baskets; installed to protect banks from erosion. E1Ka.

Brick/laid stone (BR)

Bank protection that includes any cemented walls, including brick walls, and also regimented, un-cemented, laid stones characteristic of riverside walls in the Lake District and limestone dales. E1La,b,c.

Rip-rap (RR)

Boulders (normally quarried and approximately ± square and of similar size) purposely tipped or laid along the bankface to protect it from erosion. Rip-rap is often along the toe of the bank only. Includes un-cemented blockstone and boulders compacted into the bank with vegetated soil between. E1Ma,b,c,d, I6a.

Tipped debris (TD)

Discarded material from, for example, farming, mineral extraction and building works. Includes: rubble, metal, wood, old cars and excavated soils and other minerals. Location on the bank may be un-intentional, or to provide extra bank protection. If providing bank protection, reinforcement (RI) should be recorded in bank modification.

If in doubt, enter miscellaneous artificial materials here (e.g. tyres) and take a photograph. E1Na,b,c,d.

Fabric (FA)

Synthetic (usually permeable geo-textile) bank protection fabric often used in conjunction with soil back-fill. Always non-biodegradable, with the prime function of bank support and protection from erosion. Includes materials such as plastic, and proprietary products such as 'enkamat' and 'nicospan'. E1Oa.

Bio-engineering materials (BI)

Live or dead plants (or non-synthetic materials) used to protect banks from erosion, and often to create/restore bankside and marginal habitat. Typical materials include live willow stakes and spiles, dead brushwood faggots, bio-degradable matting and planted reeds. When used in combination with synthetic fabrics (FA), record whichever has the dominant surface area. E1Pa,b,c,d,e.

BANK MODIFICATION(S)

Boxes are NOT emboldened, so more than one entry per box is permissible (e.g. if the bank is reprofiled with toe reinforcement, enter RS/RI).

Not known (NK)

If you are unsure whether or not a bank has been modified, record NK. You can consult river management records to assess if the reach has been previously engineered. If so, make additional notes. Enter 'NK' for spot-checks in culverts.

None (NO)

No **obvious** modifications visible. See NK above, and guidance below for signs indicative of resectioning. It may be that subtle changes are missed at a site on the first spot-checks, but later ones show clearer signs of modification. Under such circumstances, modifying earlier spot-check records is permissible if, on closer subsequent inspection, signs are evident. To do so, review spot-checks whilst completing the sweep-up on the return leg of the survey.

Resectioned (reprofiled) bank (RS)

Bank profile modified (but not necessarily reinforced), often to accommodate flood flows, flood defence or other maintenance machinery. Recent re-profiling will produce a relatively smooth, uniformly angled, bank slope. If either the top or the bottom of a resectioned bank is reinforced, enter both RS and RI. A1a, D8a,b,c, E2Aa,b, E3Da, I6b.

NB One or more of the following clues may be indicative of resectioning:

1. **uniform (and sometimes evenly stepped) bank profile;**
2. **no trees/uniformly aged trees/saplings along banktop;**
3. bankfull height often atypically high compared with bankfull width – width to height ratio <4:1 not uncommon;
4. intensive agricultural/urban land-use;
5. straightened river channel.

Typically bank re-sectioning is carried out in tandem with channel deepening; the former alone results primarily in characteristics 1 and 2 above, whilst bank and channel resectioning can also result in characteristics 3-5.

Figure E2 illustrates a typical flood defence/channel modification sequence.

Important – See Technical Update 2009 – Bank Resectioning.

Reinforced bank (RI)

Whole or part of bank artificially strengthened for bank protection purposes. Examples include concrete, sheet piling, corrugated iron, wood piling, gabion, brick/laid stone, rip-rap, and if clearly for bank reinforcement purposes, tipped debris (see Bank Material descriptions above). E1Ha,b, E1Ia, E1Ja,b, E1Ka, E1La,b,c, E1Ma,b,c,d, E1Oa, E1Pa,b,c,d,e.

Poached bank (PC)

Bank significantly trampled or puddled by livestock. Includes banks heavily trampled as a result of human activity such as picnic spots, canoe access points and fishing spots dug into the bank.

Add (**B**) after PC (i.e. **PC(B)**) if the bank is predominantly bare due to poaching i.e. <50% vegetation cover. E2Ba,b,c,d, I5b, P1a.

Artificial berm (BM)

Artificial two-stage channel created when either: a) a bank has been excavated laterally at a level above dryweather water level, but below the banktop; or b) an over-wide channel has artificial ledges constructed to reduce the low-flow width. This modification creates a distinct stepped or shelf appearance when first constructed, but may become less evident over time. Mention in Section P if the berm is part of river rehabilitation works. E1Hb, E2Ca,b,c,d, F18b.

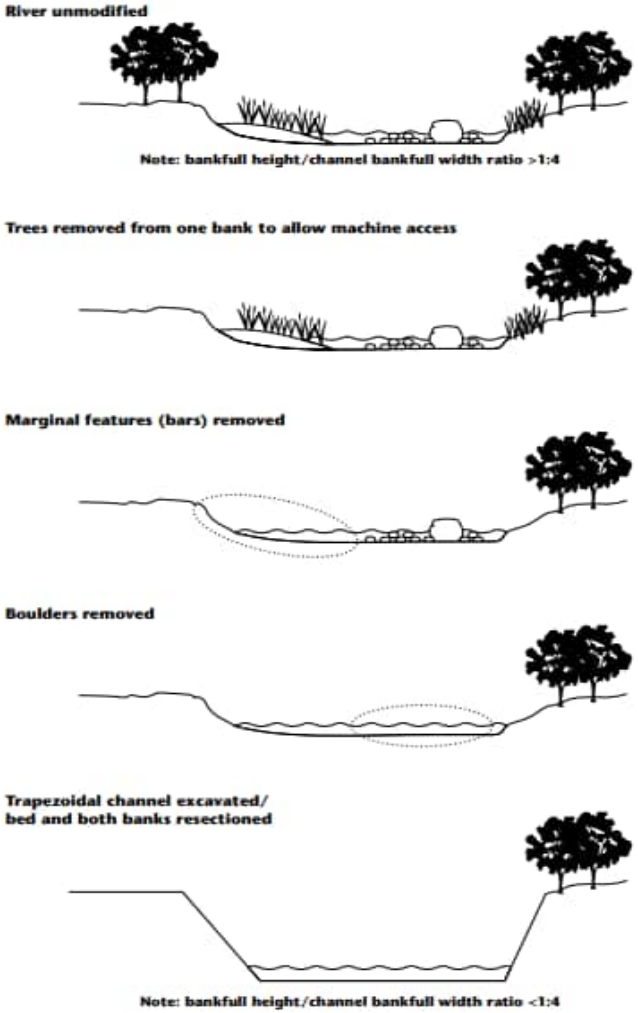
Embanked (EM)

Artificial raising of bank. A variety of materials can be used, including earth, natural stone or walls of concrete or brick. Only recorded at a spot-check when it forms an integral part of the bank. Do not include embankments set back from the immediate banktop; these are accounted for in the 'sweep-up', Section I. E2Da,b.

Note on bank modifications: if you are sure, beyond reasonable doubt, that there are no obvious signs of bank modification, then record 'NO' (none); if in doubt, record 'NK' (not known). Beware: some bankfaces will appear 'natural' even though they have been resectioned previously. Use the prompts listed above to help make up your mind whether to record 'NK' or 'NO'. See Figure E2.

Important – See Technical Update 2006 – Embankments.

Figure E2 Sequence of channel modifications for flood defence



MARGINAL AND BANK FEATURE(S)

Recording relates purely to 'cliffs' (bank features), and 'bars' (depositional marginal features). See Figure E3 for location of bar features. **Boxes are NOT emboldened, so more than one entry per box is permissible.**

Not visible (NV)

Self-explanatory. Use for culverts and if the far bank and margin are obscured by large mid-channel structures or impenetrable vegetation. Beware overgrown channels in late summer where vegetation may also mask features.

None (NO)

No **obvious** features. Record only when there is a clear view of the bank and marginal areas of the spotcheck, AND no features are present.

Eroding cliff (EC)

Bankface profile is **predominantly** vertical, near vertical, or undercut, with a minimum height of 0.5m, and showing a 'clean' face (<50% cover of mosses, ferns and other vegetation). The angle of the cliff will depend on bank substrate; clay or cohesive earth banks are often almost vertical; sandy ones are rarely this steep. Other clues: turf overhanging cliff, turf in channel, recently fallen trees, leaning or over-hanging fence posts.

If the eroding cliff is composed of sandy soil, sands and/or gravels put a circle around (EC). B1b, E1Da, b,c, E1Ea,b, E3Aa,b.

Stable cliff (SC)

Bankface profile is **predominantly** vertical, near vertical, or undercut, with a minimum height of 0.5m, and without obvious signs of recent erosion. Mosses, ferns and other vegetation on the bankface usually cover ≥50% of the bankface. Some clay banks may have little or no vegetation, but are nevertheless stable. E3Ba,b, E5Fa, FV1a.

If the stable cliff is composed of sandy soil, sands or gravels put a circle around (SC).

Vertical rock faces should not be recorded as 'SC'. The purpose of recording 'cliffs' is to identify the instream sources and character of sediments that may be transported downstream, and those riverine features associated with active erosion.

Unvegetated point bar (PB)

A distinctive depositional feature:

- composed of unconsolidated river bed material.
- exposed at low flow, usually with a shallow slope into the water.
- characteristically located on the **inside** of a distinct meander bend in actively eroding/depositing rivers.
- classified as 'unvegetated' if <50% of the surface area has plant cover. B1b, C1b, C3a,b,c, I1a,b.

Constituent material of point bars is primarily sediment that has been transported from upstream; it is generally not derived locally. This contrasts with slumped banks recorded in Section I.

Vegetated point bar (VP)

A distinctive depositional feature:

- composed of consolidating river bed material.

- exposed at low flow, usually with a shallow slope into the water.
- characteristically located on the **inside** of distinct meander bends, usually on reaches of rivers that are less-active than where 'unvegetated' bars are found.
- classified as 'vegetated' if ≥50% of surface area has plant cover, often showing a successional sequence from bare shingle to scrub, and may include mosses. C4a,b,c.

Constituent material comprising the bars is as for unvegetated point bars.

Unvegetated side bar (SB)

A distinctive depositional feature:

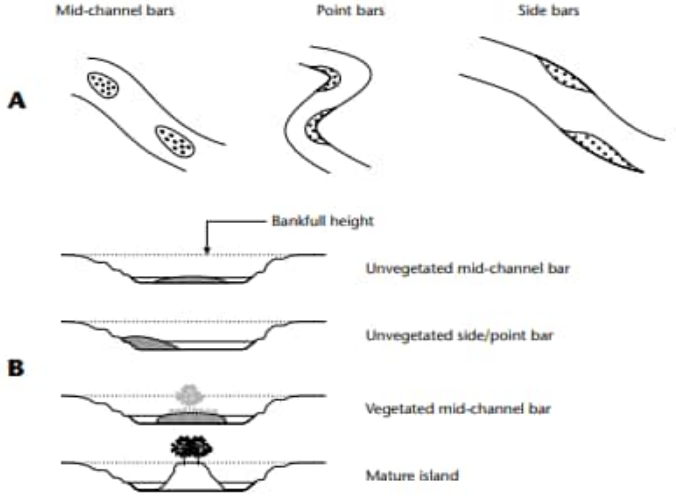
- composed of unconsolidated sediment located along the margins of rivers.
- exposed at low flow, usually with a shallow slope into the water.
- 'unvegetated' when <50% of the total surface area has plant cover.
- found in locations other-than the inside of distinct bends.

Material similar to that described for unvegetated point bars. E3Ca.

Figure E3 Location of bar features recorded in RHS:

A – planforms

B – cross-sections



Vegetated side bar (VS)

A distinctive depositional feature:

- composed of consolidating sediment along the margins of rivers.
- exposed at low flow, usually with a shallow slope into the water.

- 'vegetated' when ≥50% of the total surface area has plant cover.
- found in locations other-than inside of distinct bends. E3Da.

Material comprising the bars is as described for unvegetated point bars.

May show a successional sequence from bare shingle, herbs and mosses, to scrub.

In certain circumstances the successional sequence from unvegetated bars to vegetated bars may progress further, so that over time vegetated bars may become 'natural berms'. Here sediment may stop accumulating, and erosion may begin. A key difference between a 'bar' and a 'natural berm' is the former has a gradual slope into the water; the latter has a distinct steep face.

Bars are depositional features, primarily composed of material transported down the river channel, and deposited on the river bed. River bed material can be carried long distances (many kilometres), or very short distances, depending on the size of the material and the energy of the river. A gravel-bed river will usually have gravel bars; a sand-bed river will have sand bars.

Point or side bars composed of silt are extremely unlikely to occur in UK rivers. **Silt is not considered to be a substrate of distinct 'bars'; if silt is the predominant substrate in spot-checks, record Si; if discrete silt deposits are present record these as 'present' in Section K, and if large expanses of silt occur record as 'extensive' in Section K.** If the silt forms distinct deposits resembling bars, note this in Section P, as these deposits are often signs of channels recovering from over-widening as a result of engineering works.

Over time, some continuous silt deposits along river margins may become stable, and resemble 'bars'. When they become vegetated and have accreted sufficient sediment to be exposed during dry-weather flow, they should be recorded as 'natural berms'. If in doubt, take a photograph.

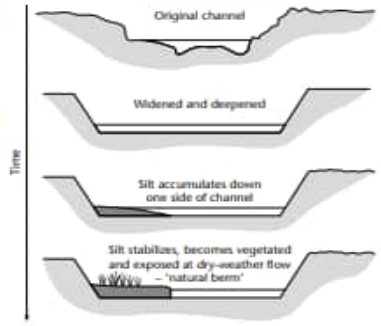
Important – See Technical Update 2009 – Silt Deposits.

Natural berm (NB)

A relatively rare feature that is transitional between a depositional bar and a terrace on the floodplain (see Figures E4 & B1). Not to be confused with an **artificial berm** (see definition and check against river management records [see Figure I1]). Natural berms can occur in: (i) actively meandering channels; or (ii) recovering rivers naturally restoring a low-flow channel width following over-widening. They can also occur as a transitional feature if channel straightening downstream results in downcutting and channel narrowing produces increased gradient.

To qualify as a natural berm, the profile must have a marked step, or a composite profile with ridges representing a series of deposition/incision events. Natural berms develop through deposition (or incision) processes and over time often attract further sediment deposition. If formed on the inside of a meander they may also have a point bar features at the water's edge.

Figure E4 Cross-sections showing formation of 'natural berm' following recovery from channel over-widening



They are usually vegetated, making them relatively stable and attracting further deposition. Depending on location and age, the vegetation may comprise bankside herbs, grasses and reeds, or a mixture of these with willow and alder saplings. As 'mature bank or riparian' vegetation becomes established, and the berm becomes higher in relation to the river bed (either by channel down-cutting or further deposition on the berm), old berms then become the new 'bankface' and 'banktop' (see Figure B1). Natural berms do not develop from bank erosion features such as slumping/slips. E3Ea, b, c, d, e.

Natural berms are difficult to determine precisely, and when recorded, should be photographed for subsequent confirmation.

CHANNEL SUBSTRATE

The ranging pole should be used to prod the river bed to determine the **predominant** channel substrate. In some cases a thin layer of silt, especially during low flows, can cover coarser substrates; in such instances, **the underlying substrate should be recorded**, together with a note that silt is present as an overlying deposit (in Section P).

Categories of substrate size are determined by the Wentworth scale[8] (Wentworth; 1922). The scale is shown on the spot-check key. When assessing substrate size, do it using the intermediate axis and not the long axis (see spot-check key and Figure E5). For more details of similar categories used also for bank material, see Section E, Bank Materials.

Boxes are emboldened, so only a single entry per box (the predominant substrate type) is permissible.

Not visible (NV)

Use this only if the channel is too deep, or water too turbid, to determine the predominant substrates of the channel. Health and safety considerations are paramount – follow the guidance in Appendix 1.

Figure E5 Illustration of correct use of the 'intermediate axis' for channel substrate assessments in RHS

Bedrock (BE)

Underlying solid rock. C2b, E4Aa,b, E5Bb, E7Bb, M3a,b, M5b.

Boulder (BO)

Large rocks ≥256mm in diameter (larger than head size). E4Ba,b, E7Aa,b, M5a, M6a,b.

Cobble (CO)

Loose material 64-256mm in diameter (half-fist to large head size). B1a, D3a, E4Ca,b, M1a,b, M2a,c.

Gravel/pebble (GP)

A combined category: Coarse gravel is 16-64mm in diameter (includes pebbles that are conker to half-fist size); fine gravel is 2-16mm in diameter. Where it is obvious that either pebble or gravel dominate, put a circle round either G(P) or (C)P depending on which one is predominant. If, as is usually the case, the proportions are roughly equal, or it is not possible to determine which is predominant, simply enter GP. E4Da,b, E4Fb.

Sand (SA)

Particle sizes <2mm but ≥0.06mm in diameter. E4Ea.

Silt (SI)

Very fine material as a deposit exceeding a depth of 10mm. Exclude thin layers of silt covering coarser substrates. E4Fa,b.

Sticky Clay (CL)

Record 'CL' if the predominant river bed material comprises sticky cohesive clay material. E4Ga,b.

Peat (PE)

Peat, as a predominant channel substrate, is rare. Record 'PE' only if the river bed is formed of organic matter derived from decayed vegetation under water-logged conditions. Peat is normally dark brown or black. E4Ha.

Earth (EA)

Reserved solely for recording when earth forms the substrate in streams with seasonal flow (e.g. winterbournes). Such streams often flow through open fields, and have substrates similar to 'soil'. E4Ia.

Artificial (AR)

Obviously non-natural bed material predominant (e.g. concrete, bricks, tipped waste). D5a,b, E1La, E4Ja,b.

Any channel substrates that cover ≥1% of the whole river bed within the whole RHS site, but are not recorded (i.e. were not predominant) in any of the ten spot-checks, should be entered in the shaded box in the end column.

FLOW TYPE

Recognising flow-types in the field

The nine flow-types used for RHS are largely based on patterns of the surface, velocity, flow direction and the influence of river bed substrate. Flow-type at a particular location will vary with different volumetric discharges and river levels, but the definitions used correspond to those occurring during dry-weather conditions.

Relying on photographs (Part Four) for recognition of flow-types is inadequate. Many of the diagnostic elements for flow-types come from other clues such as movement, sound and position in relation to channel features. **An RHS geomorphology training video** has been produced which describes characteristics of all the flow-types. All RHS surveyors will be shown this video as part of their overall training.

In all instances, the **predominant** flow-type (i.e. that normally occupying at least 50% of the wetted channel) must be recorded and only **one entry per spot-check** is allowed. Where there are two flow-types both occupying about 50% of the wetted channel, the **faster** flow-type should be recorded.

Beware: strong or gusty winds give a false impression of flow (e.g. wind-dragged ripples may suggest 'rippled' flow when flow-type is actually either 'smooth' or 'no perceptible'). Windy conditions should be recorded in Section A as a factor affecting survey conditions.

Boxes are emboldened, so only a single entry per box (the predominant flow-type) is permissible.

Not visible (NV)

This should only be used when the watercourse is in a long culvert and the flow type cannot be seen.

Free fall (FF)

Where vertically-falling water clearly separates from the 'back-wall' of a distinct vertical rock face. Generally associated with **waterfalls**. E5Aa,b, M3a, M4a,b.

Chute (CH)

Low, curving flow with substantial water contact 'hugging' the substrate. Where multiple chutes occur over individual boulders or bedrock outcrops, a 'stepped' profile is created. Mostly associated with **cascades**. D1d, E5Ba,b.

Broken standing waves (BW)

These are the 'stoppers' favoured by canoeists and rafters but they may occur on a more localised scale where water appears to be trying to flow upstream. A **white water tumbling wave** must be present for the wave to be described as broken. Mostly associated with **rapids**, but may occasionally occur within riffles. B3a, D3e, E1Ba, E5Ca,b.

Unbroken standing waves (UW)

'Babbling' water with a disturbed 'dragon-back' surface, which has **upstream facing wavelets** that have not broken. White water may occur as crest waves, not as breaking waves. Mostly associated with **riffles**, but may also occur within a **rapid**. C1a,b, E5Da,b,c.

Chaotic flow (CF)

A chaotic mixture of several faster flow-types (e.g. FF, CH, BW and UW) in no organised pattern. This category should be used only where there are three of these fast flow-types at a spot-check, and where no one of them is clearly predominant. **Not to be used as a 'catch-all category'.** E5Ea.

Rippled (RP)

Water surface with distinct, symmetrical, small ripples that are generally **only a centimetre or so high** and moving downstream. Beware: in windy conditions smooth flow can have wind-induced ripples on the surface. E5Fa,b.

Upwelling (UP)

Upwellings are found where strong upward flow movements disturb the surface, creating an appearance of bubbling or boiling water (see Figure C1). Upwellings are sometimes also called 'boils'. They are typically found on the outside of tight meander bends, behind in-channel structures (e.g. bridge abutments) or below waterfalls, cascade weirs and sluices. Upwellings also help maintain the depth of pools by their scouring action, but also produce lateral bank erosion on meander bends. E5Ga.

Smooth (SM)

Laminar flow where water movement does not produce a disturbed surface. If in doubt, put a ranging rod into the water (or observe shadows on the bed in clear water) and you will artificially produce disturbed surface movement either side of the rod or shadow. Mostly associated with **glides**. E5Ha, E7De.

No perceptible flow (NP)

In ponded reaches (such as upstream from natural bedrock controls and weirs), it may be difficult to perceive any surface water movement. When using the ranging rod test (as in '**SM**'), no surface movement of water will be seen. If associated with **impounded reaches above dams, note in Section D. Marginal deadwater (Section K)** has no perceptible flow, as will stagnant pools in prolonged dry conditions. Also used to record flow in pools where there is obvious rotational surface flow, but no obvious net downstream movement of water at the surface. A1a, E1Da, E51a,b.

No flow (DR)

When a channel is dry, either naturally or due to excessive water abstraction in a dry year, record flow as 'DR'. In limestone or chalk areas, dry reaches will occur downstream from sinkholes or in headwater winterbournes that naturally dry annually. Record channel, bank and bed materials as if flow was present, EXCEPT for dry channels with soil/earth beds – record as 'EA'. Record channel vegetation according to 'type', and provide notes in Section P. Do not include terrestrial vegetation. E5Ja,b.

In rivers with pools present between long stretches of dry channel, record 'DR' in spot-checks where the channel is dry, and 'NP' if spot-checks are located at pools.

CHANNEL MODIFICATION(S)

All recording of modifications should be confined to alterations made to the river BED, not the banks. If you are sure, beyond reasonable doubt, that there are no obvious signs of channel modification, record 'NO' (none); if in doubt, record 'NK' (not known).

Boxes are NOT emboldened, so more than one entry per box is permissible.

Not known (NK)

When unsure, record 'NK'. Seek further information from maps and flood defence records if unsure. For guidance on identifying individual types of modification, see below.

None (NO)

No **obvious** modification to the channel bed.

Culverted (CV)

As for 'Culvert' described earlier in Section E – 'Bank Modifications'.

Resectioned (RS)

Obvious over-deepening of the channel bed resulting from lowering of the river bed, affecting both long- and cross- section profiles, as well as artificially increasing the channel depth relative to its width. See 'Bank Resectioned' described earlier in Section E – 'Bank Modifications'. In Britain and Ireland channel deepening on its own is rare, so look for other signs as listed in Section E. A1a,b,c,d, E6a,b,c,d,e,f.

Reinforced (RI)

Artificial reinforcement of the channel bed with material such as concrete, brick or gabion baskets. Bank materials (artificial). E1H-M, E1Nd, E1O-P.

Dam/weir/sluice (DA)

Permanent in-channel structures installed to control river flows/levels. The presence of such structures at spotchecks may be rare, but their presence within an RHS site, and their 'impounding impacts', will be noted in Section D, and described in Section P. D1a,b,c,d,e,f.

Ford (FO)

Permanent, shallow, artificial fording place: can be made from concrete, metalled road surface, rubble infill or natural consolidated river bed material. (In Section D the 'category' of fords occurring within the site will be noted). D5a,b,c,d.

CHANNEL FEATURE(S)

Most channel features recorded by RHS will not be obvious unless the river is flowing at dry-weather level, or below.

Boxes are NOT emboldened, so more than one entry is permissible (e.g. if unvegetated mid-channel bar and exposed bedrock present, record 'MB'/'EB').

Not visible (NV)

Self-explanatory. Record 'NV' if flows are too high for accurate recording, or if mid-channel obstructions, including vegetation, obscure parts of the channel from view. Also use for culverts.

None (NO)

No channel features present. **'NO' must be entered if no other categories are recorded.**

Exposed bedrock (EB)

Bedrock exposure protruding above the water at low flow. E4Aa,b.

Exposed boulders (RO)

Naturally occurring large, (at least 'head size') boulders protruding above the water. May be covered with mosses/liverworts in upland streams. 💡 Exposed boulders should only be recorded in spot-checks and in Section K if they are prominently protruding from the water, and where the predominant channel substrate is cobble, boulder or bedrock. In cases where boulder-sized material has been placed in the river for fishery enhancements, or has collapsed into the channel from boundary walls or rip-rap, this should be recorded as artificial ('AR') when predominant in the spot-check (i.e. material is out of context with the overall river bed character). Note the presence of failed reinforcement, or imported boulders for other purposes, in Section P. 📷 E7Aa,b, K4a.

Vegetated rock (VR)

Bedrock or groups of boulders protruding from the water that have accumulated fine sediments in crevices which has allowed higher plant vegetation to become established (e.g. tall herbs, reeds, grasses, shrubs). 💡 **Does not include rocks with only mosses or liverworts.** 📷 E7Ba,b.

Unvegetated mid-channel bar(s) (MB)

A distinctive, in-channel, depositional feature composed of unconsolidated river bed material. Exposed at low flow, usually with shallow sloping sides into the water. Classified as 'unvegetated' if <50% of the total surface area has plant cover. See Figure E3 for characteristics. 📷 E7Ca,b,c.

Vegetated mid-channel bar(s) (VB)

A distinctive in-channel depositional feature composed of consolidating river bed material. Exposed at low flow, usually with shallow sloping sides into the water. Classified as 'vegetated' if ≥50% of the total surface area has plant cover. Vegetation may include perennials such as reed canary-grass, shrubs and trees. 💡 Moss-covered substrates are also included as these indicate stability. Surface of bar is lower than the bank height, so the whole feature is submerged during large floods. 📷 E7Da,b,c,d,e.

Mature island(s) (MI)

Mature islands are an erosional feature. Permanent in-channel feature, formed by erosion, with the surface at the same height, or above, the bankfull height. Usually well vegetated, often with mature scrub and trees. 💡 **If significant deposits of fresh material surround a mature island, then both mature island (MI) and unvegetated mid-channel bar (MB) can be present – if so, record both at the spot-check** because this indicates both the presence of a mature feature and active deposition. See Figure E3. 📷 E7Ea,b,c.

Trash [urban debris] (TR)

Rubbish such as bricks, shopping trolleys, piles of flotsam and jetsam etc. 📷 E7Fa, E7Cc.

Braided channels

Braided rivers are dynamic and mobile, where the channel is divided into several sub-channels separated by active mid-channel bars along most (>50%) of the 500m site. 💡 In braided rivers, most bars are unvegetated and the wetted area, at low flows, represents substantially less than 50% of the river bed. Bar surfaces are typically at lower elevations than the vegetated floodplain margins. Braided rivers must feature at least two sub-channels and two mid-channel bars along most of the site. Some of the sub-channels may be dry at the time of the survey. **Recording features of braided channels is very difficult to do accurately, and surveys will take much longer to complete than on a more typical RHS site.**

For more details, see Section M, Special Features. 📷 M1a,b,c.

💡 **When recording spot-checks on braided channels, record the number of sub-channels (wet and dry) at each spot-check in the grey row dedicated for such records, and then record all channel features of a spot-check on the channel carrying the major flow at the time of survey.**

Marginal and bank features, bank modifications and bankface vegetation structure records are all made from the outer edges of the two channels abutting the floodplain.

SECTION F: BANKTOP LAND-USE AND VEGETATION STRUCTURE

To be assessed over a 10m length of bank at each spot-check (See Figure 1). Refer to spot-check key prompts on the form.

The contribution of adjacent land-use and vegetation structure alongside watercourses can contribute significantly to riparian habitat diversity.

At each spot-check, using the 10m wide transect guidance (Figure 1), surveyors are required, for both banks, to record:

(i) **land-use within 5m of the banktop**, using abbreviations in the spot-check key;
(ii) vegetation structure within 1m of the banktop;
(iii) **vegetation structure on the bankface**, using 'B' (bare), 'U' (uniform), 'S' (simple) or 'C' (complex) categories. **See below for guidance and Figure F1.**

Since floodplain land-use up to 50m from each bank is also recorded in Section H, the combination of vegetation structure within 1m, land-use within 5m and a general overview of land-use will provide a collective picture of riparian habitat character.

Banktop

This is defined as the first major break in slope where cultivation or development would be possible. Where no distinct breaks in slope occur (e.g. streams in vee-shaped valleys), the bankfull height may be estimated by the winter flood level, often marked by a trashline or 'notches' at similar heights above the bed level. Notches may be seen along lines of exposed bank material that represent where vegetation has been ripped out by the roots at the level water reaches during times of peak floods.

Illustrated examples of banktop and bankface, as defined for recording vegetation structure and land-use during RHS are shown in Figures E1 and F1.

A banktop hedgeline (as shown in photo D7a) should be recorded as complex structure (**C**) in spot-checks and not included as tree distribution (Section **J**). A hedgeline with scattered "standard trees" would be similarly recorded as complex structure in the spot-checks, but with "isolated" or "regularly spaced" trees (as appropriate) recorded in Section J.

LAND-USE WITHIN 5M OF BANKTOP

Boxes are emboldened, so only a single entry per box (the predominant land-use) is permissible.

Broadleaf/mixed woodland (BL)

Woodland containing predominantly deciduous broadleaved trees. **Does not include broadleaf/mixed plantations**. Vegetation below trees (understorey) is usually mixed young trees/shrubs and/or mixed grasses/herbs. C3b, E7Dd, F1a,b, J6a,b, M2b.

Broadleaf/mixed plantation (BP)

Plantation woodland containing deciduous broadleaved trees such as poplars planted in rows, or in similar regimented fashion. Include young plantations with just saplings. F2a.

Coniferous woodland (CW)

Native conifers, typically Caledonian forest in Scotland. **Excludes all coniferous plantations**. F3a.

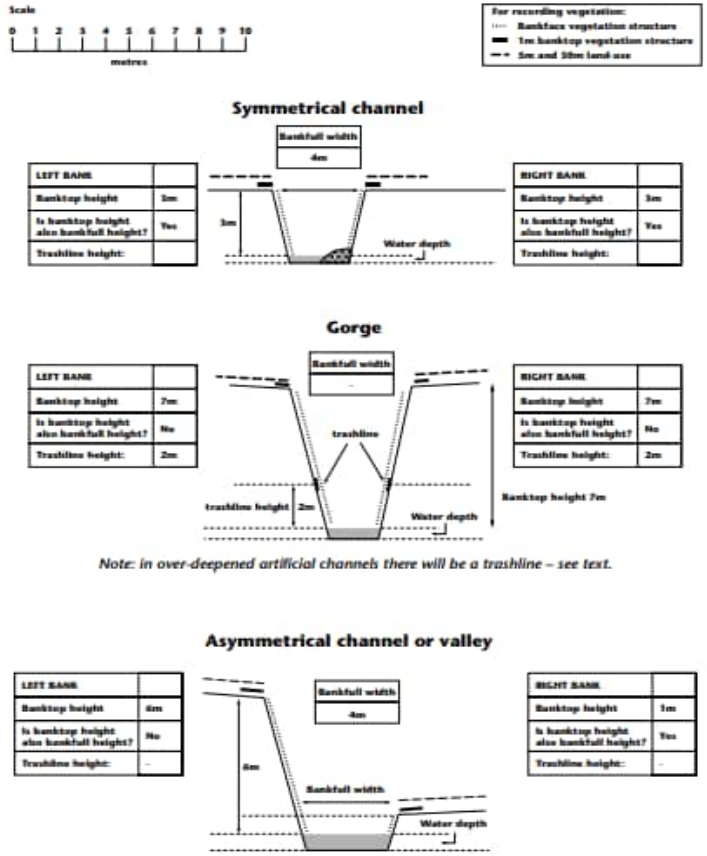
Coniferous plantation (CP)

Coniferous trees (e.g. sitka spruce, lodgepole pine) planted for commercial forestry. F4a.

Scrub & shrubs (SH)

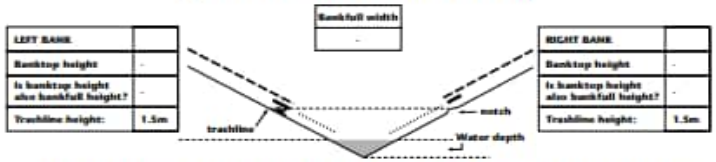
Scrub (e.g. brambles, gorse, rhododendron) and woody shrubs (e.g. blackthorn and hawthorn). F5a.

Figure F1 Examples of different channel shapes affecting definitions of bankface, banktop and bankfull width.



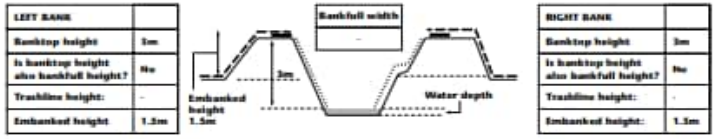
Note: in over-deepened artificial channels there will be a trashline – see text.

Deep vee/shallow vee valley (and rivers with no obvious banktop)

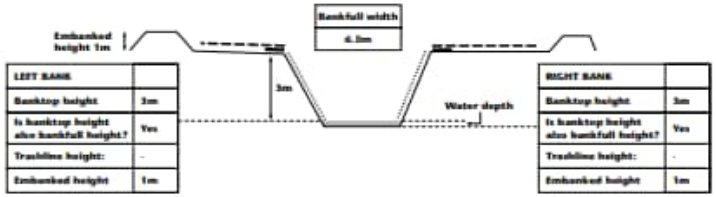


*To be used **only** when no obvious banktop evident for both banks. Look for presence of small 'notches' at consistent height to indicate level of water during large floods. Use this, or trashlines, to determine bankfull height, and areas for recording banktop vegetation structure and land-use.*

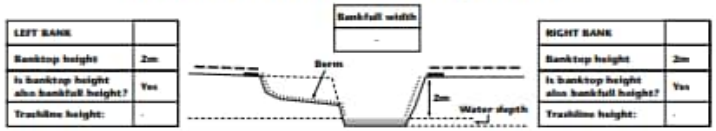
Embanked channel



Channel with set-back embankments



Two-stage channel formed through excavation



Orchard (OR)

Horticultural crop of fruit trees planted in lines and carefully managed to produce fruit crops. Includes hop fields and vineyards.

Wetland (WL)

Includes bog, marsh, and fen. **Fens** typically have groundwater sustaining them as wetlands, with vegetation, often (but not exclusively) growing over peat, where the water-table is at, or just below, the surface. Water is derived from both rainfall and drainage of surrounding land. Some fens may have *Sphagnum* moss, but typically the vegetation is dominated by tall reeds, wetland herbs, sedges, and rushes. **Bogs** have vegetation growing on wet peat; the water source is direct rainfall, or in some cases, over-land flow during heavy rain events. *Sphagnum* moss is always present, often with bog cotton (*Eriophorum*). In locally drier areas heather (*Calluna, Erica*) may also be present, but never dominant. F7a,b,c, M15a, M18a,b, M20a.

Moorland/heath (MH)

Typical moorlands and heaths have heather (*Calluna, Erica*) present, even if not the dominant vegetation type. In some upland areas (e.g. Bodmin Moor), or lowland heath areas (e.g. the machair of the Outer Hebrides), the plant communities may be dominated by acid-tolerant grasses such as purple moor-grass (*Molinia caerulea*). Cotton-grass (*Eriophorum* spp.) may occur in wetter areas, and in more free-draining areas may merge with heathy scrub with dwarf willow and birch (*Salix, Betula*) present. B2a,b, F8a,b, J1b, M16b.

When the bog component within heathland is small, and heather is dominant, record wetland as 'present', and moorland/heath as 'extensive' in Section H.

Artificial open water (AW)

Off-line artificial lakes, reservoirs, water-filled gravel pits, canals and the full range of amenity, farm and 'conservation' ponds. Natural lakes which have been modified by control structures are regarded as artificial. Includes mill streams, and artificial secondary channels which branch from, or join, the main watercourse. F9a,b,c.

RHS should not be undertaken on on-line lakes.

Natural open water (OW)

Natural lakes, ponds and pools, including bog pools and old river cut-offs.

Some natural lakes have impounding structures; if these are not clearly visible, record 'OW'. F10a,b, M20b,c.

Rough/unimproved grassland/pasture (RP)

Unimproved (i.e. not reseeded or fertilized) upland or lowland grassland. Usually herb-rich, and includes hay meadows. If ground is seasonally wet, tussocks of 'coarse' grass or rushes (e.g. *Deschampsia cespitosa, Juncus effusus*), can occur. F11a,b.

Improved/semi-improved grassland (IG)

All **agricultural** grassland other than 'RP'. Includes pasture/meadow grassland which has been re-seeded (typically with *Lolium perenne* – rye-grass) or artificially fertilised. B7b, F12a.

Tall herb/rank vegetation (TH)

Vegetation at least waist-high, dominated by herbs (not grasses or reeds, but **includes bracken** – *Pteridium*). 'Wildlife areas' where farmers have left the land on the inside of meanders uncultivated to grow 'wild' for conservation reasons are included. F13a,b,c.

Rock, scree or sand dunes (RD)

Collective category that includes extensive rock outcrops, mountain scree or sand dunes. F14a,b.

Suburban/urban development (SU)

Buildings, metalled roads, tracks, railways. Also includes land-fill sites.

Where un-metalled tracks follow the banktop, the land-use in which they are located should be recorded, and not 'SU'. A1c, F15a,b.

Tilled land (TL)

Agricultural land where crops grown on regularly ploughed soil. Includes root and horticultural crops and allotments. E1Jb, F16a.

Irrigated land (IL)

Agricultural land dependent on irrigation for crop yield. In Britain this includes cress beds. F17a.

Parkland or gardens (PG)

Includes parks, golf courses, public amenity spaces, sports fields and gardens. This includes a wide variety of land-uses, where grass is mown for recreational purposes. Do not confuse with agricultural land-use of improved grassland. E1La,b, F18a,b.

Not visible (NV)

Self-explanatory. Only to be used if land-use is genuinely obscured (e.g. top of a gorge, behind a mature island, or beyond dense stands of tall trees on the far bank).

BANK AND BANKFACE VEGETATION STRUCTURE

To be assessed over a 10m length of each bank (see Figure 1). Separate records are made for the structure of the vegetation on the face of the bank, and the vegetation structure in the 1m zone beyond the banktop (see definition above; Figures E1 and F1). Even in intensively farmed arable land, the 1m banktop vegetation structure may contrast with the land-use within the full width of the 5m banktop zone (recorded separately, and described above).

When recording bankface vegetation structure, ignore vegetation on bars or berms at the base of banks.

The category recorded is determined by the complexity of structure produced by different vegetation types. If the vegetation structure cannot be assessed (i.e. when surveying from the bottom of a gorge), record 'NV' for not visible. On wide rivers, binoculars can assist with defining vegetation structure on the far bank.

Since this exercise is a rapid overview, only **the predominant structure** is to be assessed. Use your initial assessment – time must not be wasted searching for relatively inconspicuous types of vegetation.

Vegetation structure is based on four categories. Component elements represent vegetation types that contribute to vertical layering on the bank. **Refer to the spot-check key for diagrammatic representation, and the categories of vegetation types listed below.**

Bryophytes	Mosses and liverworts. FV1a.
Short/creeping herbs or grasses	Below knee height (includes ivy). A1a, B7a,b, E2Ca, FV2a,b.
Tall herbs or grasses	Knee height, and taller; includes bracken and other ferns. C3a, D1c, D8a, E1Oa, F18a, FV3a,b.
Scrub or shrubs	Brambles, woody (and multi-stemmed) shrubs, thickets. D1c, F18a, FV4a,b.
Saplings and trees	Mature trees and single-stemmed young trees (*cf.* bushy nature of shrubs). FV5a,b, G2b.

Boxes are emboldened, so only a single entry per box (the predominant vegetation structure) is permissible.

Bare (B)

Predominantly bare earth or unvegetated artificial bank material (e.g. concrete, sheet piling, gabion). Vegetation cover <50% over the 10m bank-length. A1c, E1La,b, E1Ma,b,c, E1Pa, E7Cc, FV6a,b.

Uniform (U)

Predominantly one vegetation type (e.g. grass, nettles, heather), but lacking scrub or trees. B7a,b, C4c, D6c, E2Ca, F8a, FV1a,b, FV2a,b, FV5b, FV7a,b.

Simple (S)

Predominantly 2-3 vegetation types, often with scrub, and may include trees. Trees with sparse herb understorey (e.g. coniferous forest extending to the riverbank) to be included in this category. E1Pd, E7Dd, F18a, FV8a,b, G2b.

Complex (C)

Four or more vegetation types, and scrub and/or trees must be present. FV4b, FV5b, FV9a,b, G2b.

Not visible (NV)

To be used only where the bank is genuinely obscured.

SECTION G: CHANNEL VEGETATION TYPES

To be assessed within a 10m wide transect across the channel at each spot-check (see Figure 1).

Channel vegetation types are recorded in categories that assess the habitat structure they provide at the time of survey, not their morphological character described in textbooks. The purpose is to provide information on the range of functional habitats that channel vegetation may be providing for invertebrates and other animals. This is especially important in rivers with otherwise limited structural diversity.

To be recorded as present (✓), a channel vegetation type must occupy at least 1% of the channel area within the 10m wide transect (e.g. 1m² on a 10m wide river). To be recorded as extensive (E), the channel vegetation type must occupy at least 33% of the channel area within the 10m wide transect. Thus, vegetation growth should be obvious, and time should not be wasted looking for isolated plants.

It is essential that at each spot-check at least one box has an entry. Several 'vegetation type' entries will be made for the same spot-check when there is more than a single type present. When the water is very turbid, enter 'NV', and record cover of emergent, floating or amphibious vegetation as appropriate.

It is important to complete the end-column to assess overall presence of vegetation types occurring along the 500m as a whole, including those types not recorded at the spot-checks. Use 'E' for vegetation forms covering ≥33% of the 500m site, or ✓ for those vegetation types occupying at least 1% of the 500m site, but <33% of it.

This end-column is not a summation of the vegetation types recorded in spot-checks – it is possible that rare forms may be recorded in one or more spot-checks, but not cover ≥1% of the whole RHS site; as such they would not be recorded in the end-column.

Important – See Technical Update 2006 – Channel Vegetation.

None/Not visible

If <1% vegetation cover, or none is visible, even though water clarity is good, enter ✓ in this box. When the bed of the channel is not visible (e.g. when enclosed in a culvert) also enter 'NV'. Also enter 'NV' if the water is too turbid to determine submerged plant cover, even though entries for emergent, amphibious and floating forms can be made if present.

Liverworts/mosses/lichens

Aquatic liverworts (e.g. *Scapania*), mosses (e.g. *Fontinalis*) and lichens (e.g. *Collema*). Includes vegetation that is submerged, or in the splash zone. G1a,b,c, M6a,b.

Emergent broad-leaved herbs

Broad-leaved plants rooted on the river bed or along the water's edge. Leaves and flowers grow above water level e.g. fool's water-cress (*Apium nodiflorum*) and water-speedwell (*Veronica* spp.). G2a,b.

Emergent reeds/sedges/rushes/grasses/horsetails

Narrow-leaved monocotyledons (e.g. reeds, sedges, rushes, grasses and horsetails) rooted below water-level or along the water's edge. Examples include branched bur-reed (*Sparganium erectum*), reedmace (*Typha*), common/Norfolk reed (*Phragmites australis*), sedges (*Carex* spp.), rushes (*Juncus* spp.) bulrush (*Schoenoplectus* spp.), reed sweet-grass (*Glyceria maxima*) and water horsetail (*Equisetum fluviatile*). G3a,b,c.

Floating-leaved (rooted)

Plants rooted on the river bed but with either **broad floating leaves** such as yellow water-lily (*Nuphar lutea*) and broad-leaved pondweed (*Potamogeton natans*); or **linear floating leaves** such as those produced by unbranched bur-reed (*Sparganium emersum*). G4a.

Free-floating

Plants floating on, or just under, the water surface, and not rooted to the river bed. Examples include duckweeds (*Lemna* spp.), frogbit (*Hydrocharis morsus-ranae*), hornwort (*Ceratophyllum* spp.) and water soldier (*Stratiotes aloides*). G5a,b,c.

Amphibious

Plants rooted at the edge of the river, or on the bank, but shoots or leaves trail across the water. Examples include amphibious bistort (*Persicaria amphibia*), creeping bent-grass (*Agrostis stolonifera*), floating sweet- grass (*Glyceria fluitans*), marsh foxtail (*Alopecurus geniculatus*), and water forget-me-not (*Myosotis scorpioides*). G6a,b.

Submerged broad-leaved

Rooted submerged plants with underwater leaves no more than four times longer than broad. Some part of the plant, or some leaves, may reach the surface but the majority are submerged. Includes submerged 'cabbage-like' leaves of yellow water-lily (*Nuphar lutea*), perfoliate and several other broad-leaved pondweeds (*Potamogeton perfoliatus, P. lucens, P. alpinus*), Canadian pondweed (*Elodea canadensis*), and starworts (*Callitriche* spp.). G7a,b,c.

Submerged linear-leaved

Rooted submerged plants with narrow, unbranched, laminar leaves (blade/strap/belt-shaped) that are either totally submerged or just have their tips or upper parts floating on the surface. Shape is similar to tagliatelle! The most typical examples are unbranched bur-reed (*Sparganium emersum*) and the underwater leaves of arrowhead (*Sagittaria sagittifolia*), bulrush (*Schoenoplectus* spp.) and flowering rush (*Butomus umbellatus*). G8a,b.

Submerged fine-leaved

Rooted submerged plants with fine, branched, leaves. Shape is similar to spaghetti strands. Examples include the feathery leaves of water milfoil (*Myriophyllum* spp.) and the longer 'shoe-lace' appearance of some water-crowfoot species (*Ranunculus* spp.) and fennel pondweed (*Potamogeton pectinatus*). G9a,b,c.

Filamentous algae

Blanketweed (*Cladophora*), mole pelt (*Vaucheria*) and other obvious **filamentous** algal growths (e.g. *Enteromorpha*). Do not record diatom films that occur alone, or coating aquatic plants or stones. G10a,b.

RHS form page 3: Sweep-up

All sweep-up information is based on the occurrence of features and river characteristics over the whole 500m site.

It is important to continue another 50m beyond the last spot-check to ensure the whole RHS site is 500m long.

For the majority of features, record their presence only if they occur along at least 1% of the channel or bank. Exceptions to this general rule include the presence of specific features such as waterfalls or overhanging boughs that typically may not extend more than 5m along the channel. All features that can be recorded as present even if they occur along <1% of the RHS sites are marked with an asterisk (*) on the form.

It is possible that some features recorded as dominant in a spot-check in Section E (e.g. poached bank 'PC') may not even be recorded as a ✓ in the sweep-up if they do not extend at least 5m along the bank.

SECTION H: LAND-USE WITHIN 50M OF BANKTOP

Record 'E' if a land-use type occurs along ≥ 33% of bank-length, or ✓ when it extends for 1-33% of the bank-length. Only record land-use occurring within 50m of the banktop. Record left and right sides of the watercourse separately. Where two parallel land-uses border the river (e.g. along 50% of one bank there is a 20m grassland strip giving way to arable) – both are recorded as 'E'. Moreover, if the other 50% is a parallel pattern of urban and artificial open water, these too are both recorded as 'E'. Therefore, in exceptional circumstances, more than three 'E' categories can be recorded for one bank.

Use the prompts on the form. For descriptions of land-use categories, see Section F. The following categories are used:

Broadleaf/mixed woodland (BL)
Broadleaf/mixed plantation (BP)
Coniferous woodland (CW)
Coniferous plantation (CP)
Scrub & shrubs (SH)
Orchard (OR) Wetland (WL)
Moorland/heath (MH)
Artificial open water (AW)
Natural open water (OW)
Rough/unimproved grassland/pasture (RP)
Improved/semi-improved grassland (IG)
Tall herb/rank vegetation (TH)
Rock, scree or sand dunes (RD)
Suburban/urban development (SU)
Tilled land (TL)
Irrigated land (IL)
Parkland or gardens (PG)
Not visible (NV)

SECTION I: BANK PROFILES

Use 'E' (≥ 33% of bank-length within the site) or '✓' (present – ≥1% but <33%) for profiles visible on both left and right banks.

NATURAL/UNMODIFIED PROFILES

Record in the 'left' and 'right' bank columns the profiles (slopes) of unmodified banks. The first two categories cover vertical banks, including 'cliffs' recorded in Section E, and other vertical banks not forming cliff features such as banks on chalks streams that are vertical, but may be only a few centimetres high. Other steep banks should be recorded in the third category, and gently sloping banks in the fourth.

All natural bank profiles are recorded here. In cases where there is uncertainty over bank profile, record them as best as possible in the natural/unmodified categories.

Vertical/undercut

Predominantly vertical banks, which may include eroding and stable cliffs. B1b, C4a, E3Ab, I1a,b.

Vertical with toe

Vertical bank with slumped material at base. I2a,b.

Steep

Bank slope ≥45° angle, but not predominantly vertical. B3a, I3a, I4a.

Gentle

Bank slope <45°. B1b, B7a, C4a, E3Ec, I4a.

Composite

Banks with complex profile which may be caused by previous slumping or sequences of channel erosion. I5a,b.

Natural berm

See detailed definition in Section E and Figure E4. A transitional feature that requires a well-trained eye to confirm its presence. Beware: if artificial two-stage channels have been excavated just above the original river bed level, these may, over time, appear 'like a new floodplain'; **if so, do not record here**. E3Ea,b,c,d,e – for artificial berm, see E2Ca,b,c,d.

ARTIFICAL/MODIFIED PROFILES

The same modifications to banks noted in Section E are also included here, and as for 'unmodified banks', all the different resectioned and reinforced profiles on the left and right banks should be recorded in the appropriate columns. This is the only place where the occurrences of embankments set back from the bank are recorded.

All modifications to banks are summarized here.

Resectioned (reprofiled)

Bank profile modified, often to accommodate flood flow, flood defence or other maintenance machinery. Recent re-profiling will produce a relatively smooth, uniformly angled, bank slope. See Section E; Bank Modifications. **Only record in the sweep-up if not accompanied by whole bank reinforcement**. A1a, D8a,b,c, E2Aa,b, E3Da, I6b.

Reinforced bank

Whole or part of bank artificially strengthened for bank protection purposes. Examples include concrete, sheet piling, corrugated iron, wood piling, gabion, brick/laid stone, rip-rap and builders' waste (see descriptions of above in E: Bank Materials). For sweep-up purposes, bank reinforcements are differentiated into three categories to indicate their vertical extent: (i) whole bank; (ii) top only; (iii) toe only. **When the whole bank is reinforced, there is no need to record resectioning.** A1c, E1Ja,b, E1Ka, E1La,b, E1Oa, I6a,b,c.

Artificial two-stage channel

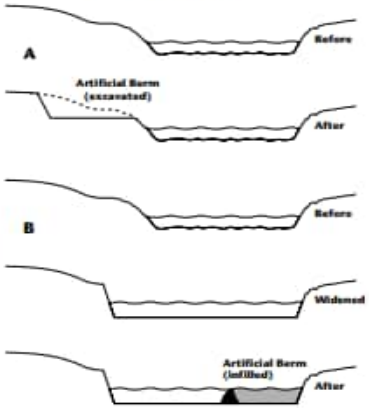
Typically this is where one or both banks have been excavated laterally into the floodplain to create a shelf above dry-weather flow (see Figure I1). Also included are shelves constructed in previously widened channels to create narrower low-flow channels. Water spills over the second (normally dry) stage shelves during high flows. These are constructed features. E2Ca,b,c,d.

Do not confuse with natural berms (see Natural berm E3Ea,b,c,d,e).

Figure I1 Artificial two-stage channel – berm formation through:

A – bank excavation

B – channel infill



Poached bank

Bank significantly trampled or puddled by livestock. Include banks trampled as a result of human activity such as picnic spots, canoe access points, and fishing spots dug into the bank. E2Ba,b,c,d, I5b, P1a.

Embanked

Artificial embankment created to increase the banktop height. Only recorded here when it forms an integral part of the bank. **Do not** include embankments set back from the immediate banktop; these are recorded as set-back embankments (below). E2Da,b.

Set-back embankment

Artificial embankment or earth bund designed to increase flood capacity but set back from the river channel and forming a distinct floodplain landscape feature. I7a.

SECTION J: EXTENT OF TREES AND ASSOCIATED FEATURES

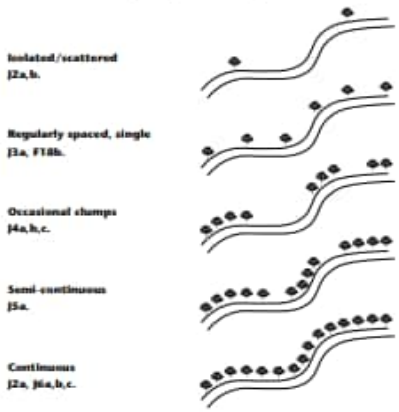
Due to the importance of trees and associated features, these warrant individual attention and are recorded in more detail in this section.

TREES

Distribution along each bank for the entire 500m length is recorded using five descriptive categories. These are not meant to represent an accurate distribution pattern for individual sites, but to provide an overview. Recent aerial photographs can provide an extra check.

For each bank tick one box only for the nearest distribution 'match' based on the categories in Figure J1. ☼ ONE BOX FOR EACH BANK MUST BE TICKED.

Figure J1 Illustration of RHS recording of bankside trees



ASSOCIATED FEATURES

These are habitats, or features, associated with trees.

☼ IN EACH CASE, ONE BOX PER FEATURE MUST BE TICKED.

Records are made on their occurrence within, or along, the total 500m length of the site. Record 'None' when <1% occurrence (absent, or not present in >5m of channel length); 'Present' if 1-33% occurrence (present in 5-165m of channel length); and 'E' when ≥ 33% occurrence (present in >165m of channel length).

For the three features marked with an asterisk (*), presence can be ticked even if they do not occur in >1% of the site.

Shading of channel

Extent of **direct**, overhead, **tree** canopy shade. ☼ Do not include shade from culverts and bridges. 📷 J7a,b, M4a, M6a, M7a.

*Overhanging boughs

Large (forearm-size or larger) tree boughs which arc horizontally over, or dip close to, the water surface. 📷 C2a, E48b, I1a, J6b, J7a, J8a,b, J9b.

*Exposed bankside roots

Large (forearm-sized or larger) exposed roots and associated cavities. These can provide a good location for otter holts. 📷 J9a,b.

*Underwater tree roots

Exposed underwater tree or shrub roots. Alder and willow roots are distinctive examples. 📷 J10a.

Fallen trees

Uprooted or collapsed tree(s) that are **still attached to the bank**, either alive or dead. 📷 J11a,b,c.

Large woody debris

Whole trees or large trunks and branches **swept downstream** and lodged in the channel or on the banks. May develop into debris dams – see section M. 📷 J12a,b.

SECTION K: EXTENT OF CHANNEL AND BANK FEATURES

This section includes a wide variety of features ranging from flow types to exposed bedrock.

IN EACH CASE, ONE BOX PER FEATURE MUST BE TICKED.

Records are made on their occurrence within, or along, the total 500m length of the site. Record 'None' when <1% occurrence; 'Present' if 1-33% occurrence; and 'E' when ≥ 33% occurrence .

For the five features marked with an asterisk (*), presence can be ticked even if they do not occur in >1% of the site.

RHS uses flow-types as a diagnostic guide to channel habitats. Predominant flow-type is determined at the 10 spot-checks (Section E). However, it is also necessary to assess flow-types in the site as a whole. For this purpose only, you need to record flow-types when they are dominant across most of the channel width **and** when they form a distinct feature that is at least 5m long (i.e. >1% of channel length). 'Free fall' and 'upwelling' flow-types can be recorded as present even if they do not represent a predominant flow type along at least 5m of the channel length. **Do not record these flow-types in Section K if they result from artificial features such as weirs.**

For the definitions of flow-types and channel features, see Section E. The following are recorded (spot-check abbreviations are included for easy cross-reference).

***Free fall flow (FF) – but only if associated with natural features**

Chute flow (CH)

Broken standing waves (BW)

Unbroken standing waves (UW)

Rippled flow (RP)

***Upwelling (UP) – but only if associated with natural features**

Smooth flow (SM)

No perceptible flow (NP) No flow [dry] (DR)

The following other (non-flow-type related) features are recorded.

Marginal deadwater

Margins of the main channel which have **no perceptible flow**. These are good refuge areas for various aquatic invertebrates and fish fry. Examples include where the bank has eroded into an embayment, or remnants of old abandoned channels are still connected to the main channel (also recorded as backwaters in Section M). Marginal deadwater may also occur downstream of large 'side' or 'point bars'. K1a,b,c, M12a,b.

Eroding cliff(s) (EC)

See Section E, marginal and bank features. Extent is for both banks.

Stable cliff(s) (SC)

See Section E, marginal and bank features. Extent is for both banks.

Exposed bedrock (EB)

See Section E, channel features.

Exposed boulders (RO)

See Section E, channel features.

Vegetated rock (VR)

See Section E, channel features.

Unvegetated mid-channel bar(s) (MB)

See Section E, channel features.

Vegetated mid-channel bar(s) (VB)

See Section E, channel features.

Mature island(s) (MI)

See Section E, channel features.

Unvegetated side bar(s) (SB)

See Section E, marginal and bank features. Extent is for both banks.

Vegetated side bar(s) (VS)

See Section E, marginal and bank features. Extent is for both banks.

Unvegetated point bar(s) (PB)

See Section C. Extent is for both banks.

Vegetated point bar(s) (VP)

See Section C. Extent is for both banks.

***Unvegetated silt deposit(s)**

DO NOT RECORD when silt covers the bed from bank to bank and does not contrast with the predominant substrate present in the whole site (recorded as 'SI' in spot-checks in Section E) – the deposits must contrast with the predominant river bed substrate(s). Unvegetated silt deposits may be either underwater or exposed, in the channel or on the margins with a minimum size of 5m². Silt deposits are often formed in response to obstructions (e.g. fallen tree, naturally protruding boulders, or artificial deflector structures); such deposits would be recorded as 'present'. Extensive deposits are often associated with rivers recovering from artificial channel over-widening. If they form discrete ledges, and occur in more than 33% of the site, record as 'E'. K2a,b,c.

***Discrete unvegetated sand deposit(s)**

A discrete unvegetated sand deposit is either underwater or exposed, in the channel or on the margins with a minimum size of 5m². **DO NOT RECORD** when sand covers the bed from bank to bank (recorded as 'SA' in Section E) – the deposits must contrast with the predominant river bed substrate(s). Discrete sand deposits are often formed in response to obstructions (e.g. fallen tree, naturally protruding boulders or artificial deflector structures), or in recesses in banks. Discrete sand deposits are recorded because they are valuable habitats for several invertebrate species. As sand deposits are not considered to be 'discrete' if they are present along more than 33% of a site (sand would be a predominant substrate in Section E), it is not possible to record extensive discrete sand deposits ('extensive' box not on the form). K3a,b.

***Discrete unvegetated gravel deposit(s)**

A discrete unvegetated gravel deposit is either underwater or exposed, in the channel or on the margins with a minimum size of 5m². ☤ DO NOT RECORD when gravel covers the bed from bank to bank (recorded as 'GP' in Section E) – the deposits must contrast with the predominant river bed substrate(s). Found only in channels with a predominant substrate of cobbles/boulders/bedrock, and located in the lee of large boulders, structures, fallen trees or other obstacles. ☤ Do not record in any other circumstances, and not to be confused with bars (recorded in Section E). As gravel deposits are not considered to be 'discrete' if they are present along more than 33% of a site (gravel would be a predominant substrate in Section E), it is not possible to record extensive discrete gravel deposits ('extensive' box not on the form). K4a,b.

RHS form page 4: Dimensions and Influences

SECTION L: CHANNEL DIMENSIONS

Make sure that Health & Safety guidance (Appendix 1) is strictly followed when entering the channel to take measurements. For large rivers where mid-channel water depth cannot be safely measured, enter "unknown" in the appropriate box.

Measurement of channel width, water depth and banktop height

Choose a straight part of the site if possible, preferably with well-defined banks and a riffle. This is the optimum location for measuring channel and bank dimensions. In many instances channel dimensions will need to be measured at a location other than at one of the spot-checks.

For guidance on banktop, water width etc., see Figure F1. To ensure consistent recording it is imperative that surveyors fully comprehend this information before undertaking field measurements.

Both steep and very low gradient sites will not have riffles. In such cases choose a relatively uniform (and if possible, shallow) cross-section and state on the form the predominant flow-type at the location where channel dimensions are taken. In some instances, the river bed will be inaccessible and consequently water depth and river bed consolidation will not be determined. If so, indicate accordingly on the form.

Rangefinders and ranging poles will improve the accuracy of measurements taken. When a rangefinder is used to measure width, indicate by adding 'R'.

☤ **Measuring channel dimensions on braided channels can be very complicated due to the presence of several sub-channels. Water depth should be the average depth of water in the largest channel (i.e. the one from which flow-type and substrate are recorded in spot-checks), but water width cannot be measured. Banktop height and bankfull width should be measured using the banks abutting the floodplain.**

Banktop height (m)

Banktop height is the vertical distance from water level, to the first major break in slope above which cultivation or development is possible. Use the ranging pole to estimate height (m).

Bankfull width (m)

Bankfull width is the horizontal distance across the channel to be measured at the level where the river first spills out of the channel on to the floodplain.

☤ Where no distinct breaks in slope occur (e.g. streams in vee-shaped valleys or gorges, the bankfull height should be **estimated** using clues such as the winter flood level, often marked by a trashline, or 'notches' along the bank at similar heights to the trashline. Estimate bankfull width and height at this point: ENTER MEASUREMENT IN LINE FOUR – and do not enter bankfull width measurements in line one.

Is banktop height also bankfull height?

Bankfull height is the vertical distance from water level on the day, to the point where the river first spills out of its channel on to the floodplain (if it can). Indicate, using 'yes' or 'no', whether the bankfull height is equivalent to the banktop height.

Water width (m)

Water width is the distance across the wetted perimeter of the channel. Use the ranging rod to make crossing the watercourse in shallow locations safer, and use the rod to help measure the width. When a range-finder is used to measure channel width, indicate by adding (R) with the width measurement entry. Note on the form the max-min range of the range-finder used.

Beware: in misty conditions, or where the bank has a non-reflective substrate, accurate range-finder readings are difficult to get.

If it is impossible to wade safely across the river, and you do not have a range-finder, a reasonably accurate estimate can be made by sticking a ranging pole on the bank, and walking along the bank until the pole appears to be the same distance away as the far bank; pace the distance to the pole to estimate the channel width. Wherever possible, however, use a range-finder for measurements.

Water depth (m)

Water depth is the estimated average depth of the channel (to the nearest 10cm). Where possible, always try to estimate the actual depth, using the ranging pole; otherwise use "not known". Common sense should prevail, but recording the average of three measurements taken across the depth range is good practice. If access to the channel is considered too risky, estimate the depth if feasible; if in doubt, record 'NK' in the box.

Embanked height (m)

Where embankments are present, record the extra height created by the embanked material. Include set- back embankments where practicable.

Trashline height (m)

The **height** of the trashline above water level is to be recorded only if lower than the banktop. This may give an indication of an over-deepened channel with the 'natural' bankfull height, indicated by trashline marks. The **width** of the channel at the trashline height can be estimated and recorded. As the height of the trashline is dependent on the previous flood, measurement of this level provides less reliable information than bankfull and banktop heights and widths.

NOTE: Do not choose a location for channel measurements based on the presence or absence of a trashline.

River bed consolidation

Consolidated river bed material will be normally characterised by luxuriant bryophyte or rooted higher plant macrophyte growth. Where gravel and cobbles are present, these will be firmly inter-locked with other substrates, be hard to dislodge, and give a stable 'feel' when kicked.

Unconsolidated river bed material will comprise gravel, pebbles, cobbles or boulders which are not inter-locked and so are easily dislodged or moved when kicked.

In deep rivers where the channel cannot be safely accessed, record as '**unknown**'.

Location of measurements

Tick one of two boxes; if 'other' box ticked, enter the predominant flow type present across the channel where the measurements were taken.

SECTION M: FEATURES OF SPECIAL INTEREST

This is an opportunity to record features of special ecological interest, either in the river channel or adjacent corridor.

The extent of all these features should be recorded as present (✓) if present along ≥1-33% of the site, or 'E' if present along ≥33% of the site. Five of the 21 listed features are marked by an asterisk (*) – these can be ticked even if they do not occur within at least 1% of the site.

Special features should be recorded as '✓' or 'E' if they are within a 50m corridor either side of the channel. Where features of special interest are observed beyond this 50m limit, their presence should be noted in Section P.

None

An entry is required in this box when no entries are made in any other boxes **to confirm that no features of interest were observed.**

Braided channels

Braided rivers are dynamic, mobile, rivers where the channel is divided into several sub-channels separated by active mid-channel bars along most (≥50%) of the 500m site. In braided rivers, most bars are unvegetated and the wetted area, at low flows, represents substantially less than 50% of the river bed. Bar surfaces are typically at lower elevations than the vegetated floodplain margins. Braided rivers must feature at least two sub-channels and two mid-channel bars along most of the site. Some of the sub-channels may be dry at the time of the survey.

Excludes all river reaches with more than a single channel that are **not actively changing the location of the sub-channels** – these include:

(i) where two or more channels have developed naturally and are separated by vegetated mid- channel bars or mature islands;
(ii) man-made by-pass channels, including mill leats;
(iii) secondary feeder channels;
(iv) parallel floodplain drainage systems;
(v) chalk streams with multiple, man-made, channels.

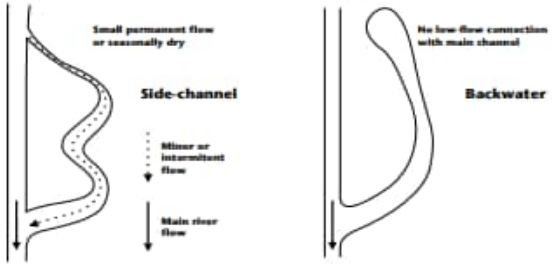
It is recommended that aerial photographs are included to confirm braided rivers. M1a,b,c.

Side channel(s)

To be considered as features of special interest, side channels must be natural, and convey only a minor flow compared with the main channel. They may be dry in periods of low-flow, and will always have bed levels higher than in the main channel (*cf.* multiple channels associated with islands). Side channels generally indicate channel migration across the floodplain, and are most often associated with down-cutting of the main channel. They are always connected to the main channel at their upstream and downstream limits (which may be outside/beyond the site), and convey flow during moderate to high flows (see Figure M1). M2a,b,c.

Do not record as special interest features any artificial channels (e.g. mill races, water meadow feeder channels and multi-channels of chalk rivers) which can be recorded in Section P as appropriate.

Figure M1 Side channels and backwaters



***Natural waterfall(s) >5m high**

Uninterrupted natural free-fall flow more than 5m high. M3a,b.

***Natural waterfall(s) <5m high**

Uninterrupted natural free-fall flow < 5m high. M4a,b.

Natural cascade(s)

Distinct series of 'stepped' flow features occurring over boulder substrate or bedrock outcrops. E5Ca, M5a,b.

Very large boulders (>1m)

Very large, (at least 1m diameter), boulders protruding well above water level. Very large boulders will be recorded as extensive only if they occur along more than 33% of the channel length. Only naturally occurring boulders are noted; those introduced for fisheries enhancement purposes, or derived from collapsed rip-rap, are excluded but can be recorded in Section P. E4Bb, M5a, M6a,b.

***Debris dam(s)**

Log jam of large woody debris creating an obstruction across the channel and significantly impeding water flow. M7a,b.

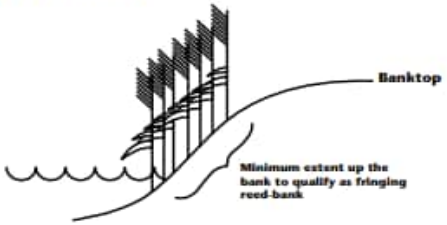
***Leafy debris**

Significant accumulations (at least 2m²) of twigs and leaf litter along channel edge. An important temporary habitat for some insects. M8a,b.

Fringing reed-bank(s)

Fringing reeds such as common/Norfolk reed (*Phragmites australis*) which extend **at least** half-way up the bank. To be recorded, a fringing reed-bank must extend at least 10m along the bank-length. See Figure M2. M9a,b,c.

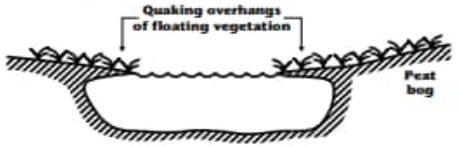
Figure M2 Fringing reed bank



Quaking bank(s)

A distinct floating 'ledge' or shelf of vegetation only, equivalent to a 'quaking', bog which extends into the channel. Usually an extension of adjacent wetland into the channel. Very rare in Britain and Ireland. See Figure M3. M10a.

Figure M3 Quaking bank



***Sink hole(s)**

A feature of some channels in limestone areas. Except during spates, flow in the channel upstream disappears into the ground through the channel bed, re-appearing further downstream. M11a,b.

Backwater(s)

Redundant river channels that are connected to the main channel only at one point, normally the downstream end. In contrast to side channels, they do not act as flood-conveyance channels (see Figure M1). B8a, K1a, M12a,b.

Floodplain boulder deposits

Boulders deposited **on the floodplain** by the river, typically close to the banktop and downstream of a constricted section of channel (e.g. gorge or V-shaped valley). Boulders in the channel should be recorded as boulder substrates or exposed boulders, as appropriate, **and not floodplain boulder deposits**. M13a.

Water meadow(s)

Floodplain meadows, primarily associated with chalk streams, and traditionally flooded via constructed feeder channels. These drainage channels are straight, shallow and parallel. Features include remnant channels and floodplain grasslands. M14a,b.

Fen(s)

Wetland vegetation, often (but not exclusively) growing over peat, where the water-table is at, or just below, the surface. Water is derived from both rainfall and drainage of surrounding land. Some fens may have *Sphagnum* moss, but typically the vegetation is dominated by tall reeds, wetland herbs, sedges, and rushes. 📷 M15a.

Bog(s)

Vegetation growing on wet peat where the water table is at, or just below, the surface. The water source is direct rainfall and in some cases, over-land flow occurs during heavy rain events. *Sphagnum* moss is always present, often with bog cotton (*Eriophorum*). In locally drier areas heather (*Calluna, Erica*) may also be present, but never dominant. 💡 When the heathland component is uncommon, and bog predominates, record 'Moorland/heath' as 'present', and record 'Bog' as 'extensive'. 📷 M16a,b,c.

Wet woodland(s)

Wet woodland comprises trees such as willow (*Salix* spp.) and alder (*Alnus* spp.), usually with an understorey of wetland herbs, reeds and mosses. Often at the edge of other wetlands, and often referred to as 'carr'. 📷 M17a,b.

Marsh(es)

Wetland habitat that includes tall grasses and rushes on periodically wet ground (unlike fen or bog that are permanently wet), or where wetland herbs are an important component of the ground flora (e.g. meadowsweet – *Filipendula ulmaria*, marsh orchids – *Dactylorhiza* spp., kingcup – *Caltha palustris*, valerians – *Valeriana* spp.). 📷 F7a, M18a,b.

Flush(es)

A collective term for wet areas near springs where water emerges from the ground or seeps from fissures in rock faces, or valley slopes. Flushes are fed by groundwater – when surface water predominates a stream is formed. 📷 M19a,b.

Natural open water

Includes abandoned ox-bows, natural lakes, bog-pools and meres.

💡 Only include features that are **NOT** connected to the river channel except during periods of floods. 📷 M20a,b,c.

Others

It is important to record any other features of ecological interest, such as reedbeds, herb-rich wet grassland etc. associated with the river and adjacent land.

SECTION N: CHOKED CHANNEL

If 33% or more of the total channel area is choked with vegetation, causing **significant** impediment to flow, indicate by putting a ✓ in the 'Yes' box. If not, ✓ the 'No' box. 💡 **One of the two boxes must be ticked.** 📷 Na,b.

The extent of vegetation will depend to some degree on seasonal influences, but choked channels can present a barrier to fish migration, or increase flood risk.

SECTION O: NOTABLE NUISANCE PLANT SPECIES

Indicate the absence or presence (including extent) of those alien plant species listed on the form by ticking appropriate boxes.

Estimate abundance within the site as a whole by using a '✓' when present along <33% of the bank-length or 'E', when present along ≥33% of total bank-length. Separate records are made for the bankface, and the river corridor up to 50m from the banktop. **Include plants growing on mid-channel bars in the 'bankface' category.**

The main introduced nuisance species associated with rivers in Britain and Ireland are:

- giant hogweed (*Heracleum mantegazzianum*) 📷 O1a;
- Himalayan (Indian) balsam (*Impatiens glandulifera*) 📷 O2a;
- Japanese knotweed (*Fallopia japponica*) 📷 O3a.

If you know that other alien species are present, list these in the space provided. A common example in some upland locations is Rhododendron. 📷 O4a.

💡 Species are shown on the form prefixed by an *asterisk, so the presence of a single plant should be recorded. It is important to report even an isolated occurrence, since control measures may be able to be taken.

SECTION P: OVERALL CHARACTERISTICS

This section has a prompt check-list to capture important additional information. Circle relevant prompt words on the form and add others as appropriate.

Major impacts

Any major impacts on the site using the self-explanatory checklist on the form. P1a,b.

Evidence of recent management

A brief descriptive checklist for obvious and recent activities is listed. Briefly describe other activities as appropriate.

'Recent' management is defined by the presence of **obvious signs** e.g. machinery present, excavated bare earth, weed/brash cuttings and bank mowing, unvegetated dredge spoil on the bank etc. E2Aa, P2a.

Enhancement works: examples include meander or riffle reinstatement, channel narrowing, bank re-profiling, reed-planting and tree-planting. Most will be obvious only when recently undertaken. E1Hb, E1Mb, E2Cc,d, P2b.

Animals

Sightings of mammals, birds, insects and other taxa of interest. Use the checklist and add as appropriate. Indicate if the presence is indirectly inferred from footprints or faeces (e.g. otter spraints). Records of animals will not be systematic since they will depend greatly on the interests and expertise of individual surveyors.

Other significant observations

It is important to record your overview of the site to complement information recorded on the form and photographs. Use a separate sheet if necessary, and make sure it has the mid-site grid reference clearly marked on it and the sheet is attached to the form.

SECTION Q: ALDERS

In this section record the presence or absence of alder trees (*Alnus glutinosa*). Record whether they are present or absent, and indicate whether they are healthy or affected by *Phytophthora* root disease. Information on *Phytophthora* is needed for a national assessment of the incidence of the disease. Qa,b.

See Appendix 3 for illustrated guidance on how to recognise symptoms. This has been reproduced with the permission of the Forestry Commission from: *Information Note 'Phytophthora Disease of Alder'* (December 2004) © Crown Copyright 2004.

One of the three boxes in both categories must by ticked. Record 'none' if no alders are present; 'present' if alders occur in <33% of bank-length (even if just one tree – hence the *asterisk reminder on the form); and 'E' if present along ≥33% of bank-length, **irrespective of whether they are affected by the disease or not**. If no trees are affected by *Phytophthora*, record 'None'; 'Present' if diseased alders occur in <33% of bank- length; and 'E' if disease affects alders along ≥33% of bank-length.

Observations of diseases affecting other trees (e.g. willows [*Salix*]) can be noted in Section P.

SECTION R: FIELD SURVEY QUALITY CONTROL

However experienced you are with filling in RHS forms, it is easy to make a mistake or send in an incomplete site record. To avoid this, you should check the form and tick the seven boxes as each one is checked in the field. This will save you having to rectify omissions later, and possibly save the need for a re-survey. The prompts ask the surveyor if they have:

- taken at least two photos that illustrate the general character of the site and additional photos of all weirs and any major/intermediate structures across the channel?
- completed all ten spot-checks and made entries in all boxes in E and F on page 2?
- completed column 11 of section G, and E if appropriate on page 2?
- recorded in section C the number of riffles, pools and point bars (even if 0) on page 1?
- given an accurate (alphanumeric) grid reference for spot-checks 1 and 6, and the end of the site (page 1)?
- stated whether spot-check 1 is at the upstream or downstream end of the site (top of page 2)?
- cross-checked spot-check and sweep-up responses with the channel modification indicators given on page 2 of the spot-check key?

Annex G
River Habitat Survey Forms

RIVER HABITAT SURVEY 2003 VERSION: SITE HEALTH AND SAFETY ASSESSMENT

Site Number[1]: RHS 1	Site Ref: RHS 1	River Name: RHS 1	Date: 26/05/22
Grid References/Co-ordinates:	Spot 1[2]: SH 689387	Mid-site: SH 688386	End of site[2]: SH 689285
Surveyor Name: GEORGE ADAMS		Accredited Surveyor Code: n/a	

[1] Leave blank if new site. [2] Optional

Weather Conditions: OVERCAST, SHOWERS, MILD

Flow Conditions: NORMAL FLOW

Site details: (enter comments or circle if applicable and give details)	**Risk Level (Low/Mod/High)**
Access and Parking: (entry & exit)	Low
Conditions: comment on ground stability, footing, exposure/remoteness	Low
Obstacles/Hazards: fencing, stiles, dense vegetation, steep bank	Mod
Occupied/Unoccupied: people (circled), livestock, animals	Low
Activities/Land-use: agriculture (circled), woodland (circled), residential, industrial (circled), construction, recreational	Low
Risk if lone-working	N/A

IF THERE ARE ANY HIGH RISKS OR MORE THAN THREE MODERATE RISKS DO NOT CONTINUE WITH THE SURVEY.

Weil's Disease (*Leptospirosis*)

Instructions to card holders

1. As infection may enter through breaks in the skin, ensure that any cut, scratch or abrasion is thoroughly cleansed and covered with a waterproof plaster.
2. Avoid rubbing your eyes, nose and mouth during work.
3. Clean protective clothing, footwear and equipment etc. after use
4. After work, and particularly before taking food or drink, wash hands thoroughly.
5. Report all accidents and/or injuries, however slight.
6. Keep your card with you at all times.

Lyme Disease

1. Dress appropriately with skin covered up.
2. Regularly inspect for ticks when in the field.
3. Check for, and remove, any ticks as soon as possible after leaving the site.
4. Seek medical attention if bitten by a tick.

River Habitat Survey Manual: 2003 version

RIVER HABITAT SURVEY 2003 Version

A FIELD SURVEY DETAILS

Site Number: (leave blank if new site) RHS 1

Site Reference:

Spot-check 1 coord: SH 689 387

Spot-check 6 coord: SH 688 386

End of site coord: SH 689 385

Reach Reference: RHS 1

River name: RHS 1

Date 26/05/2022 Time: 10:00

Surveyor name: GEORGE ADAMS

Accredited Surveyor code: n/a

Is the site part of a river or an artificial channel? River ☑ Artificial ☐

Are adverse conditions affecting survey? No ☑ Yes ☐

If yes, state .....

Is bed of river visible? barely or not ☐ partially ☐ ±entirely ☑

Is health and safety assessment form attached? Yes ☑ No ☐

Number of photographs taken: ☐

Photo references:

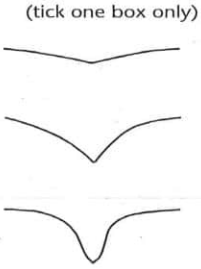
Site surveyed from: left bank ☐ right bank ☑ channel ☐

☐ When options shown with 'shadow boxes', tick one box only

LEFT banks determined by facing downstream RIGHT

B PREDOMINANT VALLEY FORM (within the horizon limit) (tick one box only)

(tick one box only)



☐ shallow vee

☐ deep vee

☐ gorge

☐ concave/bowl

☐ asymmetrical valley

☐ U-shape valley

☑ no obvious valley sides

Distinct flat valley bottom? No ☑ Yes ☐

Natural terraces? No ☑ Yes ☐

C NUMBER OF RIFFLES, POOLS AND POINT BARS (enter total number in boxes)

Riffle(s)	2	Unvegetated point bar(s)	n/a
Pool(s)	n/a	Vegetated point bar(s)	n/a

D ARTIFICIAL FEATURES (indicate total number of occurrences of each category within the 500m site)

If none, tick box ☐

	Major	Intermediate	Minor		Major	Intermediate	Minor
Weirs/sluices				Outfalls/ intakes		2	
Culverts				Fords			
Bridges			1	Deflectors/ groynes/croys			
Other - state							

Is channel obviously realigned? No ☐ Yes, <33% of site ☐ ≥33% of site ☑

Is channel obviously over-deepened? No ☑ Yes, <33% of site ☐ ≥33% of site ☐

Is water impounded by weir/dam? No ☑ Yes, <33% of site ☐ ≥33% of site ☐

River Habitat Survey Manual: 2003 version

SITE REF. RHS 1 | **RIVER HABITAT SURVEY: TEN SPOT-CHECKS** | Page 2 of 4

Spot-check 1 is at: upstream end ☐ downstream end ☑ of site (tick one box)

E PHYSICAL ATTRIBUTES (to be assessed across channel within 1m wide transect)

When boxes 'bordered', only one entry allowed	1 GPS	2	3	4	5	6 GPS	7	8	9	10	GPS
LEFT BANK	Ring EC or SC if composed of sandy substrate										
Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	
Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS	
Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB	No	No	No	No	No	No	No	No	No	No	
CHANNEL	GP- ring either G or P if predominant										
Channel substrate NV, BE, BO, CO, GP, SA, SI, CL, PE, EA, AR	GP	GP	GP	GP	GP	GP	SI	SI	SI	SI	
Flow-type NV, FF, CH, BW, UW, CF, RP, UP, SM, NP, DR	SM	SM	RP	RP	RP	RP	SM	SM	NP	SM	
Channel modification(s) NK, NO, CV, RS, RI, DA, FO	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS	
Channel feature(s) NV, NO, EB, RO, VR, MB, VB, MI, TR	No	No	No	No	No	No	No	No	No	No	
For braided rivers only: number of sub-channels	—	—	—	—	—	—	—	—	—	—	
RIGHT BANK	Ring EC or SC if composed of sandy substrate										
Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI	EA	EA	EA	EA	EA	EA	EA	EA	EA	EA	
Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS	
Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB	No	No	No	No	No	No	No	No	No	No	

Enter channel substrate(s) not occurring as predominant in spot-checks but present in >1% of whole site.

F BANKTOP LAND USE AND VEGETATION STRUCTURE (to be assessed over a 10m wide transect)

Land-use: choose one from BL, BP, CW, CP, SH, OR, WL, MH, AW, OW, RP, IG, TH, RD, SU, TL, IL, PG, NV

		1	2	3	4	5	6	7	8	9	10
LAND-USE WITHIN 5m OF LEFT BANKTOP		BL	BL	BL	BL	BL	BL	BL	SH	BL	BL
LEFT BANKTOP (structure within 1m)	B/U/S/C/NV	C	C	C	C	C	C	C	C	C	C
LEFT BANK-FACE (structure)	B/U/S/C/NV	S	S	S	C	C	C	C	C	C	C
RIGHT BANK-FACE (structure)	B/U/S/C/NV	S	S	S	C	C	C	S	C	C	C
RIGHT BANKTOP (structure within 1m)	B/U/S/C/NV	C	C	S	C	C	C	S	C	C	C
LAND-USE WITHIN 5m OF RIGHT BANKTOP		BL	BL	SU	BL	BL	BL	SH	SH	SH	SH

G CHANNEL VEGETATION TYPES (to be assessed over a 10m wide transect; use E (> 33% area), ✓ (present) or NV (not visible))

	1	2	3	4	5	6	7	8	9	10	GPS
None (✓) or Not Visible (NV)											
Liverworts/mosses/lichens	✓	✓	✓	✓	✓	✓	✓				✓
Emergent broad-leaved herbs					✓	✓			✓	✓	✓
Emergent reeds/sedges/rushes/grasses/horsetails					✓						✓
Floating-leaved (rooted)											
Free-floating											
Amphibious											
Submerged broad-leaved											
Submerged linear-leaved											
Submerged fine-leaved											
Filamentous algae	✓	✓	✓	✓	✓	✓	✓	✓			✓

Use end column for overall assessment over 500m, including types not occurring in spot-checks (use ✓, E or NV)

Riffles: *Pools:* *PB:* *VP:*

River Habitat Survey Manual: 2003 version

SITE REF. RHS 1 | **RIVER HABITAT SURVEY : 500m SWEEP-UP** | Page 3 of 4

H LAND-USE WITHIN 50m OF BANKTOP

Use ✓ (present) or E (≥ 33% banklength)

	L	R		L	R
Broadleaf/mixed woodland (semi-natural) (BL)	E	✓	Natural open water (OW)		
Broadleaf/mixed plantation (BP)			Rough/unimproved grassland/pasture (RP)	✓	
Coniferous woodland (semi-natural) (CW)			Improved/semi-improved grassland (IG)		
Coniferous plantation (CP)			Tall herb/rank vegetation (TH)		
Scrub & shrubs (SH)	✓	✓	Rock, scree or sand dunes (RD)		
Orchard (OR)			Suburban/urban development (SU)	E	
Wetland (e.g. bog, marsh, fen) (WL)			Tilled land (TL)		
Moorland/heath (MH)			Irrigated land (IL)		
Artificial open water (AW)			Parkland or gardens (PG)		
			Not visible (NV)		

I BANK PROFILES

Use ✓ (present) or E (≥ 33% banklength)

Natural/unmodified	L	R	**Artificial/modified**	L	R
Vertical/undercut			Resectioned (reprofiled)	E	E
Vertical with toe			Reinforced - whole		
Steep (>45°)	E	E	Reinforced - top only		
Gentle	✓	✓	Reinforced - toe only		
Composite			Artificial two-stage		
Natural berm			Poached bank		
			Embanked		
			Set-back embankment		

J EXTENT OF TREES AND ASSOCIATED FEATURES

*record even if <1%

TREES (tick one box per bank)

	Left	Right
None	☐	☐
Isolated/scattered	☐	☐
Regularly spaced, single	☐	☐
Occasional clumps	☐	☐
Semi-continuous	☐	☐
Continuous	☑	☑

ASSOCIATED FEATURES (tick one box per feature)

	None	Present	E (≥33%)
Shading of channel	☐	☐	☑
*Overhanging boughs	☐	☐	☐
*Exposed bankside roots	☐	☑	☐
*Underwater tree roots	☐	☐	☐
Fallen trees	☐	☐	☐
Large woody debris	☐	☑	☐

K EXTENT OF CHANNEL AND BANK FEATURES

(tick one box for each feature) *record even if <1%

	None	Present	E (≥33%)		None	Present	E (≥33%)
*Free fall flow	☐	☐	☐	Exposed bedrock	☐	☐	☐
Chute flow	☐	☐	☐	Exposed boulders	☐	☐	☐
Broken standing waves	☐	☐	☐	Vegetated bedrock/boulders	☐	☐	☐
Unbroken standing waves	☐	☐	☐	Unvegetated mid-channel bar(s)	☐	☐	☐
Rippled flow	☐	☑	☐	Vegetated mid-channel bar(s)	☐	☐	☐
*Upwelling	☐	☐	☐	Mature island(s)	☐	☐	☐
Smooth flow	☐	☐	☑	Unvegetated side bar(s)	☐	☐	☐
No perceptible flow	☐	☑	☐	Vegetated side bar(s)	☐	☐	☐
No flow (dry)	☐	☐	☐	Unvegetated point bar(s)	☐	☐	☐
Marginal deadwater	☐	☑	☐	Vegetated point bar(s)	☐	☐	☐
Eroding cliff(s)	☐	☐	☐	*Discrete unvegetated silt deposit(s)	☐	☑	☐
Stable cliff(s)	☐	☐	☐	*Discrete unvegetated sand deposit(s)	☐	☐	
				*Discrete unvegetated gravel deposit(s)	☐	☑	

River Habitat Survey Manual: 2003 version

SITE REF. RHS 1 | **RIVER HABITAT SURVEY : DIMENSIONS AND INFLUENCES** Page 4 of 4

L CHANNEL DIMENSIONS (to be measured at one location on a straight uniform section, preferably across a riffle)

LEFT BANK		CHANNEL		RIGHT BANK	
Banktop height (m)	1	Bankfull/top width (m)	5	Banktop height (m)	1
Is banktop height also bankfull height? (Y or N)	Y	Water width (m)	1	Is banktop height also bankfull height? (Y or N)	Y
Embanked height (m)	1	Water depth (m)	0.2	Embanked height (m)	1

If trashline lower than banktop, indicate: height above water (m) = n/a width from bank to bank (m) = n/a

Bed material at site is: consolidated ☐ unconsolidated (loose) ☑ unknown ☐

Location of measurements is: riffle ☐ other ☑ (state) SMOOTH

M FEATURES OF SPECIAL INTEREST Use ✓ or E (≥ 33% length) *record even if <1%

None	☐	Very large boulders (>1m)	☐	Backwater(s)	☐	Marsh(es)	☐
Braided channels	☐	*Debris dam(s)	☐	Floodplain boulder deposits	☐	Flush(es)	☐
Side channel(s)	☐	*Leafy debris	☑	Water meadow(s)	☐	Natural open water	☐
*Natural waterfall(s) > 5m high	☐	Fringing reed-bank(s)	☐	Fen(s)	☐	Others (state)	☐
*Natural waterfall(s) < 5m high	☐	Quaking bank(s)	☐	Bog(s)	☐		
Natural cascade(s)	☐	*Sink hole(s)	☐	Wet woodland(s)	☐		

N CHOKED CHANNEL (tick one box)

Is 33% or more of the channel choked with vegetation? No ☑ Yes ☐

O NOTABLE NUISANCE PLANT SPECIES Use ✓ or E (≥ 33% length) *record even if <1%

	bankface	banktop to 50m		bankface	banktop to 50m
None ☑					
*Giant hogweed	☐	☐	*Himalayan balsam	☐	☐
*Japanese knotweed	☐	☐	*Other (state).....	☐	☐

P OVERALL CHARACTERISTICS (Circle appropriate words, add others as necessary)

Major impacts: landfill - tipping - litter - sewage - pollution - drought - abstraction - mill - dam - road - rail - (industry) - housing mining - quarrying - overdeepening - overwidening (P or E) - (realignement) - afforestation - fisheries management - (silting) - waterlogging - hydroelectric power

Evidence of recent management: dredging - bank mowing - weed cutting - enhancement - river rehabilitation - gravel extraction - other (please specify)

Animals: otter - mink - water vole - kingfisher - dipper - grey wagtail - sand martin - heron - dragonflies/damselflies

Other significant observations: if necessary use separate sheet to describe overall characteristics and relevant observations

Q ALDERS (tick one box in each of the two categories) *record even if <1%

*Alders? None	☐	Present	☑	Extensive	☐	*Diseased Alders? None ☑	Present ☐	Extensive ☐

R FIELD SURVEY QUALITY CONTROL (✓ boxes to confirm checks)

Have you taken at least two photos that illustrate the general character of the site and additional photos of any weirs/ sluices and major/intermediate structures across the channel?	☑
Have you completed all ten spot-checks and made entries in all boxes in E & F on page 2?	☑
Have you completed column 11 of section G (and E if appropriate) on page 2?	☑
Have you recorded in section C the number of riffles, pools and point bars (even if 0) on page 1?	☑
Have you given an accurate (alphanumeric) grid reference for spot-checks 1, 6 and end of site (page 1)?	☑
Have you stated whether spot-check 1 is at the upstream or downstream end of the site (top of page 2)?	☑
Have you cross-checked your spot-check and sweep-up responses with the channel modification indicators given on page 2 of the spot-check key?	☑

River Habitat Survey Manual: 2003 version

RIVER HABITAT SURVEY 2003 VERSION: SITE HEALTH AND SAFETY ASSESSMENT

Site Number[1]: RHS 2	Site Ref: RHS 2	River Name:	Date: 26/5/22
Grid References/Co-ordinates:	Spot 1[2]: SH693383	Mid-site: SH693383	End of site[2]: SH693382
Surveyor Name: GEORGE ADAMS/ LIDIA R.		Accredited Surveyor Code:	

[1] Leave blank if new site. [2] Optional

Weather Conditions: OVERCAST, SHOWERS

Flow Conditions: NORMAL

Site details: (enter comments or circle if applicable and give details)	Risk Level (Low/Mod/High)
Access and Parking: (entry & exit) AS PER SITE 1	
Conditions: comment on ground stability, footing, exposure/remoteness	
Obstacles/Hazards: fencing, stiles, dense vegetation, steep bank	
Occupied/Unoccupied: people, livestock, animals	
Activities/Land-use: agriculture, woodland, residential, industrial, construction, recreational	
Risk if lone-working	

IF THERE ARE ANY HIGH RISKS OR MORE THAN THREE MODERATE RISKS DO NOT CONTINUE WITH THE SURVEY.

Weil's Disease (*Leptospirosis*)

Instructions to card holders

1. As infection may enter through breaks in the skin, ensure that any cut, scratch or abrasion is thoroughly cleansed and covered with a waterproof plaster.
2. Avoid rubbing your eyes, nose and mouth during work.
3. Clean protective clothing, footwear and equipment etc. after use
4. After work, and particularly before taking food or drink, wash hands thoroughly.
5. Report all accidents and/or injuries, however slight.
6. Keep your card with you at all times.

Lyme Disease

1. Dress appropriately with skin covered up.
2. Regularly inspect for ticks when in the field.
3. Check for, and remove, any ticks as soon as possible after leaving the site.
4. Seek medical attention if bitten by a tick.

River Habitat Survey Manual: 2003 version

RIVER HABITAT SURVEY 2003 Version

A FIELD SURVEY DETAILS

leave blank if new site

Site Number: RHS 2

Site Reference:

Spot-check 1 coord: As per front page

Spot-check 6 coord:

End of site coord:

Reach Reference: RHS 2

River name: RHS 2

Date 26/05/20 Time: 12 12

Surveyor name: GA / LR

Accredited Surveyor code:

Is the site part of a river or an artificial channel? River ☐ Artificial ☑

Are adverse conditions affecting survey? No ☑ Yes ☐

If yes, state .....

Is bed of river visible? barely or not ☐ partially ☐ ±entirely ☑

Is health and safety assessment form attached? Yes ☑ No ☐

Number of photographs taken: 15

Photo references:

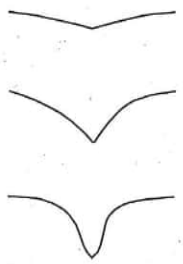
Site surveyed from: left bank ☑ right bank ☐ channel ☐

☐ **When options shown with 'shadow boxes', tick one box only**

LEFT banks determined by facing downstream RIGHT

B PREDOMINANT VALLEY FORM (within the horizon limit) (tick one box only)

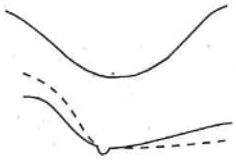
(tick one box only)



☐ shallow vee

☐ deep vee

☐ gorge



☐ concave/bowl

☐ asymmetrical valley

☐ U-shape valley

☑ no obvious valley sides

Distinct flat valley bottom? No ☑ Yes ☐

Natural terraces? No ☑ Yes ☐

C NUMBER OF RIFFLES, POOLS AND POINT BARS (enter total number in boxes)

Riffle(s)	CONTINUOUS	Unvegetated point bar(s)	
Pool(s)		Vegetated point bar(s)	

D ARTIFICIAL FEATURES (indicate total number of occurrences of each category within the 500m site)

If none, tick box ☐

	Major	Intermediate	Minor		Major	Intermediate	Minor
Weirs/sluices				Outfalls/ intakes			
Culverts	2			Fords			
Bridges				Deflectors/ groynes/croys			
Other - state							

Is channel obviously realigned?	**No** ☐	**Yes, <33% of site** ☐	**≥33% of site** ☑
Is channel obviously over-deepened?	**No** ☑	**Yes, <33% of site** ☐	**≥33% of site** ☐
Is water impounded by weir/dam?	**No** ☑	**Yes, <33% of site** ☐	**≥33% of site** ☐

River Habitat Survey Manual: 2003 version

EACH SITE WAS DUPLICATE. 5 SITES IN TOTAL WERE SURVEYED DUE TO THE SHORT STRETCH.

SITE REF. RHS 2 | **RIVER HABITAT SURVEY: TEN SPOT-CHECKS** | **Page 2 of 4**

Spot-check 1 is at: upstream end ☐ downstream end ☑ of site (tick one box)

E PHYSICAL ATTRIBUTES (to be assessed across channel within 1m wide transect)

When boxes 'bordered', only one entry allowed	1 GPS	2	3	4	5	6 GPS	7	8	9	10	GPS
LEFT BANK	Ring EC or SC if composed of sandy substrate										
Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI	Co	Co	Co	Co	Co	Co	Co	Co	Co	Co	
Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS	
Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB	No	No	No	No	No	No	No	No	No	No	
CHANNEL	GP- ring either G or P if predominant										
Channel substrate NV, BE, BO, CO, GP, SA, SI, CL, PE, EA, AR	Co	Co	Co	Co	Co	Co	Co	Co	GP	GP	
Flow-type NV, FF, CH, BW, UW, CF, RP, UP, SM, NP, DR	RP	RP	RP	RP	RP	RP	RP	RP	RP	RP	
Channel modification(s) NK, NO, CV, RS, RI, DA, FO	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS	
Channel feature(s) NV, NO, EB, RO, VR, MB, VB, MI, TR	No	No	No	No	No	No	No	No	No	No	
For braided rivers only: number of sub-channels	—	—	—	—	—	—	—	—	—	—	
RIGHT BANK	Ring EC or SC if composed of sandy substrate										
Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI	Co	Co	Co	Co	Co	Co	Co	Co	Co	Co	
Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS	
Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB	No	No	No	No	No	No	No	No	No	No	

Enter channel substrate(s) not occurring as predominant in spot-checks but present in >1% of whole site.

F BANKTOP LAND-USE AND VEGETATION STRUCTURE (to be assessed over a 10m wide transect)

Land-use: choose one from BL, BP, CW, CP, SH, OR, WL, MH, AW, OW, RP, IG, TH, RD, SU, TL, IL, PG, NV

LAND-USE WITHIN 5m OF LEFT BANKTOP	SU	SU	SU	SU	SU	SU	SU	SU	SU	SU	
LEFT BANKTOP (structure within 1m) B/U/S/C/NV	S	S	S	S	S	S	S	S	S	S	
LEFT BANK-FACE (structure) B/U/S/C/NV	S	S	S	S	S	S	S	S	S	S	
RIGHT BANK-FACE (structure) B/U/S/C/NV	C	C	C	C	C	C	C	C	S	S	
RIGHT BANKTOP (structure within 1m) B/U/S/C/NV	C	C	C	C	C	C	C	C	S	S	
LAND-USE WITHIN 5m OF RIGHT BANKTOP	BL	BL	BL	BL	BL	BL	BL	BL	SH	SH	

G CHANNEL VEGETATION TYPES (to be assessed over a 10m wide transect; use E (> 33% area), ✓ (present) or NV (not visible))

None (✓) or Not Visible (NV)											
Liverworts/mosses/lichens											
Emergent broad-leaved herbs											
Emergent reeds/sedges/rushes/grasses/horsetails											
Floating-leaved (rooted)											
Free-floating											
Amphibious											
Submerged broad-leaved	✓	✓	✓	✓	✓	✓	✓	✓			✓
Submerged linear-leaved											
Submerged fine-leaved											
Filamentous algae	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Use end column for overall assessment over 500m, including types not occurring in spot-checks (use ✓, E or NV)

Riffles: *Pools:* *PB:* *VP:*

River Habitat Survey Manual: 2003 version

SITE REF. RHS 2 | **RIVER HABITAT SURVEY : 500m SWEEP-UP** | **Page 3 of 4**

H LAND-USE WITHIN 50m OF BANKTOP Use ✓ (present) or E (≥ 33% banklength)

	L	R		L	R
Broadleaf/mixed woodland (semi-natural) (BL)		E	Natural open water (OW)		
Broadleaf/mixed plantation (BP)			Rough/unimproved grassland/pasture (RP)		
Coniferous woodland (semi-natural) (CW)			Improved/semi-improved grassland (IG)		
Coniferous plantation (CP)			Tall herb/rank vegetation (TH)		
Scrub & shrubs (SH)			Rock, scree or sand dunes (RD)		
Orchard (OR)			Suburban/urban development (SU)	E	✓
Wetland (e.g. bog, marsh, fen) (WL)			Tilled land (TL)		
Moorland/heath (MH)			Irrigated land (IL)		
Artificial open water (AW)			Parkland or gardens (PG)		
			Not visible (NV)		

I BANK PROFILES Use ✓ (present) or E (≥ 33% banklength)

Natural/unmodified	L	R	**Artificial/modified**	L	R
Vertical/undercut			Resectioned (reprofiled)	E	E
Vertical with toe			Reinforced - whole	✓	✓
Steep (>45°)	E	E	Reinforced - top only		
Gentle		✓	Reinforced - toe only		
Composite			Artificial two-stage		
Natural berm			Poached bank		
			Embanked		
			Set-back embankment		

J EXTENT OF TREES AND ASSOCIATED FEATURES *record even if <1%

TREES (tick one box per bank)

	Left	Right
None	☐	☐
Isolated/scattered	☑	☐
Regularly spaced, single	☐	☐
Occasional clumps	☐	☐
Semi-continuous	☐	☐
Continuous	☐	☑

ASSOCIATED FEATURES (tick one box per feature)

	None	Present	E (≥33%)
Shading of channel	☐	☑	☐
*Overhanging boughs	☐	☐	☐
*Exposed bankside roots	☐	☑	☐
*Underwater tree roots	☐	☑	☐
Fallen trees	☐	☐	☐
Large woody debris	☐	☐	☐

K EXTENT OF CHANNEL AND BANK FEATURES (tick one box for each feature) *record even if <1%

	None	Present	E (≥33%)		None	Present	E (≥33%)
*Free fall flow	☐	☐	☐	Exposed bedrock	☐	☐	☐
Chute flow	☐	☐	☐	Exposed boulders	☐	☐	☐
Broken standing waves	☐	☐	☐	Vegetated bedrock/boulders	☐	☐	☐
Unbroken standing waves	☐	☐	☐	Unvegetated mid-channel bar(s)	☐	☐	☐
Rippled flow	☐	☐	☑	Vegetated mid-channel bar(s)	☐	☐	☐
*Upwelling	☐	☐	☐	Mature island(s)	☐	☐	☐
Smooth flow	☐	☐	☐	Unvegetated side bar(s)	☐	☐	☐
No perceptible flow	☐	☐	☐	Vegetated side bar(s)	☐	☐	☐
No flow (dry)	☐	☐	☐	Unvegetated point bar(s)	☐	☐	☐
Marginal deadwater	☐	☑	☐	Vegetated point bar(s)	☐	☐	☐
Eroding cliff(s)	☐	☐	☐	*Discrete unvegetated silt deposit(s)	☐	☐	☐
Stable cliff(s)	☐	☐	☐	*Discrete unvegetated sand deposit(s)	☐	☐	
				*Discrete unvegetated gravel deposit(s)	☐	☐	

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SITE REF. RHS 2 | **RIVER HABITAT SURVEY : DIMENSIONS AND INFLUENCES** | Page 4 of 4

L CHANNEL DIMENSIONS (to be measured at one location on a straight uniform section, preferably across a riffle)

LEFT BANK		CHANNEL		RIGHT BANK	
Banktop height (m)	1	Bankfull/top width (m)	2	Banktop height (m)	1
Is banktop height also bankfull height? (Y or N)	Y	Water width (m)	2	Is banktop height also bankfull height? (Y or N)	Y
Embanked height (m)	1	Water depth (m)	0,3	Embanked height (m)	1

If trashline lower than banktop, indicate: height above water (m) = width from bank to bank (m) =

Bed material at site is: consolidated ☑ unconsolidated (loose) ☐ unknown ☐

Location of measurements is: riffle ☑ other ☐ (state)

M FEATURES OF SPECIAL INTEREST Use ✓ or E (> 33% length) *record even if <1%

None	☑	Very large boulders (>1m)	☐	Backwater(s)	☐	Marsh(es)	☐
Braided channels	☐	*Debris dam(s)	☐	Floodplain boulder deposits	☐	Flush(es)	☐
Side channel(s)	☐	*Leafy debris	☐	Water meadow(s)	☐	Natural open water	☐
*Natural waterfall(s) > 5m high	☐	Fringing reed-bank(s)	☐	Fen(s)	☐	Others (state)	☐
*Natural waterfall(s) < 5m high	☐	Quaking bank(s)	☐	Bog(s)	☐		
Natural cascade(s)	☐	*Sink hole(s)	☐	Wet woodland(s)	☐		

N CHOKED CHANNEL (tick one box)

Is 33% or more of the channel choked with vegetation? No ☑ Yes ☐

O NOTABLE NUISANCE PLANT SPECIES Use ✓ or E (> 33% length) *record even if <1%

	bankface	banktop to 50m		bankface	banktop to 50m
None ☑ *Giant hogweed	☐	☐	*Himalayan balsam	☐	☐
*Japanese knotweed	☐	☐	*Other (state).....	☐	☐

P OVERALL CHARACTERISTICS (Circle appropriate words, add others as necessary)

Major impacts: landfill - tipping - litter - (sewage) - pollution - drought - abstraction - mill - dam - road - rail - (industry) - housing mining - quarrying - overdeepening - overwidening (P or E) - (realignement) - afforestation - fisheries management - silting - waterlogging - hydroelectric power

Evidence of recent management: dredging - bank mowing - weed cutting - enhancement - river rehabilitation - gravel extraction - other (please specify)

Animals: otter - mink - water vole - kingfisher - dipper - grey wagtail - sand martin - heron - dragonflies/damselflies

Other significant observations: if necessary use separate sheet to describe overall characteristics and relevant observations

Q ALDERS (tick one box in each of the two categories) *record even if <1%

*Alders? None	☐	Present	☑	Extensive	☐	*Diseased Alders? None	☑	Present	☐	Extensive	☐

R FIELD SURVEY QUALITY CONTROL (✓ boxes to confirm checks)

Have you taken at least two photos that illustrate the general character of the site and additional photos of any weirs/ sluices and major/intermediate structures across the channel?	☑
Have you completed all ten spot-checks and made entries in all boxes in E & F on page 2?	☐
Have you completed column 11 of section G (and E if appropriate) on page 2?	☑
Have you recorded in section C the number of riffles, pools and point bars (even if 0) on page 1?	☑
Have you given an accurate (alphanumeric) grid reference for spot-checks 1, 6 and end of site (page 1)?	☑
Have you stated whether spot-check 1 is at the upstream or downstream end of the site (top of page 2)?	☑
Have you cross-checked your spot-check and sweep-up responses with the channel modification indicators given on page 2 of the spot-check key?	☑

River Habitat Survey Manual: 2003 version

VERY TINY TRICKLE OF WATER FOR 10M. IT DRIES UP COMPLETELY. NOT POSSIBLE TO COMPLETE PROPER RHS.

RIVER HABITAT SURVEY 2003 VERSION: SITE HEALTH AND SAFETY ASSESSMENT			
Site Number[1]: RHS3	Site Ref: RHS3	River Name: RHS 3	Date: 26/15/22
Grid References/Co-ordinates:	Spot 1[2]: SH 688383	Mid-site:	End of site[2]:
Surveyor Name: GA/LR		Accredited Surveyor Code: N/A	

[1] Leave blank if new site. [2] Optional

Weather Conditions:	OVERCAST, SHOWERS, MILD
Flow Conditions:	VERY LOW → ALMOST DRY

Site details: (enter comments or circle if applicable and give details)	Risk Level (Low/Mod/High)
Access and Parking: (entry & exit) AS PER SITE 1	
Conditions: comment on ground stability, footing, exposure/remoteness	
Obstacles/Hazards: fencing, stiles, dense vegetation, steep bank	
Occupied/Unoccupied: people, livestock, animals	
Activities/Land-use: agriculture, woodland, residential, industrial, construction, recreational	
Risk if lone-working	

IF THERE ARE ANY HIGH RISKS OR MORE THAN THREE MODERATE RISKS DO NOT CONTINUE WITH THE SURVEY.

Weil's Disease (*Leptospirosis*)

Instructions to card holders

1. As infection may enter through breaks in the skin, ensure that any cut, scratch or abrasion is thoroughly cleansed and covered with a waterproof plaster.
2. Avoid rubbing your eyes, nose and mouth during work.
3. Clean protective clothing, footwear and equipment etc. after use
4. After work, and particularly before taking food or drink, wash hands thoroughly.
5. Report all accidents and/or injuries, however slight.
6. Keep your card with you at all times.

Lyme Disease

1. Dress appropriately with skin covered up.
2. Regularly inspect for ticks when in the field.
3. Check for, and remove, any ticks as soon as possible after leaving the site.
4. Seek medical attention if bitten by a tick.

River Habitat Survey Manual: 2003 version

ALMOST DRY SEASONAL STREAM. DRY IN SUMMER ONLY A TRICKLE FOR 5-10M.

RIVER HABITAT SURVEY 2003 Version

A FIELD SURVEY DETAILS

Site Number: (leave blank if new site) RHS 3

Site Reference: RHS 3

Spot-check 1 coord: AS PER FRONT PAGE

Spot-check 6 coord:

End of site coord:

Reach Reference:

River name: RHS 3

Date 26/05/2022 Time: 12:58

Surveyor name: GA

Accredited Surveyor code: n/a

Is the site part of a river or an artificial channel? River ☐ Artificial ☐ STREAM, DRY

Are adverse conditions affecting survey? No ☑ Yes ☐

If yes, state .....

Is bed of river visible? barely or not ☐ partially ☐ ±entirely ☑

Is health and safety assessment form attached? Yes ☑ No ☐

Number of photographs taken: 3

Photo references:

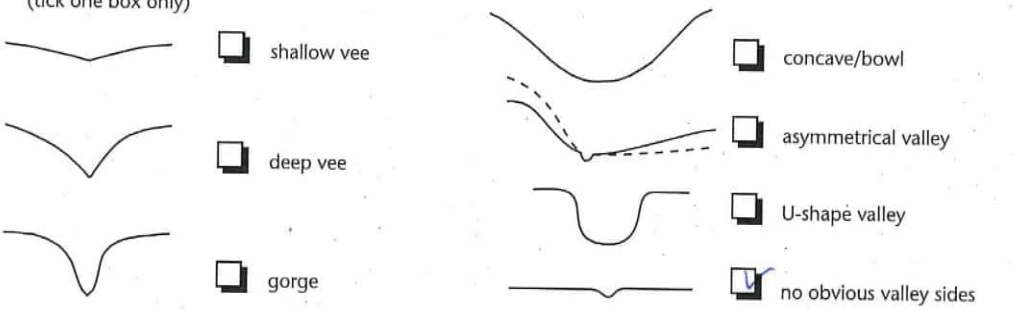
Site surveyed from: left bank ☑ right bank ☐ channel ☐

☐ **When options shown with 'shadow boxes', tick one box only**

LEFT banks determined by facing downstream RIGHT

B PREDOMINANT VALLEY FORM (within the horizon limit) (tick one box only)

(tick one box only)



☐ shallow vee

☐ deep vee

☐ gorge

☐ concave/bowl

☐ asymmetrical valley

☐ U-shape valley

☑ no obvious valley sides

Distinct flat valley bottom? No ☑ Yes ☐

Natural terraces? No ☑ Yes ☐

C NUMBER OF RIFFLES, POOLS AND POINT BARS (enter total number in boxes)

Riffle(s)	CONTINUOUS 1	Unvegetated point bar(s)	
Pool(s)		Vegetated point bar(s)	

D ARTIFICIAL FEATURES (indicate total number of occurrences of each category within the 500m site)

If none, tick box ☐

	Major	Intermediate	Minor		Major	Intermediate	Minor
Weirs/sluices				Outfalls/ intakes			
Culverts				Fords			
Bridges				Deflectors/ groynes/croys			
Other - state							

Is channel obviously realigned? No ☑ Yes, <33% of site ☐ ≥33% of site ☐

Is channel obviously over-deepened? No ☑ Yes, <33% of site ☐ ≥33% of site ☐

Is water impounded by weir/dam? No ☑ Yes, <33% of site ☐ ≥33% of site ☐

River Habitat Survey Manual: 2003 version

SITE REF. RHS3 | **RIVER HABITAT SURVEY: TEN SPOT-CHECKS** | Page 2 of 4

Spot-check 1 is at: upstream end ☐ downstream end ☑ of site (tick one box)

E PHYSICAL ATTRIBUTES (to be assessed across channel within 1m wide transect)

When boxes 'bordered', only one entry allowed	1 GPS	2	3	4	5	6 GPS	7	8	9	10	GPS
LEFT BANK	Ring EC or SC if composed of sandy substrate										
Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI	Co										
Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM	No										
Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB	No										
CHANNEL	GP- ring either C or P if predominant										
Channel substrate NV, BE, BO, CO, GP, SA, SI, CL, PE, EA, AR	Co										
Flow-type NV, FF, CH, BW, UW, CF, RP, UP, SM, NP, DR	RP										
Channel modification(s) NK, NO, CV, RS, RI, DA, FO	No										
Channel feature(s) NV, NO, EB, RO, VR, MB, VB, MI, TR	No										
For braided rivers only: number of sub-channels	—										
RIGHT BANK	Ring EC or SC if composed of sandy substrate										
Material NV, BE, BO, CO, GS, EA, PE, CL, CC, SP, WP, GA, BR, RR, TD, FA, BI	Co										
Bank modification(s) NK, NO, RS, RI, PC(B), BM, EM	No										
Marginal & bank feature(s) NV, NO, EC, SC, PB, VP, SB, VS, NB	No										

Enter channel substrate(s) not occurring as predominant in spot-checks but present in >1% of whole site.

F BANKTOP LAND-USE AND VEGETATION STRUCTURE (to be assessed over a 10m wide transect)

Land-use: choose one from BL, BP, CW, CP, SH, OR, WL, MH, AW, OW, RP, IG, TH, RD, SU, TL, IL, PG, NV

LAND-USE WITHIN 5m OF LEFT BANKTOP	SH										
LEFT BANKTOP (structure within 1m) B/U/S/C/NV	S										
LEFT BANK-FACE (structure) B/U/S/C/NV	S										
RIGHT BANK-FACE (structure) B/U/S/C/NV	S										
RIGHT BANKTOP (structure within 1m) B/U/S/C/NV	S										
LAND-USE WITHIN 5m OF RIGHT BANKTOP	SH										

G CHANNEL VEGETATION TYPES (to be assessed over a 10m wide transect: use E (≥ 33% area), ✓ (present) or NV (not visible))

None (✓) or Not Visible (NV)											
Liverworts/mosses/lichens											
Emergent broad-leaved herbs											
Emergent reeds/sedges/rushes/grasses/horsetails											
Floating-leaved (rooted)											
Free-floating											
Amphibious											
Submerged broad-leaved											
Submerged linear-leaved											
Submerged fine-leaved											
Filamentous algae											

Use end column for overall assessment over 500m, including types not occurring in spot-checks (use ✓, E or NV)

Riffles: *Pools:* *PB:* *VP:*

River Habitat Survey Manual: 2003 version

SITE REF. RHS3 | **RIVER HABITAT SURVEY : 500m SWEEP-UP** | Page 3 of 4

H LAND USE WITHIN 50m OF BANKTOP Use ✓ (present) or E (≥ 33% banklength)

	L	R		L	R
Broadleaf/mixed woodland (semi-natural) (BL)		✓	Natural open water (OW)		
Broadleaf/mixed plantation (BP)			Rough/unimproved grassland/pasture (RP)		
Coniferous woodland (semi-natural) (CW)			Improved/semi-improved grassland (IG)		
Coniferous plantation (CP)			Tall herb/rank vegetation (TH)		
Scrub & shrubs (SH)	E	E	Rock, scree or sand dunes (RD)		
Orchard (OR)			Suburban/urban development (SU)		
Wetland (e.g. bog, marsh, fen) (WL)			Tilled land (TL)		
Moorland/heath (MH)			Irrigated land (IL)		
Artificial open water (AW)			Parkland or gardens (PG)		
			Not visible (NV)		

I BANK PROFILES Use ✓ (present) or E (≥ 33% banklength)

Natural/unmodified	L	R	**Artificial/modified**	L	R
Vertical/undercut			Resectioned (reprofiled)		
Vertical with toe			Reinforced - whole		
Steep (>45°)			Reinforced - top only		
Gentle	E	E	Reinforced - toe only		
Composite			Artificial two-stage		
Natural berm			Poached bank		
			Embanked		
			Set-back embankment		

J EXTENT OF TREES AND ASSOCIATED FEATURES *record even if <1%

TREES (tick one box per bank)

	Left	Right
None	☐	☐
Isolated/scattered	☑	☐
Regularly spaced, single	☐	☐
Occasional clumps	☐	☐
Semi-continuous	☐	☑
Continuous	☐	☐

ASSOCIATED FEATURES (tick one box per feature)

	None	Present	E (≥33%)
Shading of channel	☐	☑	☐
*Overhanging boughs	☐	☐	☐
*Exposed bankside roots	☐	☐	☐
*Underwater tree roots	☐	☐	☐
Fallen trees	☐	☐	☐
Large woody debris	☐	☑	☐

K EXTENT OF CHANNEL AND BANK FEATURES (tick one box for each feature) *record even if <1%

	None	Present	E (≥33%)		None	Present	E (≥33%)
*Free fall flow	☐	☐	☐	Exposed bedrock	☐	☐	☐
Chute flow	☐	☐	☐	Exposed boulders	☐	☐	☐
Broken standing waves	☐	☐	☐	Vegetated bedrock/boulders	☐	☐	☐
Unbroken standing waves	☐	☐	☐	Unvegetated mid-channel bar(s)	☐	☐	☐
Rippled flow	☐	☐	☑	Vegetated mid-channel bar(s)	☐	☐	☐
*Upwelling	☐	☐	☐	Mature island(s)	☐	☐	☐
Smooth flow	☐	☐	☐	Unvegetated side bar(s)	☐	☐	☐
No perceptible flow	☐	☐	☑	Vegetated side bar(s)	☐	☐	☐
No flow (dry)	☐	☐	☑	Unvegetated point bar(s)	☐	☐	☐
Marginal deadwater	☐	☐	☐	Vegetated point bar(s)	☐	☐	☐
Eroding cliff(s)	☐	☐	☐	*Discrete unvegetated silt deposit(s)	☐	☐	☐
Stable cliff(s)	☐	☐	☐	*Discrete unvegetated sand deposit(s)	☐	☐	
				*Discrete unvegetated gravel deposit(s)	☐	☐	

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NO BANK, TINY TRICKLE AND STREAM.

SITE REF. RHS3 | **RIVER HABITAT SURVEY : DIMENSIONS AND INFLUENCES** Page 4 of 4

L CHANNEL DIMENSIONS (to be measured at one location on a straight uniform section, preferably across a riffle)

LEFT BANK		CHANNEL		RIGHT BANK	
Banktop height (m)	n/a	Bankfull/top width (m)	n/a	Banktop height (m)	n/a
Is banktop height also bankfull height? (Y or N)	n/a	Water width (m)	0,4	Is banktop height also bankfull height? (Y or N)	n/a
Embanked height (m)	n/a	Water depth (m)	0,05	Embanked height (m)	n/a

If trashline lower than banktop, indicate: height above water (m) = width from bank to bank (m) =

Bed material at site is: consolidated ☑ unconsolidated (loose) ☐ unknown ☐

Location of measurements is: riffle ☑ other ☐ (state)

M FEATURES OF SPECIAL INTEREST Use √ or E (≥ 33% length) *record even if <1%

None	☐	Very large boulders (>1m)	☐	Backwater(s)	☐	Marsh(es)	☐
Braided channels	☐	*Debris dam(s)	☐	Floodplain boulder deposits	☐	Flush(es)	☐
Side channel(s)	☐	*Leafy debris	☐	Water meadow(s)	☐	Natural open water	☐
*Natural waterfall(s) > 5m high	☐	Fringing reed-bank(s)	☐	Fen(s)	☐	Others (state)	☐
*Natural waterfall(s) < 5m high	☐	Quaking bank(s)	☐	Bog(s)	☐		
Natural cascade(s)	☐	*Sink hole(s)	☐	Wet woodland(s)	☐		

N CHOKED CHANNEL (tick one box)

Is 33% or more of the channel choked with vegetation? No ☑ Yes ☐

O NOTABLE NUISANCE PLANT SPECIES Use √ or E (≥ 33% length) *record even if <1%

	bankface	banktop to 50m		bankface	banktop to 50m
None ☑					
*Giant hogweed	☐	☐	*Himalayan balsam	☐	☐
*Japanese knotweed	☐	☐	*Other (state).....	☐	☐

P OVERALL CHARACTERISTICS (Circle appropriate words, add others as necessary)

Major impacts: landfill - tipping - litter - sewage - pollution - drought - abstraction - mill - dam - road - rail - industry - housing mining - quarrying - overdeepening - overwidening (P or E) - realignement - afforestation - fisheries management - silting - waterlogging - hydroelectric power

Evidence of recent management: dredging - bank mowing - weed cutting - enhancement - river rehabilitation - gravel extraction - other (please specify)

Animals: otter - mink - water vole - kingfisher - dipper - grey wagtail - sand martin - heron - dragonflies/damselflies

Other significant observations: if necessary use separate sheet to describe overall characteristics and relevant observations

n/a

Q ALDERS (tick one box in each of the two categories) *record even if <1%

*Alders? None	☑	Present	☐	Extensive	☐	*Diseased Alders? None ☐	Present ☐	Extensive ☐

R FIELD SURVEY QUALITY CONTROL (/ boxes to confirm checks)

Have you taken at least two photos that illustrate the general character of the site and additional photos of any weirs/ sluices and major/intermediate structures across the channel?	☐
Have you completed all ten spot-checks and made entries in all boxes in E & F on page 2?	☐
Have you completed column 11 of section G (and E if appropriate) on page 2?	☐
Have you recorded in section C the number of riffles, pools and point bars (even if 0) on page 1?	☐
Have you given an accurate (alphanumeric) grid reference for spot-checks 1, 6 and end of site (page 1)?	☐
Have you stated whether spot-check 1 is at the upstream or downstream end of the site (top of page 2)?	☐
Have you cross-checked your spot-check and sweep-up responses with the channel modification indicators given on page 2 of the spot-check key?	☐

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Annex H
Habitat Modification Scores (HMS) and Habitat Quality Assessment (HQA) scores from Rapid

HMS scores

Survey No.	CULVERTS	BANK AND BED RE-INFORCE-MENT	BANK AND BED RE-SECTIONING	BERMS AND EMBANK-MENTS	WEIRS DAMS AND SLUICES	BRIDGES	POACHING	FORDS	OUTFALLS AND DEFLECTORS	HMS_Score	HMC
1	0	40	2800	0	0	100	0	0	100	3040	5
2	800	0	2800	0	0	0	0	0	0	3600	5

HMClassification Description
1 Pristine/Semi-natural
2 Predominantly unmodified
3 Obviously modified
4 Significantly modified
5 Severely modified
0 Not classified

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HQA scores

Habitat Quality Assessment v. 2.1

Sample No	FLOW	CHANNEL SUBSTR.	CHANNEL FEATURES	BANK FEATURES	BANK VEG. STRUCTURE	IN-STREAM CHANNEL VEG.	LAND-USE	TREES ASSOC. FEATURES	SPECIAL FEATURES	HQA SCORE	No. Not Visible records	No. Missing values
1	8	8	1	0	12	5	4	8	1	**47**	0	0
2	4	5	2	0	12	2	2	6	0	**33**	0	0

Annex I
Metrics and their interpretation, taxa lists and index values

Biological Monitoring Working Party

The Biological Monitoring Working Party (BMWP) score was introduced in 1980 to provide a metric for river water quality for England and Wales using aquatic invertebrates. Each family of aquatic invertebrate has a different sensitivity to organic pollution, which allows scores between 1 and 10 to be applied to families present in a sample based on 82 known taxa (the BMWP-scoring families) of benthic invertebrates colonising lotic habitats. The BMWP score for a sample as a whole, comprises the sum of the scores for each individual taxon occurring within the sample[35].

Average Score Per Taxon

The average score per taxon (ASPT) is a widely used metric that can be calculated as an indication of average sensitivity to environmental pollutants from the families present in a sample. Lower values of BMWP ASPT indicate that there could be an environmental stressor present. It is also important to consider the number of different taxa (NTAXA) present in a sample as this gives an indication of biodiversity. Lower biodiversity, an abundance of pollutant tolerant taxa, and the absence of families sensitive to pollution would indicate poor water quality at a given site at the time the sample was taken[36].

The BMWP and ASPT scores can then be categorized and interpreted using the thresholds developed in the work by Armitage[37], Chapman[38] and Mason [39]), as outlined in **Table I.1**. However, it is noted that BMWP score can be misleading due to the variability of scores in relation to habitat diversity. Armitage[37] recommended the use of ASPT since its

[35] Paisley. M, Trigg. D, Walley. W. (2013). Revision Of The Biological Monitoring Working Party (BMWP) Score System: Derivation Of Present-Only And Abundance-Related Scores From Field Data. [Online] Available at: https://onlinelibrary.wiley.com/doi/abs/10.1002/rra.2686 [Accessed 15 March 2024].
[36] Hawkes. H (1998). Origin and development of the biological monitoring working party score system. [Online] Available at: https://www.sciencedirect.com/science/article/abs/pii/S0043135497002753?via%3Dihub [Accessed 15 March 2024].
[37] Armitage. P.D, Moss. D, Wright. J. F, Furse. M. T (1983). The performance of a new biological water quality score system based on macroinvertebrates over a wide range of unpolluted running-water sites. [Online] Available at: https://www.sciencedirect.com/science/article/abs/pii/0043135483901884 [Accessed 15 March 2024].
[38] Chapman, D. (1996). Water Quality Assessments: A Guide to the Use of Biota, Sediments and Water in Environmental Monitoring. UNESCO/WHO/UNEP, Cambridge, Great Britain, p.609.
[39] Mason C.F. (2002). Biology of freshwater pollution. 4th Ed. NY, USA. Prentice-Hall.

value is less sensitive to variations in sampling effort and seasonal change than is the BMWP score. Therefore it is the ASPT score that is used in this report in respect of indicating water quality.

Table I.1 BMWP, ASPT and associated environmental interpretation

BMWP score	ASPT	Interpretation
0-10	<3.0	Very poor, heavily polluted
11-40	3.0-4.3	Poor, polluted or impacted
41-70	4.3-4.8	Moderate, moderately impacted
71-100	4.8-5.4	Good, clean but slightly impacted
>100	>5.4	Very good, unpolluted, unimpacted

The environmental interpretation of BMWP ASPT scores should be used only as an indication of river health, as it must be considered that maximum achievable values would vary naturally. This variation is dependent on the specific pollutant and also geographical factors such as the quality and diversity of habitat, natural water chemistry, geology, distance from source, altitude, gradient and discharge as well as the time of year the sample was taken.

Community Conservation Index

The Community Conservation Index (CCI)[40] uses species level analysis to estimate the conservation value of the invertebrate community at a sample site. This is done by allocating scores between 1–10 to the aquatic invertebrates found in a sample, where the most common species score 1 and the most endangered species score 10, as shown in **Table I.2**. An average score for the sample is calculated by using the sum of all the scores in a sample and dividing this by the number of different scoring species present. The conservation value associated with the average score can then be interpreted as set out by Chadd & Extence[40] and shown in **Table I.2** and **Table I.3**.

Table I.2 Conservation scores from the CCI

Conservation score	Conservation value/Equivalent RDB status
10	RDB1 (Endangered)
9	RDB2 (Vulnerable)
8	RDB3 (Rare)
7	Notable (but not RDB status)
6	Regionally notable
5	Local
4	Occasional (species not in categories 10-5, which occur in up to 10% of all samples from similar habitats)
3	Frequent (species not in categories 10-5, which occur in up to >10-25% of all samples from similar habitats)

[40] Chadd. R , Extence. C (2004). The conservation of freshwater macroinvertebrate populations: a community-based classification scheme. [Online] Available at: https://onlinelibrary.wiley.com/doi/10.1002/aqc.630 [Accessed 05 December 2023].

2	Common (species not in categories 10-5, which occur in up to >25-50% of all samples from similar habitats)
1	Very common (species not in categories 10-5, which occur in up to >50-100 % of all samples from similar habitats)

Table I.3 Guidance on interpretation of CCI scores

CCI Score	Description	Interpretation
0.0 – 5.0	Sites supporting only common species and/or a community of low taxon richness	Low conservation value
5.0 – 10.0	Sites supporting at least one species of restricted distribution and/or a community of moderate taxon richness	Moderate conservation value
10.0 – 15.0	Sites supporting at least one uncommon species, or several species of restricted distribution and/or a community of high taxon richness	Fairly high conservation value
15.0 – 20.0	Sites supporting several uncommon species, at least one of which may be nationally rare and/or a community of high taxon richness	High conservation value
>20.0	Sites supporting several rarities, including species of national importance, or at least one extreme rarity and/or a community of high taxon richness	Very high conservation value

Lotic Invertebrate Index for Flow Evaluation

The Lotic Invertebrate Index for Flow Evaluation (LIFE) was developed to recognise the various flow associations of different macroinvertebrate species and families. Taxa are assigned flow scores (fs) which are calculated from the matrix shown in **Table I.4**, based on the flow regime preferences exhibited by different taxa and their estimated abundance in a sample reported in **Table I.5**.

Table I.4 Scores (fs) for different abundance categories of taxa associated with flow groups I-VI[41]

Flow groups	Abundance categories			
	A	B	C	D/E
I: Rapid	9	10	11	12
II: Moderate/Fast	8	9	10	11
III: Slow/Sluggish	7	7	7	7

[41] Extence, C. et al. (1999) River Flow Indexing Using British Benthic Macroinvertebrates: A Framework for Setting Hydroecological Objectives. [Online] Available at: https://www.researchgate.net/publication/247954840_River_Flow_Indexing_Using_British_Benthic_Macroinvertebrates_A_Framework_for_Setting_Hydroecological_Objectives [Accessed 05 December 2023].

IV: Flowing/Standing	6	5	4	3
V: Standing	5	4	3	2
VI: Drought Resistant	4	3	2	1

Table I.5 Standard Environment Agency macroinvertebrate abundance categories for LIFE

Category	Estimated abundance
A	1-9
B	10-99
C	100-999
D	1000-9999
E	10000+

The greater the preference for faster flows the higher the flow score for a species. The LIFE score is calculated by totalling the flow scores for all taxa and dividing the result by the total number of taxa in the sample. A higher LIFE score in a sample indicates that there are high abundances of species associated with faster flows.

The scores generated can be interpreted against the scale described in **Table I.6**[42] in respect of sensitivity to changes in water flow.

Table I.6 Interpretation of LIFE scores

LIFE score	Invertebrate community flow sensitivity
7.26 and above	High sensitivity to reduced flows
6.51 – 7.25	Moderately sensitive to reduced flows
6.5 and below	Low sensitivity to reduce flows

Proportion of Sediment-sensitive Invertebrates

Proportion of Sediment-sensitive Invertebrates (PSI) provides an insight into the potential impacts associated with fine sediment inputs based on the various sediment preferences between taxa groups[43]. Aquatic invertebrates can be sensitive to an increase in fine sediment as this can result in smothering of the riverbed and changes in macrophyte and algal communities, which may have both a direct and indirect effect on macroinvertebrates. Many anthropogenic activities can be a source of fine sediment

[42] Environment Agency, (2011). Operational Instruction 387_09 on Interpreting and reporting freshwater ecology data

[43] Extence, C.A. et al., (2011). The assessment of fine sediment accumulation in rivers using macro-invertebrate community response. [Online] Available at: https://onlinelibrary.wiley.com/doi/abs/10.1002/rra.1569 [Accessed 05 December 2023].

increase in a river, such as agriculture and construction activities and PSI is used to monitor and mitigate any potential impacts to the lotic environment[44].

Each species found in a sample is given a fine sediment sensitivity rating (FSSR) (see **Table I.7**) with an associated PSI, as described in **Table I.8**. Unusually low PSI scores on a fast-flowing stony river could indicate excessive fine sediment input, which is useful for comparing baseline data with that collected post impact.

Table I.7 Fine Sediment Sensitivity Rating (FSSR) with associated taxa group and abundance

Group	Fine Sediment Sensitivity Ratings (FSSR)	Log abundance			
		1-9	10-99	100-999	1000+
A	Highly Sensitive	2	3	4	5
B	Moderately Sensitive	1	2	3	4
C	Moderately Insensitive	1	2	3	4
D	Highly Insensitive	2	3	4	5

Table I.8 Riverbed conditions for proportion of sediment sensitive invertebrates (PSI) scores

PSI	Riverbed condition
81-100	Minimally sedimented/unsedimented
61-80	Slightly sedimented
41-60	Moderately sedimented
21-40	Well sedimented
0-20	Heavily sedimented

Walley Hawkes Paisley Trigg

The Walley Hawkes Paisley Trigg (WHPT) indices was introduced in 2016 under the Water Framework Directive (WFD)[30] as a basis of classifying the status of UK rivers using aquatic invertebrates as indicators. As with BMWP, WHPT can be expressed as a ASPT and NTAXA scores, however the sensitivity to abundance related effects is increased with WHPT by assigning different 'weights' to different abundance categories, as can be seen in **Table I.9**. The WHPT metric is also derived from a very large set of field results (>100,000 samples) and is based on 106 taxa, that confers reliability and sensitivity of the WHPT metric[45].

[44] Extence. C, Chadd. R, England. J, Naura. M., (2017). Application of the Proportion of Sediment-sensitive Invertebrates (PSI) biomonitoring index. [Online] Available at: https://www.researchgate.net/publication/321079459_Application_of_the_Proportion_of_Sediment-sensitive_Invertebrates_PSI_biomonitoring_index [Accessed 15 March 2024].
[45] Environment Agency, (2019). Walley Hawkes Paisley Trigg (WHPT) index of river invertebrate quality and its use in assessing ecological status. [Online] Available at: https://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwizhb_X--

Table I.9 Abundance categories and associated numerical abundances

Abundance category	Numerical abundance
AB1	1 – 9
AB2	10 – 99
AB3	100 – 999
AB4	1000-9999*

River Invertebrate Classification Tool

The River Invertebrate Classification Tool (RICT) has been developed by the four UK environmental agencies to classify the ecological quality of rivers. The RICT is a web tool that implements the River Invertebrate Prediction and Classification System (RIVPACS) IV predictive model for England, Wales, Scotland and Northern Ireland[46]. Each site is given expected WHPT (NTAXA and ASPT) scores using the RIVPACS for reference 'pristine' conditions, considering the unique environmental parameters of the sample site such as channel width, depth, gradient, altitude, pH and discharge. The expected scores are then compared to the observed scores (from the invertebrates actually present in the sample) to create the Ecological Quality Ratio (EQR) and the further from expected scores, the lower the environmental quality of the site. The WFD status is then assigned to the EQR categories as set out in **Table I.10**[45].

Table I.10 WFD status categories and associated EQR values

WFD status boundary	EQR WHPT-ASPT	EQR WHPT-NTAXA
High/Good	0.97	0.80
Good/Moderate	0.86	0.68
Moderate/Poor	0.72	0.56
Poor/Bad	0.59	0.47

L7AhWCWcAKHfbOCQUQFnoECAYQAQ&url=https%3A%2F%2Fstatic1.squarespace.com%2Fstatic%2F621616256950454546689e6d%2Ft%2F623c4d3b9300dc575bbcfc7a%2F1648119100439%2FWHPT%2Bshort%2Bguide%2Bv10.docx&usg=AOvVaw2Hnh3OdNin3ucAhneQdyHg [Accessed 15 March 2024].

[46] Freshwater Biological Association (FBA), (2022). River Invertebrate Classification Tool (RICT) Available online at: https://www.fba.org.uk/rivpacs-and-rict/river-invertebrate-classification-tool [Accessed 15 March 2024].

Spring survey

Table I.11 Aquatic invertebrate species data table for spring survey

Higher classification	Family (or higher classification)	Genus & species (where possible)	Unnamed stream MI 1	Unnamed stream MI 2	Unnamed stream MI 3	Afon Tafarn-helyg MI 4	Nant Gwylan MI 6b	Nant Gwylan MI 6
Tricladida	Planariidae	Polycelis sp.					6	
Nematoda	Nematoda	Nematoda indet		1				1
Annelida / Hirudinea	Hirudinea: Glossiphoniidae	Glossiphonia complanata		4	1	2		
	Hirudinea: Erpobdellidae	Erpobella octoculata					2	3
Annelida/Oligochaeta	Oligochaeta		11	5	18	23	7	19
Mollusca/Gastropoda	Tateidae	Potamopyrgus antipodarum		928	110	38	7	141
	Lymnaeidae	Ampullaceana balthica					29	7
	Physidae	Physa sp.					5	
Mollusca/Bivalvia	Sphaeriidae	Pisidium nitidum						6
	Sphaeriidae	Pisidium subtruncatum			2			
	Sphaeriidae	Pisidium casertanum						8
	Sphaeriidae	*Pisidium* sp. indet.						9
Crustacea/Isopoda	Asellidae	Asellus aquaticus		1			49	32
	Asellidae	*Asellus* sp. indet.					101	56
Crustacea / Amphipoda	Gammaridae	Gammarus pulex		2	3	13		
	Gammaridae	Crangonyx pseudogracilis		3	7	2	27	57

Collembola	Isotomidae	Isotomidae					1	
Insecta / Ephemeroptera	Baetidae	Baetis rhodani				2		
	Baetidae	Baetidae indet.				5		2
	Ephemerellidae	Ephemerella ignita					22	24
Insecta / Odonata	Cordulegasteriidae	Cordulegaster boltonii		8	1	1		
	Coenagrionidae	Coenagrionidae sp.indet.			1			
	Zygoptera	Zygoptera larvae indet.		2				
Insecta / Plecoptera	Nemouridae	Nemurella pictata			4			
	Nemouridae	Nemouridae sp.early larvae			7		1	
Insecta / Hemiptera	Veliidae	Velia caprai					2	3
Insecta / Trichoptera	Hydropsychidae	Hydropsyche siltalai					55	
	Hydropsychidae	Hydropsyche pellucidula					4	
	Glossosomatidae	Agapetus fuscipes				2		
	Lepidostomatidae	Lepidostomatidae early instar					1	
	Leptoceridae	Mystacides sp.						1
	Leptoceridae	Oecetis testacea					2	1
	Leptoceridae	Leptoceridae early instar					4	
	Limnephilidae	Limnephilus sp.					1	
	Limnephilidae	Limnephilidae indet.	1	1	6	4	1	12
	Polycentropodidae	Holocentropus ? stagnalis	1					

	Rhyacophilidae	Rhyacophila dorsalis					1	5
	Sericostomatidae	Sericostomata personatum				1	4	
Insecta/Coleoptera	Cuculionidae	Cuculionidae (terr.) indet.	2					
	Dytiscidae	Agabus sp.	4					
	Dytiscidae	Helophorus sp.	2					
	Dytiscidae	Hydroporinae	3					1
	Dytiscidae	Hydroporus tesselatus	1					
	Elminthidae	Elmis aenea				3		
	Haliplidae	Haliplidae indet		22				
	Haliplidae	Haliplus lineatocollis		4				
Insecta / Diptera	Diptera indet.	Dipteran larvae indet.				1		
	Chaoboridae	Chaoboridae larvae					1	
	Ceratopogonidae	Ceratopogonidae larvae					4	
	Chironomidae	Chironomidae larvae	9	168	115	240	93	140
	Chironomidae	Chironomidae pupae	1	11	1	10	10	6
	Empididae	Empididae larvae					3	2
	Psychodidae	Psychodidae larvae	1					
	Psychodidae	Pericoma sp.		2		1	1	
	Tipulidae	Tipulidae larvae	1				3	
Arachnida	Acari	Acari indet.	1					
	Arachnida	Arachnida (terr.) indet.	1				1	
Eggs indet.							yes	
Anthropogenic material			yes	yes		yes	yes	yes

Table I.12 Indices values for spring survey

Index	Parameter	Unnamed stream MI 1	Unnamed stream MI 2	Unnamed stream MI 3	Afon Tafarn-helyg MI 4	Nant Gwylan MI 6b	Nant Gwylan MI 6
Biological Monitoring Working Party (BMWP) Score	BMWP Score	33.00	44.80	51.40	65.10	105.70	76.20
	No. Scoring Taxa	6	10	10	12	19	16
	Average Score Per Taxon (ASPT)	5.50	4.48	5.14	5.43	5.56	4.76
	Indicative Water Quality	Very good	Moderate	Good	Very good	Very good	Moderate
Community Conservation Index (CCI)	CCI Score	2.00	1.14	1.14	7.50	6.25	4.36
	No. Scoring Taxa	2	7	7	13	12	11
	Community description	Only common species and/or a community of low taxon richness	Only common species and/or a community of low taxon richness	Only common species and/or a community of low taxon richness	Only common species and/or a community of low taxon richness	At least one species of restricted distribution and/or a community of moderate taxon richness	Only common species and/or a community of low taxon richness
	Conservation Value	Low	Low	Low	Low	Moderate	Low
Lotic Invertebrate Index for Flow Evaluation (LIFE)	LIFE Score	5.83	6.56	6.56	7.50	6.52	6.38
	No. Scoring Taxa	6	9	9	13	21	16
	Indicative Sensitivity	Low	Moderate	Moderate	High	Moderate	Low

Proportion of sediment sensitive invertebrates (PSI)	PSI Score	7.69	5.00	5.88	45.83	36.59	23.08
	No. Scoring Taxa	7	11	10	15	21	17
	Sedimented?	Heavily	Heavily	Heavily	Moderately	Well	Well
Walley Hawkes Paisley Trigg (WHPT)	WHPT N-Taxa	7	10	10	12	23	16
	Abundance related WHPT ASPT	4.63	4.25	4.81	4.94	5.19	4.58

Table I.13 Aquatic invertebrate species data table for autumn

Higher classification	Family (or higher classification)	Genus & species	Unnamed stream MI 2	Unnamed stream MI 3	Afon Tafarn-helyg MI 4	Nant Gwylan MI 5	Nant Gwylan MI 6b	Nant Gwylan MI 6
Bryozoa		Not identified further						Several colonies on dead leaves
Anthoathecata	Hydridae	Hydra sp				5	5	12
Tricladida	Planariidae	Polycelis sp			1	16	47	19
Annelida/Hirudinea	Glossiphoniidae	Glossiphonia complanata	8		1		1	
		Helobdella stagnalis				1		
	Erpobdellidae	Erpobdella octoculata				1	4	1
		Trocheta sp					4	
		Erpobdellidae				1 (v-small)		
Annelida/Oligochaeta		Oligochaeta	Several fragments	1	About 40 fragments	14 + several fragments	15 + about 50 fragments	Several fragments
Mollusca/Gastropoda	Tateidae	Potamopyrgus antipodarum	2	28	13	1	6	17
	Limnaeidae	Ampullaceana balthica		1	1	5	25	8
	Physidae	Physella acuta				11	42	7
Mollusca/Bivalvia	Sphaeriidae	Sphaeriidae	1	5				

Crustacea/Isopoda	Asellidae	Asellus aquaticus		1		159	179	38
	Crangonyctidae	Crangonyx pseudogracilis	5	8	2	132	122	63
Crustacea/Amphipoda	Gammaridae	Gammarus pulex	2		2			
Insecta/Plecoptera	Nemouridae	Nemurella picteti	2	1			1	
		Nemoura sp		7				
		Protonemura meyeri				2		
	Nemouridae	Nemouridae			15 (v-small)			
Insecta/Odonata	Calopterygidae	Calopteryx virgo		1	3			
		Pyrrhosoma nymphula	1	7				
	Cordulegastridae	Cordulegaster boltoni	3		4			
Insecta/Trichoptera	Hydropsychidae	Hydropsyche siltalai				67	36	
	Psychomyiidae	Lype sp			1	3	5	
	Polycentropodidae	Cyrnus flavidus						2
	Limnephilidae	Chaetopteryx villosa		1				
	Limnephilidae	Limnephilidae		1 (v-small)	6 (v-small)			1 (v-small)
	Sericostomatidae	Sericostoma personatum			1	7	5	
	Leptoceridae	Mystacides sp			1 (v-small)	1	5	6 (v-small)
		Oecetis testacea				1		
		Oecetis sp					4	
Insecta/Coleoptera	Haliplidae	Haliplus lineatocollis		1 (A)				
	Dytiscidae	Platambus maculatus		1 (L)	10 (L) 1 (A)			

	Hydraenidae	Limnebius truncatellus				1 (A)		
	Elmidae	Elmis aenea			24 (L) 1 (A)			
Insecta/Diptera	Chironomidae	Tanypodinae	10	25	7	8	17	22
		Prodiamesinae	3	3	7	2		
		Chironominae			1		18	18
		Tanytarsini			2	4	4	162
		Orthocladinae	3	9	66	1		3
	Chaoboridae	Chaoborus sp				1	1	1
	Dixidae	Dixa dilatata		1				
	Simuliidae	Simuliidae				1	1	
	Empididae	Empididae			2		6	
Arachnida	Acari	Acari			1			

Table I.14 Indices values for autumn survey

Index	Parameter	Unnamed stream MI 2	Unnamed stream MI 3	Afon Tafarn-helyg MI 4	Nant Gwylan MI 5	Nant Gwylan MI 6b	Nant Gwylan MI 6
Biological Monitoring Working Party Score	BMWP Score	48.00	59.00	96.50	78.00	78.00	52.80
	No. Scoring Taxa	10	13	17	16	16	12
	ASPT	4.8	4.54	5.68	4.99	4.88	4.40
	Indicative Water Quality	Good	Moderate	Very good	Good	Good	Moderate
Community Conservation Index	CCI Score	4.29	9.00	8.00	4.00	3.90	10.00
	No. Scoring Taxa	7	2	10	12	10	7
	Community description	Only common species and / or a community of low taxon richness	At least one species of restricted distribution and / or a community of moderate taxon richness	At least one species of restricted distribution and / or a community of moderate taxon richness	Only common species and / or a community of low taxon richness	Only common species and / or a community of low taxon richness	At least one species of restricted distribution and / or a community of moderate taxon richness
	Conservation Value	Low	Moderate	Moderate	Low	Low	Moderate
Lotic Invertebrate Index for Flow Evaluation	LIFE Score	6.63	6.62	7.07	6.53	6.19	5.70
	No. Scoring Taxa	8	13	15	17	16	10
	Indicative sensitivity	Moderate	Moderate	Moderate	Moderate	Low	Low
Proportion of sediment sensitive invertebrates	PSI Score	8.33	20.00	33.33	27.27	16.67	0.00
	No. Scoring Taxa	8	14	15	16	14	9
	Sedimented?	Heavily	Heavily	Well	Well	Heavily	Heavily
	WHPT N-Taxa	10	13	18	18	18	13

Walley Hawkes Paisley Trigg	Abundance related WHPT ASPT	4.92	4.65	5.65	4.69	4.56	4.02

Table I.15 Abiotic factors for RICT analysis

Sample	National Grid Reference (NGR)	Easting	Northing	Altitude (m)	Slope	Discharge (category)	Distance from source (m)	Mean width (m)	Mean depth (cm)	Alkalinity (mg l^{-1} $CaCo^{3}$)	Boulder/ Cobbles (%)	Pebbles/ Gravel (%)	Sand (%)	Silt/ Clay (%)	Conductivity (uS/cm)
MI1	SH	26880	33830	200	0.5	1	400	0.5	10	10.41	90	0	10	0	57.7
MI2	SH	26890	33850	200	0.2	1	800	1	25	95.493	0	20	0	80	323.5
MI3	SH	26890	33860	200	0.2	1	1000	1	20	73.278	90	0	0	10	254.1
MI4	SH	26890	33870	200	0.2	1	1300	1	25	58.697	80	0	0	20	208.55
MI5	SH	26937	33841	200	0.2	1	400	1.1	30	2.824	80	0	20	0	34
MI6	SH	26934	33826	200	0.2	1	200	1	30	12.459	20	30	50	0	64.1
MI6b	SH	69370	38309	200	0.2	1	300	1	30	2.664	80	0	20	0	33.5

Annex J
Macrophyte Survey Data

Table J.1 Macrophyte survey data

River	Nant Gwylan	Unnamed stream	Unnamed stream	Afon Tafarn-helyg	Unnamed stream
Station description	MP1	MP2	MP3	MP4	MP5
Surveyor	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.
Aquatic / In-channel Species					
Blue-green algal scum/pelts	1	1		2	
Brachythecium rivulare	1		1		
Calliergon cuspidatum		2			
Callitriche stagnalis		1		1	
Chiloscyphus polyanthos	1		6	3	3
Cladophora glomerata	6				4
Cratoneuron filicinum				1	
Fissidens viridulus	1				
Glyceria fluitans		1	1		
Hyocomium armoricum				2	
Juncus bulbosus	1				
Mentha aquatica		3	1		
Myosotis scorpioides		2			
Oenanthe crocata				2	
Pellia epiphylla	2	2	2	3	
Phalaris arundinacea				3	
Platyhypnidium riparioides	3		1	2	
Potamogeton polygonifolius			2		
Racomitrium aciculare					2
Ranunculus flammula		2	2		
Rorippa nasturtium-aquaticum agg.		3	3		
Scapania undulata					2
Sparganium erectum	3				

River	Nant Gwylan	Unnamed stream	Unnamed stream	Afon Tafarn-helyg	Unnamed stream
Station description	MP1	MP2	MP3	MP4	MP5
Surveyor	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.
Sphagnum denticulatum					2
Thamnobryum alopecurum	3	1	3	3	
Vaucheria sp(p)	3				
Terrestrial / Non-channel Species					
Acer pseudoplatanus				1	
Agrostis stolonifera	2	3	2		3
Alnus glutinosa		2			
Alnus incana	1				
Angelica sylvestris		1	1	1	
Athyrium filix-femina	1	2	2	2	3
Blechnum spicant	1		1		2
Cardamine flexuosa	1		1	1	
Carex echinata	1				
Chrysosplenium oppositifolium		1		1	
Corylus avellana	1				
Crustose lichens	1				
Deschampsia cespitosa				1	1
Digitalis purpurea					2
Diplophyllum albicans					1
Dryopteris affinis	1	1	1	1	2
Dryopteris dilatata	1	1	1		
Epilobium ciliatum	1	1	1		1
Filpendula ulmaria		2	1	1	
Fissidens adianthoides			1	1	
Galium palustre	1	1	1	1	
Geranium robertianum				1	
Hedera helix	2		2	1	
Hypericum androsaemum		1			
Hypnum cupressiforme					4
Juncus effusus		1	1	1	
Lejeunea lamacerina			1		

River	Nant Gwylan	Unnamed stream	Unnamed stream	Afon Tafarn-helyg	Unnamed stream
Station description	MP1	MP2	MP3	MP4	MP5
Surveyor	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.
Leptothryx ochracea		2			
Lysimachia nemorum				1	1
Oxalis acetosella				1	2
Oxyrhynchium hians					
Phyllittis scolopendrium		1			
Plagiomnium undulatum		3			
Polytrichum commune				1	2
Prunus spinosa					2
Pteridium aquilinum	1				
Ranunculus repens		2			
Rhizomnium punctatum		2			
Rhododendron ponticum					3
Rubus fruticosus	3	3	2	3	5
Rumex obtusifolius		1			
Salix auritta	2	2			2
Salix cinerea	2	2	1		
Silene dioica				1	
Thuidium tamariscinum	2	2	2	1	6
Urtica dioica	2		2		
Valeriana officinalis		1	1		
Viola palustris		2			
Date	20.9.22	20.9.22	20.9.22	20.9.22	20.9.22
Site name	MP1	MP2	MP3	MP4	MP5
Surveyor	N.F.Stewart	N.F.Stewart	N.F.Stewart	N.F.Stewart	N.F.Stewart
National Grid Reference (NGR) start (U/S)	SH69353.38 251	SH68996.38 538	SH68874.38 670	SH69008.38 701	SH68815.38 440
NGR end (D/S)	SH69385.38 318	SH68925.38 611	SH68945.38 748	SH68954.38 769	SH68788.38 363
% Wadeable	100	100	100	100	100
% cover of emergents	5	5	5	5	30
% cover of bryophytes	3	1	20	5	30

River		Nant Gwylan	Unnamed stream	Unnamed stream	Afon Tafarn-helyg	Unnamed stream
Station description		MP1	MP2	MP3	MP4	MP5
Surveyor		Stewart, N.F.	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.
% cover of submerged/floating vascular plants		0	0.5	1	0.1	0
Total % cover of macrophytes		8	6	25	10	60
% cover of filamentous algae		30	0	0	0	3
Dry channel %		0	20			99.9
Width (m) %	<1		50	50		100
	1-5	100	50	50	100	
	5-10					
	10-20					
	>20					
Depth (m) %	<0.25	30	70	90	60	0.1
	0.25-0.5	65	10	10	40	
	0.5-1	5				
	>1					
Substrate %	Peat					
	Silt/clay	10	88	20	5	
	Sand	20		5	10	
	Pebbles/gravel	20	10	75	70	35
	Boulder/cobble	50	2	10	15	65
	Bedrock					
Habitat %	Pool			5	1	0.1
	Riffle	40	5	40	59	
	Run	50			30	
	Slack	10	75	55	10	
	Total	50	99	100	99	10
Shading %	LB none					
	LB broken	10	20	20	20	5
	LB dense	0	60	40	40	0
	RB none					
	RB broken	10	22	20	20	5
	RB dense	20	40	40	40	0

River		Nant Gwylan	Unnamed stream	Unnamed stream	Afon Tafarn-helyg	Unnamed stream
Station description		MP1	MP2	MP3	MP4	MP5
Surveyor		Stewart, N.F.	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.	Stewart, N.F.
Clarity %	Clear	100	100	100	100	0.1
	Cloudy					
	Turbid					
	Solid/firm					
Bed stability %	Unstable	20	10	70	75	35
	Stable	50		10	15	65
	Soft/sinking	30	90	20	10	
Photograph		y	y	y	y	
		y	y	y	y	
Notes		Top and bottom at start of culverts.	Bottom at footbridge. Top 5m below inflow and 20m from fence. Very soft silty base makes it difficult to wade.	Top at fence corner on RB. Bottom at fence across stream.	Bottom at river junction.	Bottom at footpath. Top at fence. Large parts inaccessible due to brambles etc.

Appendix 5C
Ecological receptors (Works Phase) considered during the assessment process

This Appendix presents a justification of all determinations of importance for all ecological features, including those scoped out. The justifications for these are provided in **Table C-1**.

Table C-1 Ecological receptors considered during the assessment process

Ecological Feature	Importance-legislation and policy	Importance-project level	Environmental change (as defined in paragraph 5.7.5)	Scoped in/out
Meirionnydd Oakwoods and Bat Sites Special Area of Conservation (SAC)	International	International	Habitat change / fragmentation	Out – The nearest part of the Application Site is approximately 0.9km south-west, and no woodland or other natural bat habitat is included within the Application Site boundary. Therefore, it is concluded that there is no potential mechanism for significant effects.
Rhinog SAC	International	International	All environmental changes	Out – located approximately 4.1km south-west of the Application Site. Site designated for habitats only. Separation distance sufficient to conclude no potential mechanism for significant effects.
Migneint-Arenig-Ddualllt SAC	International	International	All environmental changes	Out – located approximately 1km east of the Application Site. Site designated for habitats only. Separation distance sufficient to conclude no potential mechanism for significant effects.
Afon Eden – Cors Goch Trawsfynydd SAC	International	International	All environmental changes	Out – located approximately 2.9km south of the Application Site. Site designated for habitats only. Separation distance sufficient, and hydrologically upstream, enables conclusion of no potential mechanism for significant effects.
Lleyn Peninsula and the Sarnau SAC	International	International	All environmental changes	Out - located approximately 3.2km north-west of the Application Site. Separation distance sufficient to conclude no potential mechanism for significant effects.
Migneint-Arenig-Ddualllt Special Protection Area (SPA)	International	International	All environmental changes	Out - located approximately 1km east of the Application Site. Combination of site not providing habitat for the designated features, and separation distance, sufficient to conclude no potential mechanism for significant effects.
Migneint-Arenig-Ddualllt Site of Special Scientific Interest (SSSI)	National	National	All environmental changes	Out – located approximately 1km east of the Application Site. Combination of site not providing habitat for the designated features, and separation distance, sufficient to conclude no potential mechanism for significant effects.

Coed y Rhygen SSSI	National	National	All environmental changes	Out – located approximately 0.9km south-west of the Application Site. Separation distance sufficient to conclude no potential mechanism for significant effects.
Coedydd De Dyffryn Maentwrog SSSI	National	National	All environmental changes	Out – located approximately 1.4km west of the Application Site. Part of the Meirionnydd Oakwoods and Bat Sites SAC. No woodland, or other natural, bat habitat is included within the Application Site boundary. Therefore, it is concluded that there is no potential mechanism for significant effects.
Afon Eden – Cors Goch Trawsfynydd SSSI	National	National	All environmental changes	Out – located approximately 2.9km south of the Application Site. Combination of site not providing habitat for the designated features, and separation distance, sufficient to conclude no potential mechanism for significant effects.
Morfa Harlech SSSI	National	National	All environmental changes	Out – located approximately 3km north-west of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.
Ceunant Cynfal SSSI	National	National	All environmental changes	Out – located approximately 2.7km north of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.
Coedydd Dyffryn Ffestiniog SSSI	National	National	All environmental changes	Out – located approximately 3.2km north-west of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.
Rhinog SSSI	National	National	All environmental changes	Out – located approximately 4.1km south-west of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.
Cwm Cynfal SSSI	National	National	All environmental changes	Out – located approximately 4.5km north-east of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.
Llafar River Section SSSI	National	National	All environmental changes	Out – located approximately 4.5km north-east of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.
Coed-y-Rhygen National Nature Reserve (NNR)	National	National	All environmental changes	Out – located approximately 0.9km south-west of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.

Ceunant Llennyrch NNR	National	National	All environmental changes	Out – located approximately 2km west of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.
Coed Camlyn NNR	National	National	All environmental changes	Out – located approximately 2.4km north-west of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.
Ceunant Cynfal NNR	National	National	All environmental changes	Out – located approximately 2.7km north-east of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.
Coedydd Maentwrog NNR	National	National	All environmental changes	Out – located approximately 3.3km north-west of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.
Coed Cymerau NNR	National	National	All environmental changes	Out – located approximately 3.8km north of the Application Site. Separation distance, sufficient to conclude no potential mechanism for significant effects.
Broad-leaved woodland Section 7[1] Habitat of Principal Importance (HPI)	National	National	All environmental changes	Out – No woodland is present within the Application Site boundary and hence there will be no direct habitat loss. Effects on broad-leaved woodland were scoped in on a precautionary basis until the feature status (i.e. Section 7[1] HPI or not) and sensitivity was confirmed. The status of the woodland has now been confirmed and is considered not to be an HPI. Hence, effects on broad-leaved woodland are scoped out of the assessment. Furthermore, based on consultation with an air quality specialist, the woodland which borders the Trawsfynydd site would be considered to have a low sensitivity to the effects of dust deposition, as defined within the Institute of Air Quality Management (IAQM) guidance[2]. Therefore, and based on the knowledge that the Proposed Development only includes demolition works and not any other dust emitting activities, as a worst-case the risk of impacts from demolition works associated with the Proposed Development is medium if no mitigation

[1] Environment (Wales) Act 2016. [Online]. Available at: https://www.legislation.gov.uk/anaw/2016/3/contents [Accessed 25 July 2024].

[2] Institute of Air Quality Management AQM, (2016). *Guidance on the assessment of dust from demolition and construction*. [Online] Available at: https://iaqm.co.uk/text/guidance/construction-dust-2014.pdf [Accessed 24 July 2025].

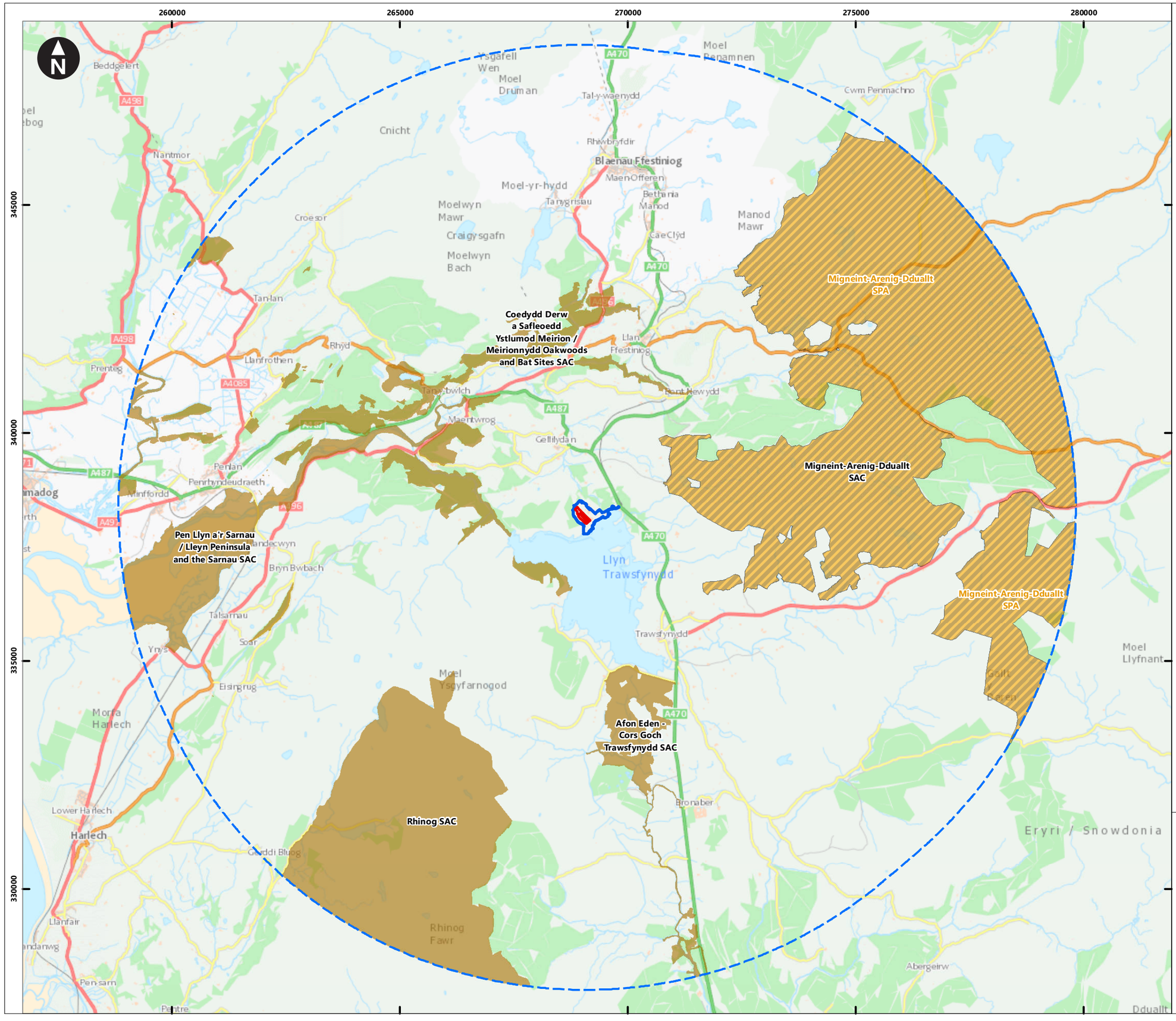
				measures were applied. control and environmental measures to ensure no adverse effects occur are reported within **Chapter 5: Biodiversity**.
Running water Section 7[1] HPI	National	National	Contamination	Out - The potential for contamination of off-site watercourses, which may represent a Section 7 HPI, was identified in **Chapter 7: Geoenvironmental impacts and surface water quality**. However, the assessment presented in **Chapter 7: Geoenvironmental impacts and surface water quality** of this Environmental Statement has concluded that there will be negligible effects on surface and groundwater quality and as such no effects on nearby watercourses. Therefore, effects on the biodiversity of these running watercourses are scoped out.
Section 7[1] plant species	National	Local	All environmental changes	Out - the desk study returned 33 records of notable plant species comprising one tree, two flowering plants, four mosses, eight liverworts and 18 lichens. However, the habitat within the Application Site boundary, which mostly comprises buildings and hardstanding, are considered unlikely to support Section 7 plant species. Therefore, there is considered to be no mechanism for a significant direct effect on Section 7 plant species. No Section 7 plant species have been recorded during surveys of the Trawsfynydd site (including the ponds complex) and surrounds. Therefore, significant indirect effects are also considered unlikely.
Bats	International	Local	Increase in noise, vibration and light levels	In – a wide variety of bat species has been recorded within the Trawsfynydd site. Buildings and structures included within the scope of the works for the Proposed Development have only low or very low bat roost potential and no roosts were located on the Trawsfynydd site in 2021. However, a soprano pipistrelle maternity roost is present within the Pump House, which is approximately 200m from the Application Site boundary. Additionally, there is also a small soprano pipistrelle roost in the Old Conference Centre, which is approximately 350m from the Proposed Development. The woodland habitat immediately outside the Application Site boundary is used by bats for foraging and commuting.

			All other environmental changes	Out – a wide variety of bat species are known to be present at the Trawsfynydd site. However, the buildings and structures included within the scope of the Application Site offer very little opportunity for bats in terms of roosting, foraging, and commuting potential.
Birds	International to Local	International to Local	All environmental changes	Out – a variety of birds has been recorded nesting in the habitat surrounding the Trawsfynydd site, none were nesting on or in any of the buildings of the ponds complex. Furthermore, whilst peregrine and other raptors have been recorded hunting from, and in the vicinity of, the Trawsfynydd site, there are no records of nesting within the Trawsfynydd site or the ponds complex specifically. It is also noted that osprey has recently nested Osprey has recently nested on the Trawsfynydd lakeside, albeit the nest is >1km from the Application Site and is hidden from it by a hill. Therefore the proposed development is considered very unlikely to adversely affect the species nesting success. Any future nests will be monitored by the BTO as has happened for previous nests.
Badger	Local	Local	Increase in vehicle movements	Out – badgers are known to be present in the wider area outside the Trawsfynydd site. Habitats adjacent to the Trawsfynydd site access road have the potential to support foraging and commuting badgers. Whilst an unmanaged increase in numbers of vehicle movements has the potential to impact badgers via collision, existing traffic calming measures will continue to apply and therefore there is no additional risk to badger as a result of the Application Site.
			All other environmental changes	Out – badgers are known to be present in the wider area outside the Trawsfynydd site. However, the Proposed Development area offers very little opportunity for badger in terms of sheltering, foraging, or commuting potential (and the multiple layers of security fencing are likely to prevent badgers from accessing the Trawsfynydd site).

Reptiles	National	Local	Increase in vehicle movements	Out – whilst reptiles may be present in the wider area surrounding the Trawsfynydd site, this is likely to be in very low numbers as none were recorded during survey work completed in 2021.
			All environmental changes	Out - reptiles are considered likely to be present in the wider area surrounding the Trawsfynydd site. However, the habitat within the Application Site boundary, which mostly comprises buildings and hardstanding, are considered unlikely to support reptiles.
Great crested newt	International	County	All environmental changes	Out - the desk study returned no records for GCN within 3km of the Trawsfynydd site. Llyn Trawsfynydd is run as a commercial leisure fishery and is likely to be unsuitable for GCN. No other ponds were identified within 500m of the Application SiteApplication Site boundary. GCN are not considered to be present within the vicinity of the Trawsfynydd site access road or within Trawsfynydd site and hence there is no mechanism for significant effect.
Otter	International	County	Increase in vehicle movements	Out - otter sightings have been made by staff at the Trawsfynydd site, specifically in the car park area to the south of the security lodge. Whilst an unmanaged increase in numbers of vehicle movements has the potential to impact otters via collision, existing traffic calming measures will continue to apply and therefore there is no additional risk to otter as a result of the Application Site.
			All environmental changes	Out - the desk study returned 35 records of otter within approximately 3km of the Trawsfynydd site, including records of otter activity, including a holt ,within and near to the Application Site boundary. No evidence of this species was observed during the 2019 survey, and there are no suitable habitats within the Application Site boundary. There will be no effect on core otter habitat and therefore no mechanism for significant effect on this species.
Water vole	National	County	All environmental changes	Out - the desk study returned three records of water vole within approximately 3km of the Trawsfynydd site, the nearest record being at approximately 0.19km. No evidence of water vole was observed during the survey. The watercourse habitats within 50m

				of the Trawsfynydd site are likely to be unsuitable for water vole, providing limited burrowing habitat due to the presence of rock outcrops, limited depth and width of fast flowing water, and limited cover of riparian vegetation. Similarly, the wetland vegetation is generally absent around the margins of Llyn Trawsfynydd, which mainly comprise of rocky shoreline. Water voles are not considered to be present within the vicinity of the Application Site.
Red squirrel	National	County	All environmental changes	Out - there are no records of red squirrel within 3km of the Application Site. However, site staff have reported a red squirrel within broadleaved woodland adjacent to the Trawsfynydd site. The habitat surrounding the Trawsfynydd site includes broadleaved woodland, which is suitable for this species. The habitat within the Application Site boundary, which mostly comprises buildings and hardstanding, are considered unlikely to support red squirrel. Therefore, there is considered to be no mechanism for a significant effect on red squirrel.
Pine marten	National	County	All environmental changes	Out - the desk study revealed no records of pine marten within 3km of the Trawsfynydd site. Whilst there is an anecdotal record of pine marten from the edge of the broadleaved woodland surrounding the Trawsfynydd site, this remains unproven, and the species is a shy species and extremely rare in North Wales. The habitat within the Application Site boundary, which mostly comprises buildings and hardstanding, is considered unlikely to support pine marten. Therefore, there is considered to be no mechanism for a significant effect on pine marten.
Dormouse	International	County	All environmental changes	Out – there are no records of dormouse within approximately 3km of the Trawsfynydd site. The broadleaved woodland and scrub surrounding the Trawsfynydd site is potentially suitable habitat for dormouse, however, it is unknown whether the species is present in the area as this species has a restricted distribution in within north-west Wales. No evidence of this species was observed during the 2019 survey, and there are no suitable habitats within the Application Site boundary. This species is therefore considered absent.

Invertebrates	National to Local	National to Local	All environmental changes	Out - the habitat within the boundary of the Application Site, which mostly comprises buildings and hardstanding, are considered unlikely to support notable terrestrial invertebrate species.
Other conservation-notable (Section 7[1]) species	National	Local	All environmental changes	Out - records for Section 7 species including hedgehog, brown hare, polecat, stoat, weasel, palmate newt, toad and frog were returned for the 3km search area from the Trawsfynydd site. However, none of the species were recorded on-site during the survey and the area within which the Proposed Development is cited is unlikely to be used by these species due to the absence of suitable habitat.
Invasive non-native species	National	Local	Introduction of invasive non-native species	Out - no legally controlled species were recorded within the Proposed Development area and biosecurity measures should prevent import.



Key

- Area of Land Leased by Magnox from the Nuclear Decommissioning Authority
- Proposed Development boundary
- Study Area (10km)
- Special Protection Area (SPA)
- Special Area of Conservation (SAC)

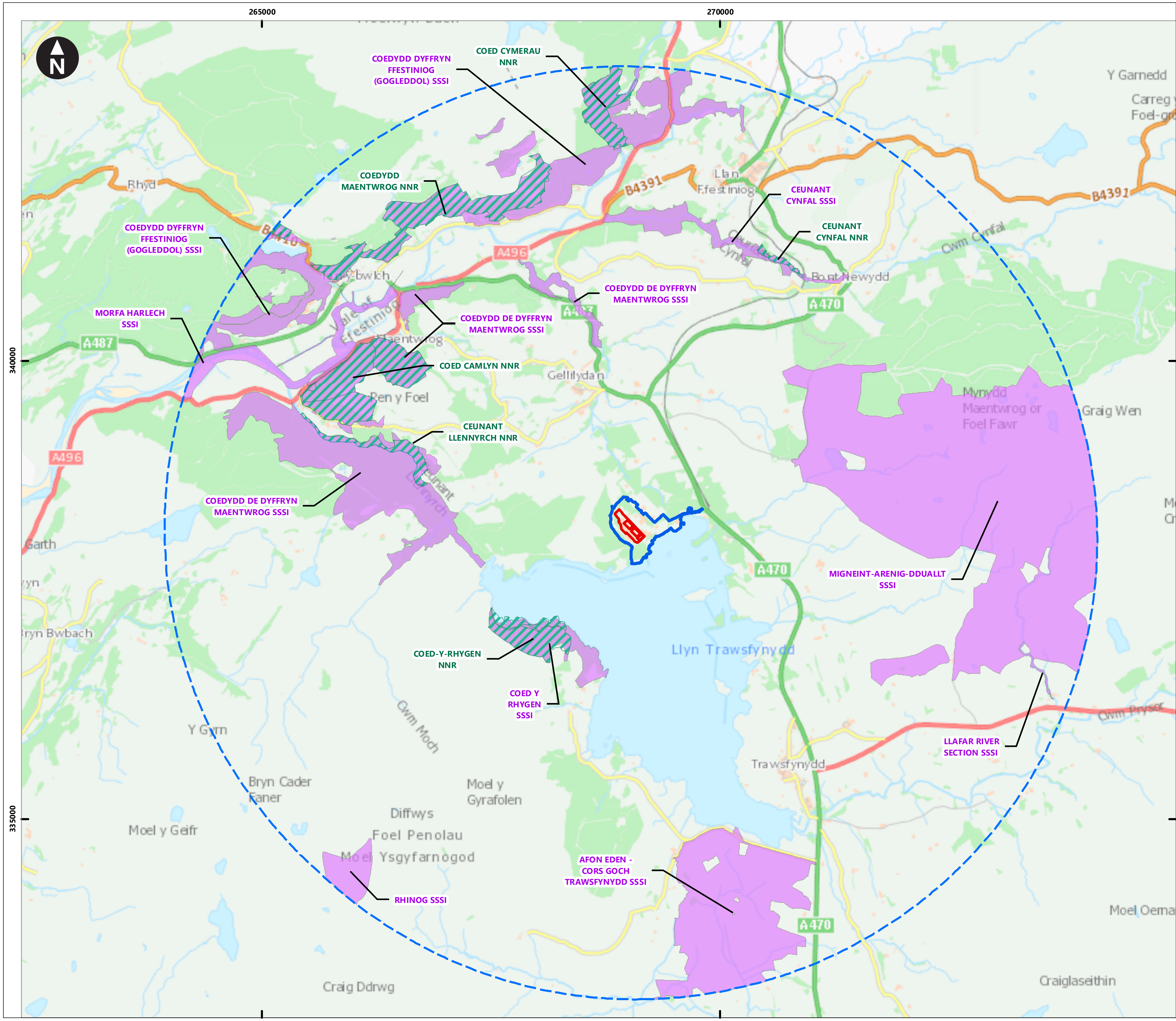
0 1,000 2,000 3,000 m

Scale at A3: 1:80,000

Magnox Ltd
Decommissioning of Trawsfynydd Ponds Complex
Environmental Statement

Figure 5.1
Statutory designated biodiversity sites of international importance within 10km of the Proposed Development

October 2022



H:\Projects\807521 Trawsfynydd Site Ponds Complex Demolition and Disposal EIA\Deliver Stage\D Design_Technical\Drawings\GIS\807521-WSPE-XX-XX-FG-OE-00002_S2_P01.1.mxd Originator: jacqui.parkin

Key

- Area of Land Leased by Magnox from the Nuclear Decommissioning Authority
- Proposed Development boundary
- Study Area (5km)
- National Nature Reserve (NNR)
- Site of Special Scientific Interest (SSSI)

0 500 1,000 1,500 m

Scale at A3: 1:40,000

Magnox Ltd
Decommissioning of Trawsfynydd Ponds Complex
Environmental Statement

Figure 5.2
Statutory designated biodiversity sites of national or local importance within 5km of the Proposed Development

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807521-WSPE-XX-XX-FG-OE-00002_S2_P01.1

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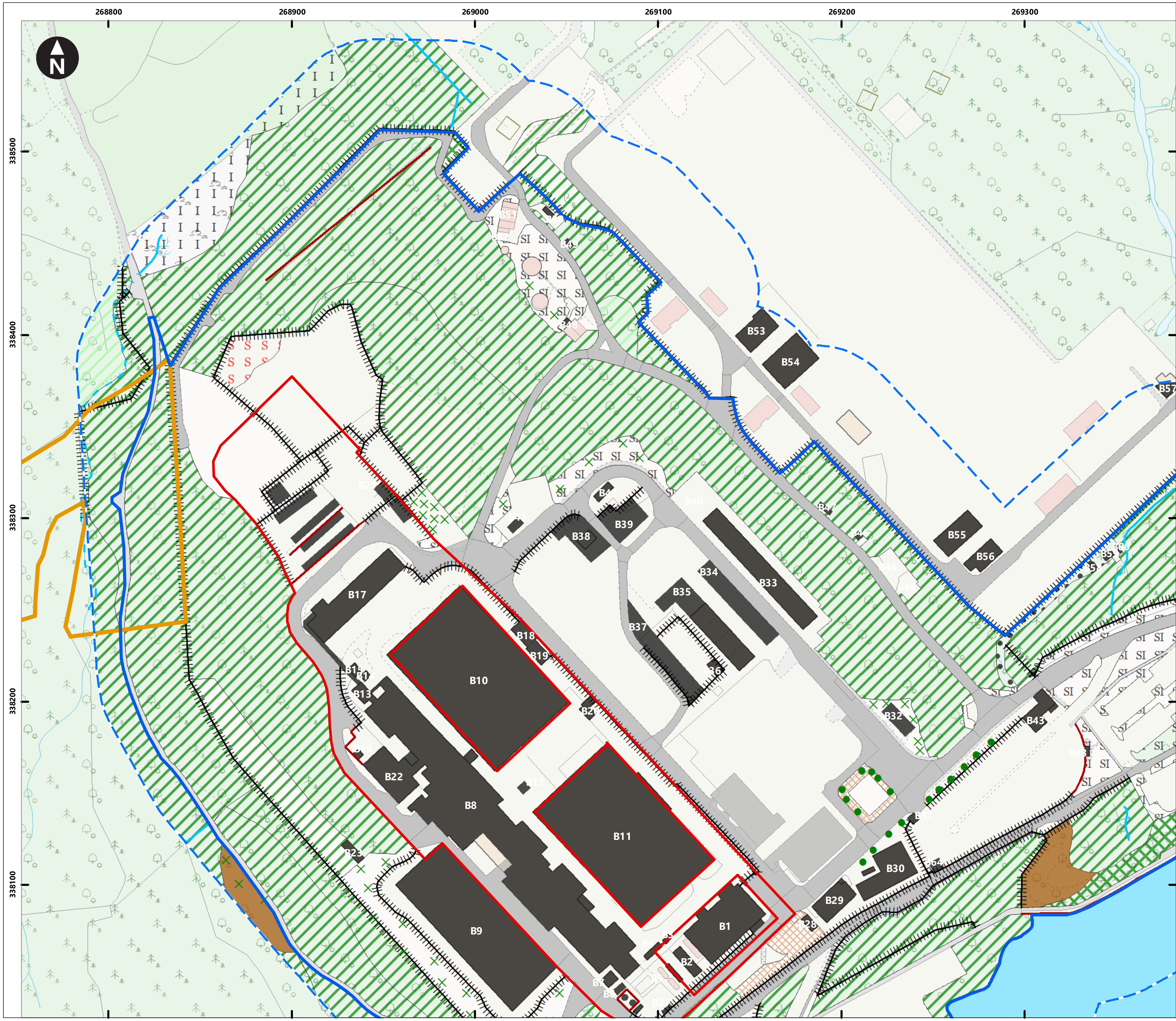

Key

Area of Land Leased by Magnox from the Nuclear Decommissioning Authority

Proposed Development boundary

Study Area (50m)

Plantation on Ancient Woodland Site

Broadleaved woodland - plantation

Coniferous woodland - plantation

Mixed woodland - plantation

Scrub - dense/continuous

Improved grassland

Poor semi-improved grassland

Continous bracken

Standing water

Spoil

Introduced shrub

Buildings

Bare ground

Hardstanding

Scrub - scattered

Scattered trees- broad-leaved

Running water

Fence

Wall

Dry ditch

0 50 100 m

Scale at A3: 1:2,000

Magnox Ltd
Decommissioning of Trawsfynydd Ponds Complex
Environmental Statement

Figure 5.3
Phase 1 habitat plan

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269000 269100 269200 269300 269400 269500

338200 338100 338000 337900 337800

N

B10 B18 B19 B37 B61 B22 B8 B11 B32 B43 B62 B9 B1 B30 B29 B63

Key

- Area of Land Leased by Magnox from the Nuclear Decommissioning Authority
- Proposed Development boundary
- Study Area (50m)
- Broadleaved woodland - plantation
- Mixed woodland - plantation
- Scrub - dense/continuous
- Neutral grassland - semi-improved
- Poor semi-improved grassland
- Continous bracken
- Dry dwarf shrub heath - acid
- Standing water
- Spoil
- Amenity grassland
- Introduced shrub
- Buildings
- Bare ground
- Hardstanding
- Scrub - scattered
- Scattered trees- broad-leaved
- Running water
- Fence
- Wall

0 50 100 m

Scale at A3: 1:2,000

Magnox Ltd
Decommissioning of Trawsfynydd Ponds Complex
Environmental Statement

Figure 5.3
Phase 1 habitat plan

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269400 269500 269600 269700 269800 269900

338500 338400 338300 338200 338100

N

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13 T14

B57 B61 B62 B63 B5

Key

- Area of Land Leased by Magnox from the Nuclear Decommissioning Authority
- Study Area (50m)
- Ancient semi -natural woodland
- Broadleaved woodland - semi-natural
- Broadleaved woodland - plantation
- Mixed woodland - plantation
- Scrub - dense/continuous
- Neutral grassland - semi-improved
- Marshy grassland
- Poor semi-improved grassland
- Continous bracken
- Standing water
- Amenity grassland
- Introduced shrub
- Buildings
- Bare ground
- Hardstanding
- Scrub - scattered
- Trees with potential roosting features
- Running water
- Fence
- Wall

0 50 100 m

Scale at A3: 1:2,000

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Decommissioning of Trawsfynydd Ponds Complex
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Figure 5.3
Phase 1 habitat plan

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