

University of Edinburgh

Ecology Assessment for proposed Woodland Creation at
Drumbrae, near Bridge of Allan

Final Draft

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Figure 1: Nature Conservation Designations within 1km

Figure 2a: Phase 1 Habitat Survey Results

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1 Introduction

Cameron Ecology Ltd was commissioned by the University of Edinburgh to undertake an ecological assessment of a woodland creation proposal at Drumbrae, near Bridge of Allan.

This area falls within a larger area surveyed in 2021 in relation to proposals for woodland planting at the adjacent Dumyat Woodland Creation proposal. This assessment makes use of the data collected in 2021 as part of that larger area, which has been updated with additional field surveys in 2023.

The site is in Stirling Council Local Authority Area.

This work had two main objectives:

1. Identify the ecological constraints and opportunities associated with the woodland creation; and
2. Provide an assessment of the potential ecological effects of woodland creation at this location.

This report sets out the findings of this work to date. This includes baseline information gathered about the site to date, an evaluation of the important ecological receptors present at this site, and identification of constraints and opportunities to be taken into account in the design process.

Survey results together with design proposals and other baseline information were shared with a range of interested parties at a consultation event on 25 August 2023. Following feedback and a review of received information, a number of adjustments have been made to the draft design presented at that meeting, and this report now presents an assessment of the ecological effects of the finalised woodland creation proposals.

2 Methods

This section of the report sets out the methods used in the ecological assessment process. The first stage in the ecological assessment process is determining the baseline ecological conditions. Two main methods have been used in this: desk study and field survey. These are described in more detail below.

2.1 Desk Study and Consultation

The desk study in this case involved re-visiting the data searches undertaken previously for the larger area and identifying information of relevance to this new survey area. The search included a search of the SNH datasets on designations in the vicinity of the proposed development.

A data request was submitted in 2021 The Wildlife Information Centre (TWIC), which is the biological records centre covering this area.

A search was made of the records on the National Biodiversity Network using a polygon enclosing the site (NBN) (records.nbnatlas.org, accessed 30 May 2023).

The Native Woodland Survey of Scotland (NWSS)¹ was also consulted as a desk study source, together with a range of other online sources.

A number of bodies were consulted by Edinburgh University including the following who provided information relevant to the ecological assessment: NatureScot, the RSPB, adjacent landowners, Butterfly Conservation and the Scottish Wildlife Trust.

2.2 Field Survey

Field survey included the following surveys:

- As noted above a Phase 1 habitat survey² and National Vegetation Classification (NVC)³ survey of semi-natural habitats present in a wider area was undertaken in 2021. This was updated by revisiting the site on 13 April, 22 May and 15 July 2023. The habitat survey area is shown in Figure 1;
- In 2021, A three-visit breeding bird survey following the methods described by Brown & Shepherd (1993)⁴, modified to include recording all species including passerines was undertaken.
- In 2023, the above breeding bird survey was updated with a further four-visit survey with survey visits on 17 April, 12 May, 09 June and 1 July 2023;
- In 2021, a two-visit black grouse survey, following the methods described in Gilbert *et al* 1998⁵ was undertaken. This was not updated in 2023;
- Search for field signs of badger. Field signs of badger are described in the following references: Neal and Cheeseman (1996)⁶, Bang and Dahlström (2001)⁷,

1 Native Woodland Survey of Scotland – dataset downloadabale from forestry.gov.uk

2 Nature Conservancy Council 1990 Handbook for Phase 1 habitat survey – a technique for environmental audit Joint Nature Conservancy Council, Peterborough

3 Rodwell, J.S. (ed), 1991 *et seq* British Plant Communities Vols 1-5 Cambridge University Press, Cambridge

4 Brown, A.F. and Shepherd, K.B. (1993). "A method for censusing upland breeding waders". *Bird Study* 40: 189-195.]

5 Gilbert, G, Gibbons, D.W. and Evans, J 1998 *Bird Monitoring Methods: a manual of techniques for key UK species*, Royal Society for the Protection of Birds, Sandy, Bedfordshire

6 Neal, E. and Cheeseman, C. (1996). *Badgers*. Christopher Helm, London

7 Bang, P. and Dahlström, P. (2001). *Animal Tracks and Signs*. Oxford University Press, Oxford

SNH (2001)⁸ and Sargent and Morris (2003)⁹. The area searched is the same as the habitat survey area and is shown in Figure 1, and was searched on the same dates, including 13 April, 22 May and 19 June 2023;

- Search for field signs of water vole and otter. Areas surveyed included spot checks on all watercourses within the habitat survey area, and included spot checks in 2021 and in 2023 (13 April, 22 May and 19 June). Survey methods are described in more detail in Strachan & Moorhouse (2006)¹⁰ and Chanin (2003)¹¹;
- A series of butterfly surveys were undertaken, with a focus on recording possible northern brown argus colonies on 24 June 2023, 9 July 2023 and 15 July 2023;
- Assessment of structures and trees present in relation to their potential to support bat roosts; and
- A watching brief for other protected or otherwise notable species.

2.3 *Limitations*

Butterfly surveys did not cover the whole site but were targeted to potentially suitable habitat and informed by feedback from the Scottish Wildlife Trust and others. Butterfly interest was recorded in other areas as part of an overall watching brief for species of interest. On the basis of where butterfly interest has been recorded it is considered that other areas of value to butterflies will coincide with herb-rich habitats and thus be taken into account in the design on the basis of habitat.

No other specific limitations have been identified in this study.

2.4 *Assessment Methods*

Once the baseline has been described (following the methods outlined above) the ecology assessment involves three main stages:

- Evaluation of features of ecological importance;
- Characterisation of potential effects; and
- Determination of significance.

These stages are described in more detail below.

2.4.1 *Evaluation of Features of Ecological Importance*

This process involves assigning a value to “Features of Ecological Importance” (FEIs). FEIs are the designated sites, habitats and species of highest ecological value present on the site.

Designated receptors are usually straightforward to assign a value to as most designations have an intrinsic value level associated with them. For example, a Site of Special Scientific Interest is a national level designation and so is of “national” value. Non-designated receptors are assigned a value using these same principles, relying on

⁸ Scottish Natural Heritage (2001). *Scotland's Wildlife: Badgers and Development*, Scottish Natural Heritage, Battleby

⁹ Sargent, G. and Morris, P. (2003). *How to find & Identify Mammals*. The Mammal Society, London

¹⁰ Strachan, R. and Moorhouse, T. (2006). *Water vole conservation handbook* 2nd ed. Wildlife Conservation Research Unit, University of Oxford, Oxford

¹¹ Chanin P (2003). *Monitoring the Otter Lutra lutra*. *Conserving Natura 2000 Rivers Monitoring Series No. 10*, English Nature, Peterborough

suitable guidance where this exists. The table given below is intended to illustrate the approach to valuing ecological features.

Table 1 Approach to Valuing Ecological Features

Level of Value	Examples
International	An internationally designated site (e.g. SAC), or site meeting criteria for international designations.
	Species present in internationally important numbers (>1% of biogeographic populations).
National	A nationally designated site (Site of Special Scientific Interest, SSSI, or a National Nature Reserve, NNR), or sites meeting the criteria for national designation.
	Species present in nationally important numbers (>1% UK population).
	Large areas of priority habitat listed on Annex I of the EC Habitats Directive and smaller areas of such habitat that are essential to maintain the viability of that ecological resource.
Regional (Natural Heritage Zone or Local Authority Area)	Species present in regionally important numbers (>1% Eastern Lowlands Natural Heritage Zone ¹² (NHZ) population (the site lies just on the northern edge of this natural heritage zone).
	Sites falling slightly below criteria for selection as a SSSI.
	Site of Importance for Nature Conservation, Scottish Wildlife Trust Reserves, Local Nature Reserves, or areas meeting criteria for these designations.
Local	Areas of semi-natural ancient woodland smaller than 0.25 ha.
	Areas of habitat or species considered to appreciably enrich the ecological resource within the local context, e.g. species-rich flushes or hedgerows.
Negligible	Usually widespread and common habitats and species. Receptors falling below local value are not normally considered in detail in the assessment process.

2.4.2 Characterisation of Potential Effects

The assessment seeks to systematically describe potential effects on ecological features in relation to set criteria such as magnitude, extent, duration, frequency, reversibility and probability of occurrence.

2.4.3 Determination of Significance

The primary purpose of the assessment process is to determine whether an effect is ecologically significant. The approach taken in this assessment is to make a judgement as to whether there will be an effect on the integrity of a defined ecological feature.

¹² <https://www.nature.scot/about-naturescot/our-work/natural-heritage-futures>, accessed 22 Aug 23

3 Ecological Baseline

3.1 Desk Study and Consultation Results

Figure 1 shows nature conservation designations within 1km.

No statutory nature conservation designations were recorded applying to the site itself, based on a search of NatureScot datasets.

Six LNCS lie immediately adjacent to the Site:

- Cocksburn Reservoir Local Nature Conservation Site (LNCS) is adjacent to the western boundary of the Site. This area is designated for its relatively diverse wetland flora, including locally rare plants; it also supports populations of butterflies of conservation interest and breeding birds.
- Yellowcraig Wood pLNCS is a provisional Local Nature Conservation Site. No site statement was available to describe the interest of this area, however it appears to be an area of high-quality woodland including some native ground flora species.
- Adjacent to Yellowcraig Wood to the west (and around 200m from the site boundary at its closest point) is Hermitage Wood. This designation includes a number of locally rare plants and protected mammals including red squirrel.
- Waltersmuir Reservoir pLNCS is another provisional wildlife site to the north-west, and no site statement was available in relation to the interest of this area. The designation primarily covers the water body, but wetland habitats of interest were noted to occur near this waterbody.
- Approximately 650m south of the site, Blairlogie Meadows pLNCS is presumably a wildlife site supporting grassland interest.
- Menstrie Wood (Redcar Wood) LNCS lies just over 1km to the south and east of the site; this site supports ancient woodland with native bluebells.

The nearest SAC and SSSI is Kippenrait Glen, around 250m from the north-western boundary of the survey area. This is an upland mixed ashwood that supports a number of rare plants and invertebrates.

The site lies approximately 4.7km from the upper part of the Firth of Forth SPA but does not support any habitats of value to the notified interests of this designation which are primarily waterfowl and seabird interests.

A review of the data on NBN from the site itself reveals a reasonably good level of biological recording has occurred in this area, with 1,950 records (of 217 species, primarily bird records).

A review of desk study records from TWIC (covering the larger area surveyed in 2021¹³) highlights a huge number of biological records (over 23,000) from within a 1km buffer of the area surveyed in 2021, primarily as a result of regular biological recording from the area around Stirling University. A summary of the records of relevance is provided below:

¹³ A 1km buffer around the Drumbrae Boundary gives an area that is 64% of the larger area covered in 2021, with most of the extra land being to the east.

- Both red and grey squirrel are present in this area, with red squirrels being more frequently encountered away from centres of population. Data from the Saving Scotlands Red Squirrels website¹⁴ show regular sightings of both red and grey squirrels throughout this area throughout the most recent years including 2023, with the grey squirrels being markedly more frequent in towns such as Bridge of Allan and Dunblane). This is not well reflected in the TWIC data, with most recent red squirrel record in the TWIC data set being from 2014. There is an NBN record from 2020.
- Pine marten have been recorded from within 1km to the north.
- A total of 251 species of lichen were included in the data set, many of these were recorded from the Menstrie Burn/Inchra Burn area which is off-site to the east in relation to Drumbrae or from around Logie Old Kirk, off-site to the south.
- Butterfly records of note include dark green fritillary and small pear-bordered fritillary from various locations, and a record of large heath from Cocksburn Reservoir.
- 410 species of vascular plants have been recorded, reflecting the large size of the desk study area, the range of altitudes and habitats and the relatively high level of biological recording in this area.
- The majority of the records (18,828) were birds records, many of which were from Stirling University; a total of 147 species have been recorded in this area, again highlighting the relative diversity of the habitat zones within the search area, including waterbodies, mature broadleaved woodland and upland habitats.

Consultation Comments

The **Scottish Wildlife Trust** responded on 7 April and 1 May 2023 highlighting the presence of Local Nature Conservation Sites and potential Nature Conservation Sites. The importance of on-site watercourses was also highlighted, with the catchment being within a river system supporting specially protected Atlantic salmon and lamprey populations. The potential value of acid grassland and the opportunities for natural regeneration were noted. The potential value of pond creation was noted. Recommendations in relation to broadleaved species choices that would benefit pollinators were also noted, together with management recommendations to benefit native wildflowers and the connectivity of habitat networks for pollinators.

The requirements of a number of species of note were highlighted including the potential presence of black grouse, waders, cuckoo (and meadow pipit) and raptors.

The presence and habitat requirements for a range of butterflies were also highlighted.

NatureScot responded on 12 May 2023, and made the following comments of relevance to this assessment:

- The proximity of the Kippenrait Glen SSSI and SAC was noted, in particular highlighting the need to take care in relation to water quality entering this designation. A number of designated features of the Kippenrait Glen SSSI and other SSSIs in the area have a reliance on deadwood habitats, and continuity of supply for this habitat type is thought to be important for these features, notably the protected assemblage of beetles. Well-designed woodland has the opportunity to improve habitat connectivity for beetles and other species.

¹⁴ <https://scottishsquirrels.org.uk>, accessed 21 August 2023

- The proximity of the Cocksburn Reservoir Local Nature Conservation Site was also highlighted.
- The likely presence of peatlands and Groundwater-dependant wetlands (GWDTE) was also highlighted, and the need to take these into account in the design process.
- The likely presence of protected species including European Protected Species (EPS) was highlighted.
- The possible presence of black grouse was noted.
- The potential presence of sticky catchfly and northern brown argus was highlighted in relation to the potential for biodiversity enhancement measures and the benefit of consulting Butterfly Conservation and the Scottish Wildlife Trust, together with collaboration with adjacent forestry projects was highlighted.
- Opportunities to enhance the connectivity of the woodland network were also noted.

The **RSPB** responded on 30th June 2023 and advised that the suite of proposed bird surveys was considered appropriate. The RSPB did not directly provide any bird data. The availability of data from a Butterfly Conservation transect near Cocksburn Reservoir which has been running since 2009 was noted¹⁵. In this data set twenty butterfly species have been noted, including a single record of a pearl-bordered fritillary.

A **Butterfly Conservation** volunteer undertook a specific search on 15 August 2023 for common rock-rose (*Helianthemum nummularium*), which is the main food plant for northern brown argus. The area searched included the steep slopes to the south of the path to Dumyat Hill, in the southern part of the survey area. An area of approximately 2m x 2.5m in size was found at NS8199 9763, containing scattered plants of rock-rose. These plants were searched for signs of northern brown argus (eggs, larvae, leaf damage) but none were recorded. This plant does also occur elsewhere along the steep sections at Dumyat.

Staff from the **British Trust for Ornithology (BTO)** provided generally positive comments on the opportunities for enhancement in this area and noted the presence of degraded peatlands and other wetland habitats (captured in the habitat survey), together with grasshopper warbler to be taken into account in the design. The low productivity of the area in relation to breeding waders was noted, as was the possibility of the presence of short-eared owls.

3.2 Desk Study – Wader Sensitivity Mapping

The BTO highlighted the availability of the work they have produced in relation to wader sensitivity mapping^{16,17}. Outputs from this modelling show predicted 'heat maps' for a number of species of relevance to this report including curlew, lapwing and snipe. The primary interpretative output from this mapping is that there are areas within the site that are zoned as being sensitive with regard to curlew in particular. The output of the model in this case leads to a recommendation that surveys are undertaken.

¹⁵ https://ukbms.org/site-details-map?location_id=3102, accessed 21 Aug. 23

¹⁶ <https://app.bto.org/wader-map/index.jsp>, accessed 21 Aug 2023

¹⁷ O'Connell, P., Wilson, M., Wetherhill, A., Calladine, J. 2021 'Sensitivity mapping for breeding waders in Britain: towards producing zonal maps to guide wader conservation, forest expansion and other land use changes. Report with specific data for Northumberland and north-east Cumbria' BTO Research Report 740

Interestingly, the output in relation to curlew looks appropriate in the context of the larger 'heat map' of this region, but the model appears to have had less predictive power in relation to species such as snipe.

These maps are based on data from 2008-2011, and the authors note that they are aware that wader populations have continued to decline in the period since these data were collected but found that the data compared well for sites in northern England being used to evaluate the model. In a Scottish context the model output expressed as a number of birds per km² appears to be very high in suitable areas of habitat, such that for hottest areas of the map the number of birds predicted appears unrealistically high in this author's opinion.

However, the primary purpose of the sensitivity mapping model was not to focus on individual squares or total numbers of birds, but to look more broadly at patterns at the landscape scale. For this reason the outputs of the wader sensitivity modelling are useful when considering the wider context and potential for cumulative impacts.

3.3 Phase 1 and NVC vegetation walkover results

The initial Phase 1 and NVC fieldwork was undertaken on 10, 17, 25 May, 11, 15 and 18 of June 2021. Update walkovers of the Drumbrae area were undertaken on 14 April and 20 May 2023. **Figure 2** shows the updated results of this survey. Appendix 1 provides a species list and target notes, and some other summary statistics in relation to the vegetation survey results. Species names in the text and in Appendix 1 follow Stace (2019)¹⁸. Twenty-seven habitat types have been recorded. Descriptions of the habitat types recorded are provided below:

- 1. Mixed Plantation Woodland** – Near the centre of the survey area there is an area of mixed plantation called Cocksburn Wood. Red squirrel have been seen in this woodland. This woodland has a very open character and an understorey of marshy grassland rush-pasture type vegetation. It is not of particularly high intrinsic nature conservation importance but is suitable habitat for a number of breeding birds. Nocturnal surveys were not undertaken as part of this assessment but such habitats are frequently found to support long-eared owl.
- 2. Dense Scrub** – Throughout the survey area on steeper slopes there are a number of areas with scrub; this habitat type covers a total of 5.3 hectares (1% of the survey area). All of the scrub in the survey area is gorse-dominated and conforms to the W23 *Ulex europaeus* – *Rubus fruticosus* scrub vegetation community. Scrub of this type is generally of low intrinsic value for nature conservation but can provide useful habitat for nesting birds such as linnet.
- 3. Unimproved Acid Grassland** – Unimproved acid grassland is scattered the survey area, generally on the higher ground. This grassland accounts for 6% (27 hectares). A range of vegetation communities were recorded within this habitat type. Generally more frequent on steeply-sloping ground in the south of the survey there were a number of areas of relatively species-poor U5a *Nardus stricta* – *Galium saxatile* grassland. To the north and west of the Sherrifmuir Road on less steeply sloping ground, U4a *Festuca ovina*- *Agrostis capillaris* – *Galium saxatile* grassland was more common. In some places these were in mosaic with scree or rock, or with dry heath vegetation types. In a number of places species-rich acid grasslands were recorded. These were most frequently

¹⁸ Stace, C 2019 *New Flora of the British Isles, 4th Edition* C & M Floristics, Suffolk. (Note that a number of name changes have been introduced in this most recent revision).

encountered north of the track in the northern part of the survey area, near the Wharry Burn. Both the U4c *Festuca ovina*-*Agrostis capillaris* – *Galium saxatile* grassland, *Lathyrus linifolius* – *Stachys officinalis* sub-community, and U5c *Nardus stricta* – *Galium saxatile* grassland *Carex panicea* – *Viola riviniana* sub-communities were recorded, being herb-rich forms of acid grassland. In a number of places *Viola lutea* (mountain pansy) was recorded.

4. **Semi-improved Acid Grassland** – The remainder of the acid grassland (usually on lower ground) is less diverse. 12% (54 hectares) have been coded as semi-improved grassland of acid origin. The most common NVC community here was the more nutrient-rich sub-community of U4, U4b *Festuca ovina*-*Agrostis capillaris* – *Galium saxatile* grassland, *Holcus lanatus* – *Trifolium repens* sub-community. A range of other vegetation communities were recorded in these areas; overall these habitats are of lower importance for nature conservation.
5. **Marshy Grassland** – 61 hectares (14% of the survey area) was coded as marshy grassland, mostly in the northern part of the survey area. There were broadly two main NVC communities within this category. The dominant vegetation form of rush-dominated grassland was M23 *Juncus effusus/acutiflorus* – *Galium palustre* mire. This habitat category varies in its biodiversity value, but at this site most examples were species-poor grasslands conforming to the M23b sub-community. In places there was also some MG10 *Holco-Juncetum effusi* rush-pasture, this is a form of marshy grassland with abundant *Holcus lanatus* (Yorkshire fog), some areas also included MG9 *Holcus lanatus* – *Deschampsia cespitosa* grassland as a component of the overall mosaic. Consistently wetter areas supported M23a the *Juncus acutiflorus* sub-community, occasionally herb-rich forms with (for example) marsh violet *Viola palustris*, an important foodplant for small pearl-bordered fritillaries. Some areas of M23a were herb rich and included *Angelica sylvestris* and *Valeriana officinalis*. In some cases there were fragments of acid flush vegetation types in the wetter areas within this community. Marshy grassland is also the phase 1 classification for a few areas of M28 *Iris pseudacorus* – *Filipendula ulmaria* mire NVC community – flag-iris dominated wetland areas. This rather broad phase 1 category also includes *Molinia caerulea* (purple moor-grass) dominated areas. These areas are M25 *Molinia caerulea* – *Potentilla erecta* mire in the NVC and occur on the side slopes of Loss Hill and on a flatter area to the north-west of Dumyat.
6. **Species-poor semi-improved grassland** – This code was used for one part of a field in the north of survey area. The vegetation was assessed as a species-poor form of U4b, but it was considered that this was a reversion from a sown seed mix in this case, with frequent ryegrass persisting in the sward.
7. **Dense Bracken** – Dense bracken occurs in a few areas in the southwest. In total there are 8.9 hectares (2% of the survey area). Dense bracken is coded here as U20c – *Pteridium aquilinum* – *Galium saxatile* community – species-poor sub-community. Generally, bracken has relatively low importance for nature conservation, although it can provide nesting opportunities for various birds, for example stonechat are frequently recorded in this community.
8. **Scattered Bracken** – Scattered bracken covers 42 hectares, (10% of the survey area), including a large area of south-facing slope in the south of the survey area. The dominant NVC community in these areas is the U20a *Pteridium aquilinum* – *Galium saxatile* community, *Anthoxanthum odoratum* sub-community. This occurs in mosaic with a range of acid grassland

vegetation types. As with dense bracken (above) this is generally regarded as a vegetation community of low importance for nature conservation.

- 9. Tall Ruderal** – A single polygon of the OV24 *Urtica dioica* – *Gallium aparine* community has been noted adjacent to one of the lower paths on the west side of Dumyat. The dominance of *Urtica dioica* (stinging-nettle) suggests there may have been some disturbance and/or nutrients in this area, for example from the storage of straw bales or farmyard manure in the past at this location.
- 10. Dry Heath** – 28 hectares (6% of the survey area) has been coded as dry heath. This habitat type is distributed throughout the survey area but is generally present on the highest ground. Three main NVC communities are present within this habitat type: H10a, H12a and H18a. H10a *Calluna vulgaris* – *Erica cinerea* heath, typical sub-community occurs on the steepest slopes and supports a closed canopy of more or less ungrazed heather, slightly more prevalent on south-west facing slopes. H12a *Calluna vulgaris* – *Vaccinium myrtillus* heath, *Calluna vulgaris* sub-community at this site is a more open mixture of lightly grazed heather and *Vaccinium myrtillus* (blaeberry), and occurs throughout the dry heath areas. H18a *Vaccinium myrtillus* – *Deschampsia flexuosa* heath, *Hylocomium splendens* – *Hylocomiadelphus loreus* sub-community was slightly more prevalent on south-east facing slopes that were perhaps more accessible for grazing stock. Dry heath is a semi-natural vegetation type of value as part of an upland habitat mosaic.
- 11. Wet Heath** – 160 hectares (37% of the survey area) has been coded as wet heath, making this by far the most abundant individual phase 1 habitat category in the survey area. The majority of the plateau of moorland to the north and west of Dumyat has been coded as wet heath. These are mostly areas dominated by the species-poor sub-community of M15: M15b *Trichophorum germanicum* – *Erica tetralix* wet heath. The wet heath vegetation here support mixtures of *Calluna vulgaris* (heather), *Molinia caerulea* (purple moor-grass) with occasional plants of *Erica tetralix* (cross-leaved heath) often with a carpet of mixed mosses, with mat-forming (pleurocarpous) mosses and occasional sphagnum mosses such as *Sphagnum capillifolium*. Wet heath is a semi-natural vegetation type of value as part of an upland habitat mosaic.
- 12. Dry Heath/Acid Grassland Mosaic** – 13 hectares (3% of the survey area) has been coded as dry heath/acid grassland mosaic. This habitat occurs patchily in the north of the survey area on high ground west of Sherrifmuir Road. The vegetation is typically a mixture of grassland vegetation types (U4 and U5) with dry heath types (especially H12 and H18). Higher ground tended to have mixtures of U5 grassland and H18 heath, relatively lower or flatter areas supported mixtures of U4 grassland and H12 heath vegetation communities.
- 13. Wet heath/Acid Grassland Mosaic** – 6 hectares (1% of the survey area) was coded as wet heath/acid grassland mosaic. This habitat type occurs patchily within the higher ground in the south of the survey area and includes M15 wet heath vegetation mixed with U5 grassland and U6 *Juncus squarrosus* – *Festuca ovina* grassland.
- 14. Blanket Bog** – Just one polygon of blanket bog was coded in the survey area, almost in the middle of the plateau east of Sherrifmuir Road. The vegetation in this area is the relatively drier peatland vegetation type M19 *Calluna vulgaris* – *Eriophorum vaginatum* mire. This bog is a relatively small confined mire. It is the only example of this vegetation type in the survey area and is of value for nature conservation.

- 15. Wet Modified Bog** – A single polygon at Cocks Burn has been coded as wet modified bog. This area sits in a mosaic of flushed peatland habitats and supports a mixture of M25 *Molinia caerulea* – *Potentilla erecta* mire and M20 *Eriophorum vaginatum* mire vegetation communities. There is also some modified bog in flatter ground on the moor east of the Sherrifmuir Road. These areas are of value for nature conservation and could benefit from restoration.
- 16. Dry Modified Bog** – 4 hectares (1% of the survey area) was coded as dry modified bog – these were areas supporting the M20 *Eriophorum vaginatum* mire vegetation community, dominated by tussocks of hare’s-tail cotton-grass. These were in mosaic with a number of other vegetation types in some cases, including U6 grassland, the M19 mire described above and M15 wet heath. Generally, these were relatively small isolated areas in the flatter areas of the moor west of the Sherrifmuir Road. These areas are of value for nature conservation and could benefit from restoration; reduced grazing pressure on these areas would be likely over long time periods to lead to the formation of less modified peatland vegetation.
- 17. Acid Flushes and Related Wetlands** – A total of 11 hectares (3% of the survey area) has been coded as being a flushed wetland habitat type. Three sub-communities of M6 mire are included in this habitat type; M6a, M6b and M6d. M6d *Carex echinata* – *Sphagnum fallax/denticulatum* mire, *Juncus acutiflorus* sub-community is the most abundant of these types, and is relatively the least diverse. A number of areas were coded as small-sedge mires M6a *Carex echinata* – *Sphagnum fallax/denticulatum* mire, *Carex echinata* sub-community, supporting a wider range of sedges and some bryophyte interest. Also present were grassier flushes coded as M6b *Carex echinata* – *Sphagnum fallax/denticulatum* mire, *Carex nigra* – *Nardus stricta* sub-community. Also within this category were species-rich forms of M23a where plants such as *Mentha aquatica* (water mint) or *Valeriana officinalis* (Valerian) indicate some enrichment most likely from groundwater flushing.
- 18. Base-rich Flushes** – 0.25 hectares (0.1% of the survey area) (just one polygon, at the headwaters of one of the watercourses feeding Cocksburn Reservoir, was mapped as base-rich flush. However, there are several base rich flushes that were recorded but were too small to map and these have been recorded through target notes, and so are not included in this total. The base-rich flushes are amongst the most diverse habitats in the survey area and are associated with a number of plants of conservation interest. These areas are M10 *Pinguicula* – *Caricetum dioicae* mire in the NVC. Note that these features can be very small and some could be overlooked, but they are generally found on steeply sloping ground. This includes for example the area where some common rock-rose was recorded on 15 August 2023 (see **section 3.1** above).
- 19. Valley Mire** - Amongst the highest nature conservation value habitats in the survey area are three polygons of complex wetlands coded as valley mires/fens. These include diverse mosaics of different vegetation communities, including M3 *Eriophorum vaginatum* pools, M4 *Carex rostrata* -*Sphagnum fallax* mire, M29 *Potamogeton polygonifolius* soakaway, and S27 *Carex rostrata* – *Comarum palustris* tall-herb fen. One of these is near the old Mill Lade at Waltersmuir Reservoir, and one is below the disused quarry at Cuperlaw Wood. A less diverse example coded as valley mire is mostly M3 type vegetation on the high ground west of the summit at Dumyat.
- 20. Running Water** – There are a number of watercourses within the survey area.
- 21. Scree** – 0.2 hectares (0.05% of the survey area) is coded as scree; this habitat also occurs in mosaic with some of the other habitats in the survey area. Most

of the scree areas were very difficult to access and were not surveyed in detail. Nearby wildlife sites include some rare plants associated with this habitat type.

22.Tracks/Buildings – 4 hectares (1% of the survey area) is coded as tracks, this is mostly the public road and track to Waltersmuir reservoir.

An evaluation of which are the most valuable habitats within this area is provided in section **4.1** below.

In terms of plant species of note, records of *Genista anglica* had previously been noted in the desk study undertaken in 2021 relating to an area south of Cocksburn Reservoir. This area was searched in 2021 but no plants were noted at the time. These plant records were noted again in the consultation information in 2023, highlighted by NatureScot, and so a repeat search was made in 2023. Although the plants were not re-found, it has subsequently come to light that management of this population has been undertaken in the past, including *ex-situ* cultivation of seed to improve population size. The current population may be very small, and some plants may have been lost as a result of improvements to the path in this location.

Some areas of the site with damp grassland were rich in orchids, and these have been noted as constrained. These can be difficult to precisely identify but certainly plants of northern marsh orchid (*Dactylorhiza purpurella*), heath spotted orchid (*D. maculata*), and common spotted orchid (*D. fuchsii*) occur in his area, and a number of plants are likely hybrids of these species, some particularly likely *D. x formosa* the hybrid between northern marsh and heath spotted orchid, although these would need to be determined by a specialist. The only other orchid noted was a small colony of twayblade (*Neottia ovata*).

3.4 Birds

There are two years of bird survey available for this site: the results from the larger area in 2021, and the results from the 2023 surveys focussing on Drumbrae itself.

The bird surveys undertaken have identified a total of 69 species of bird in the vicinity of the survey area, of which at least 34 are considered to be breeding on site. A full list of bird species recorded and their conservation status¹⁹ is provided in Appendix 2. This list includes birds recorded through incidental observations in the course of habitat and protected species surveys in addition to bird survey records. This high level of diversity reflects the large size of the survey area and the range of habitats within it. The following species groups have been recorded as present:

- An assemblage of breeding waders;
- Black grouse and other native gamebirds;
- Raptors;
- Skylarks;
- Other red-listed passerines; and
- Amber-listed passerines.

¹⁹ Species of Conservation Concern are classified as red, amber or green as defined in: Eaton MA, Brown AF, Noble DG, Musgrove AJ, Hearn R, Aebischer NJ, Gibbons DW, Evans A and Gregory RD (2009) Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man. British Birds 102, pp296–341.

These species groups are considered in more detail below.

3.4.1 Breeding Wader Assemblage

In evaluating the breeding wader assemblage present at this site, reference has been made to survey information from 2021, when a larger area was surveyed, and update surveys in 2023, focussing specifically on Drumbrae.

In 2021, five pairs of curlew were interpreted to be present, with three of those territories located within Drumbrae. In 2023, as discussed below, three curlew territories are interpreted to be present at Drumbrae, probably with quite low breeding success.

In the analysis of the curlews from the breeding bird survey data in 2023, there were up to five birds displaying based on April's data in isolation, birds vocalising in at least four locations in May's data and in three locations in June's data. In July only a single curlew was present. This is a fairly typical pattern in the data for a species such as curlew, which is a species which begins the breeding cycle early (usually on territory in late March) and where the perceived number of pairs decreases through the season. The most common explanation for this is that birds establish a territory but some pairs will fail at an early stage in the breeding cycle – displaying pairs may move to another area, nests may be predated by foxes, corvids and possibly badger, for example. By June some pairs could have fledged young and left the area. A bird still present in July is suggestive of successful breeding, but for waders breeding cannot be definitively proven unless nests are found, young are seen or specific behaviour is recorded such as a distraction display²⁰.

In this case it is also possible to compare these data with observations from Dr Matt Bell, Senior Lecturer and Honours Programme Organiser in Ecology at Edinburgh University. Dr Bell made 10 visits to the site for the purposes of deer management between February and June, including surveying with a thermal imager from one hour before dawn, or an hour after dusk. Dr Bell's interpretation of his observations is that there were:

- Two curlew territories (with possibly one successful nest, though this is not confirmed).
- No breeding lapwings.
- Four actively displaying male snipe, so probably not more than 4 nests.
- Frequent casual visits by oystercatchers but no nests (though there were nests on the fields to the West).

Having this data from the dawn/dusk period is of particular interest because the current author and a number of other workers in this area have had concerns in the past that the use of the Brown and Shepherd can have a tendency to over-estimate the number of pairs, especially for a highly mobile species such as curlew. Dawn visits in particular can help give a more accurate picture of the number of active nests/breeding attempts (pers. obs.) and it may be appropriate to consider revising the methodologies used for species such as curlew given their increasing conservation importance.

Based on a 'traditional' Brown and Shepherd interpretation of the data, potentially as many as three pairs/breeding attempts would be interpreted from the data in 2023 taking all the visits into account. By the 1 July a single bird was present, suggesting at least

²⁰ A distraction display is when a bird feigns injury to lure observer or predator away from nest site.

one of these pairs had a breeding attempt that lasted long enough that they may have fledged young.

Snipe is a very difficult species to accurately census – the times of day where this species is most easily detected do not always align with the generalised breeding bird survey methodology. A moderate density of snipe has been recorded in 2023, with eight territories in the survey area interpreted from the data. This contrasts with the four territories estimated by Dr Bell. Despite the inherent variability in the detectability of snipe, this result indicates the presence of a good snipe population in this area, consistent with the availability of wet habitats that are relatively free from disturbance.

Three other species of wader were recorded – a pair of oystercatcher were noted in May 2023 – these birds will have been breeding locally but were only recorded in the May visit. A single Common sandpiper territory was recorded on the Wharry Burn to the north. In the June visit, there were three separate sightings of lapwing. This species usually has a high level of detectability and so its probable that these birds moved in to the area late in the season (perhaps having eggs predated or otherwise failed in another location), rather than being undetected on previous visits.

The location of interpreted territory centres (including the precautionary inclusion of lapwing, and a location for oystercatcher despite the low probability that they will have bred on site) is shown in **Figure 3**, note that this does not necessarily imply a nest at this location, but is an interpretation of the number of breeding pairs for each species and an approximate territory centre based on the observations made across three visits. For comparison, **Figure 4** provides details of the waders recorded here in 2021. The pattern is broadly similar, showing waders making use of this area. It is very difficult to speculate on the underlying reasons for any changes or trends in this data. Work undertaken in relation to planting on the adjacent Dumyat site may have displaced birds into this area, however the likely number of pairs present appears to be similar in both survey periods.

Oystercatcher, common sandpiper and lapwing were not recorded here in 2021. Similarly in 2021 there were a couple of wader species recorded that were not recorded in 2023: a jack snipe (a late-staying wintering bird recorded in April 2021), and a single golden plover, recorded in the northern part of the site in May 2021 but not interpreted to be breeding.

3.4.2 Black Grouse and Other Native Gamebirds

Black grouse survey work undertaken in 2021 recorded three females off-site at a location approximately 1.2km to the east. In 2021 this was interpreted as part of a population that is probably centred much further north. No signs of black grouse were seen in 2023.

Red grouse numbers were high in 2023, with up to 14 territories recorded, mostly on the ground to the east of the Sherrifmuir Road. This contrasts strongly with only two red grouse territories (and only one within Drumbrae) interpreted to be present in 2021. It is possible that the relatively good weather conditions in the 2023 spring favoured this species.

A calling quail was recorded at the location shown in **Figure 4**. Quail have been recorded in this area in previous seasons (P Carroll, pers com.).

A single record of a pair of grey partridge was made in the course of the habitat walkovers, in the north of the survey area, as shown in **Figure 3**. A pair of grey partridge were also seen in this area in 2021 on two occasions, at the location shown in **Figure 4**. A very low density of grey partridge appear to be present at this site.

3.4.3 Raptors

Seven species of raptor were recorded in the course of the bird surveys between 2021 and 2023, including:

- Buzzard – up to two territories;
- Kestrel – one territory;
- Red kite – one territory, a probable off-site breeding location for this species is shown in the confidential annex;
- Sparrowhawk – not recorded in 2023, but likely to be present;
- Merlin – not recorded in 2023, seen in 2021 but not confirmed breeding;
- Osprey – not recorded in 2023 but noted to use the reservoirs in the area for fishing in 2021; and
- Peregrine – seen overflying the site on one occasion in 2021, and on one occasion in July 2023. Not recorded breeding on site.

Overall this is a relatively high diversity of birds of prey.

On 2 August 2023, University of Edinburgh staff recorded a short-eared owl on site. Short-eared owl can be very difficult to survey. In areas with other birds of prey, they may possibly become more nocturnal²¹ (Scott Smith pers. comm.).

3.4.4 Skyarks

On re-examining the skylark data for 2023, it has become apparent that numbers provided in the interim report related to a tally of maximum sightings, and not necessarily a true maximum number of breeding territories. This explains a discrepancy where apparent skylark density was much higher in 2023 than it was in 2021, where territory analysis was undertaken over four visits.

Taking the 2021 data and considering the Drumbrae portion of that area, there are 51 territories, and this equates to a density of 0.12 pairs per km². This is within the typical range of densities recorded for skylark as reported for upland sites²².

3.4.5 Other Red-listed Passerines

Other red-listed passerine species recorded included:

- Cuckoo – up to three calling males;
- Grasshopper warbler – seven pairs;
- Linnet – 12 pairs;
- Lesser redpoll – two pairs;
- Mistle thrush – seven pairs;
- Starling – not breeding on site in 2023;

²¹ Short-eared owls are one of the few owl species that are often active during the day, or at least crepuscular (active at dawn and dusk). They are vulnerable to predation from larger birds of prey such as goshawk and eagles.

²² Densities recorded are within the range of variation reported for agricultural grasslands in the literature (see for example https://www.bto.org/sites/default/files/shared_documents/publications/research-reports/1993/rr129.pdf, where Wilson and Browne report densities of 0.1-0.2).

- Spotted flycatcher – one pair;
- Tree pipit – six pairs; and
- Whinchat – seven pairs. Whinchat populations have declined very steeply in recent years, and this is a good number of this species.

3.4.6 Amber-listed Passerines

The following amber-listed passerines have been recorded breeding:

- Dipper – one pair;
- Dunnock – 13 pairs;
- Mallard – four pairs;
- Meadow pipit – 160 pairs. The most abundant bird species in the survey area. This equates to 0.58 pairs per hectare, which is a relatively high density;
- Reed bunting – seventeen pairs;
- Song thrush – four pairs;
- Willow warbler – 21 pairs; and
- Wren – twelve pairs.

3.5 Protected species baseline: Badger

The protected species walkover was undertaken on the same dates as the habitat surveys. Badger continue to be present at this site. More details of sett locations are provided in the confidential annex.

3.6 Protected species baseline: Otter and Water Vole

Otter spraint was noted at various locations on the Wharry Burn, indicating that this watercourse is part of an otter territory.

Otter are very likely to make infrequent use of any of the minor watercourses on site, and at times may forage overland hunting for frogs and other amphibians in small seasonal pools and other minor water features.

No field signs of water vole were recorded. Droppings and burrows of suitable size and shape for bank vole were noted in various locations by watercourses including the unnamed tributary feeding Cocksburn Reservoir, and minor watercourses in the northern part of the site. Field vole runs and droppings were noted throughout the survey area.

3.7 Butterfly Surveys

As noted above, butterfly surveys were undertaken on 24 June 2023 and 9 July 2023 with a focus on recording possible northern brown argus colonies, targeting the southern part of the site, including some steeply sloping south-facing areas. A watching brief was maintained for other species including green hairstreak. In addition, desk study information indicated a range of other butterflies of conservation interest have been recorded in the vicinity in previous years. The results of the butterfly surveys are provided in Appendix 2.

Eight butterfly species were recorded including ringlet, meadow brown, small heath, small pearl-bordered fritillary, dark green fritillary, peacock, common blue and small

tortoiseshell. This is a diverse butterfly assemblage, and in particular the presence of species such as common blue, small pearl-bordered fritillary, and dark green fritillary together is indicative of areas of good quality habitat from an invertebrate point of view.

No northern brown argus were recorded, however on a subsequent visit by a Butterfly Conservation volunteer, some common rock-rose (this species primary food plant) was recorded in this area.

Moths recorded included yellow shell, chimneysweep, six-spot burnet and narrow-bordered five-spot burnet.

Other invertebrates included common blue damselflies, a sexton beetle species, and at least one spiny shield bug.

Incidental records from a more detailed habitat survey visit to the northern part of the site in July also yielded a relatively diverse assemblage of butterflies, with dark green fritillary, small pearl-bordered fritillary and common blue present on the east bank of Waltersmuir Reservoir.

Incidental records from a walkover on 19 July 2023 included at least one small pearl-bordered fritillary recorded just south of the standing stone. There may be other areas of value for invertebrates, and species such as this are reliant on herb-rich areas of wet grassland with (usually) *Viola palustris* (marsh violet) or sometimes areas with *Viola riviniana* (common dog-violet).

3.8 Other species

Molehills were noted in various locations.

Fox scats and a couple of fox earths were noted in various locations.

Common frog and common lizard were noted in various locations.

Based on incidental observations, there appear to be a relatively high density of roe deer at his site.

4 Future Situation Without the Scheme

Forestry is by definition a long-term proposal, and over the period that this forestry will be established there are predicted to be a number of other factors that will influence baseline ecological conditions which should be taken into account in relation to decision-making for a forestry proposal of this kind. A number of these are discussed below.

4.1 *Agricultural Management*

There is currently considerable uncertainty in relation to the future of agriculture in upland areas such as Drumbrae. Support mechanisms for existing agricultural patterns are currently under review. With the support mechanisms that are currently in place there is limited prospect of productive agriculture being proposed for the land at Drumbrae.

In the absence of targeted agricultural management there is a risk that some of the ecological interest of the area, and most notably the species-rich grasslands in the northern part of the site would be lost over time, and these areas would begin to revert to scrub.

4.2 *Ash Dieback and other Tree Diseases*

Mature ash trees in this area are being lost due to ash dieback. Ash provide a good percentage of the larger/veteran trees in the wider landscape around Drumbrae, which provide important micro-habitats for a wide range of biodiversity interests. Over the next couple of decades there may be in some places a temporary 'boom' in the proportion of standing large diameter deadwood and other deadwood habitats. This is predicted to be followed by a relatively long period of time where there will be a scarcity of large trees in the landscape and a corresponding scarcity of standing deadwood and other deadwood habitats.

The planting proposals will not directly influence the prevalence of ash dieback, however they will perhaps bring forward to some extent the future provision of mature trees in the landscape and of the related deadwood habitats.

4.3 *Climate Change*

Summer and winter temperatures are predicted to be greater²³, with winter rainfall increasing and summer rainfall decreasing²⁴. This will affect the ecological receptors at Drumbrae in a number of ways:

- Remaining small areas of peatland may deteriorate in condition, especially where reduced summer rainfall causes greater fluctuation in the position of the water table within these peatlands. This is particularly likely to be the case for the small peatland features within Drumbrae, which are already degraded to some extent and will be less resilient.
- Wetlands generally will become drier, and this is likely to lead to a change in species composition within them.

²³ <https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/summaries/index>, accessed 21 Aug 2023

²⁴ <https://www.environment.gov.scot/our-environment/climate/changing-climate/#:~:text=Scotland%20generally%20has%20cool%20summers, summers%20with%20more%20extreme%20events>, accessed 21 Aug 2023

- Specific features such as base-rich flushes may lose their biodiversity interest as reduced flow rates through groundwater result in change to the hydrology of these features.
- The distributions of a wide range of species may shift northwards, meaning new species occur in the area whilst others are lost. Northern brown argus and small pearl-bordered fritillary are two butterflies that are likely to be sensitive to changes in the climate and may be lost from this region.
- The risk of fires in grassland and heathland habitats is likely to increase in the summer period.

4.4 *Recreational Pressures*

This area in general is already subject to relatively high levels of recreation, with walkers selecting a number of different routes to the summit of Dumyat, and generally making use of the countryside for dog-walking, mountain biking etc. Density and breeding success of disturbance-sensitive waders such as curlew may already be being influenced negatively by recreational pressure. With or without the proposed planting, it is probable that the level of recreational pressure will increase in future years.

5 **Ecological Constraints and Opportunities**

This section of the report makes use of the baseline information to identify constraints and opportunities associated with the woodland creation proposal. Areas discussed in this section are shown on **Figure 5**.

5.1 *Constraints*

Figure 5 identifies features that are constraints to be taken into account in the planting design. The habitat constraints correlate with the features identified above:

1. 'Hard' Constraints: there are five categories of 'hard' habitat constraints as summarised below. These are normally areas that cannot be replaced if lost or damaged, and should not be planted -
 - a. Peatlands – areas of the NVC communities M20, M19, and some mosaics with modified peatland and wet heath (NVC M15) should be treated as hard constraints. Even where the underlying peat is not consistently over 50cm depth, these areas are technically restorable or may be restorable in the future to more functional peatlands and should be left unplanted.
 - b. Flushes – areas of the NVC communities M4, M6 and M10 are sustained by movement of groundwater through the surface layers of the soil profile and support biodiversity interests that are restricted to these situations.
 - c. Wetlands – some of the wetlands present are diverse examples of more common and widespread wet grassland types (rich forms of M23a with lots of herbs/forbs such as valerian, angelica, marsh violet, mint etc), or other valuable wetlands such as sedge-beds with bottle sedge and marsh cinquefoil (NVC S27). These areas should not be planted.
 - d. Species-rich grasslands – these are more difficult to map and evaluate in this context and some subjective judgements are made in deciding which areas are consistently sufficiently species-rich to be coded in this way, but the best examples of areas supporting herb-rich acid grassland (usually with small fragments of calcareous grassland within them) have been mapped as 'red' and thus a hard constraint.

- e. Scree – open scree is a scarce habitat in and of itself and often supports bryophytes and other species with restricted distributions. It is in any event unsuitable for planting, but recent work suggests that a buffer around open scree areas is appropriate to safeguard biodiversity interests associated with these areas²⁵.
2. 'Soft' Constraints: these areas support semi-natural habitats that have some value; in many cases planting with productive conifers in these areas would lead to some loss of biodiversity, but conversion to broadleaved woodland, or Scots pine forestry may in some cases be net-neutral or positive in the longer term. As a guide retaining some 'amber' open space will help retain the biodiversity interest of the site. There are four broad categories of habitats that have been coded as 'amber' –
 - a. Less diverse wetlands and wet grasslands – wet rush pastures with a lower frequency of herbs (usually M23a) – these areas would in some cases be suitable for conversion to wet woodland.
 - b. Heaths – (NVC H10, H12 and H18 (dry heaths) and M15 (wet heath)) – ideally the design should seek to retain some open heath areas (especially in the dry heath areas H10, H12 or H18), however in the long run planting of these areas would be predicted to result in acid woodland of the W17 type, especially if lower density planting is in these areas. The wet heath areas (M15) will similarly retain a wet woodland W4 type interest in the long run; these are relatively less sensitive (within the context of the amber category) than the dry heaths, and would be interpreted to be derived from loss of birch woodland cover historically. The current design draft retains dry heath on the steeper/higher ground in the south-east, and a core of heath in the centre of an open area west of the power line wayleave between the standing stone and cairns, and some representative examples of wet heath as open ground generally throughout the draft design.
 - c. Other unimproved acid grasslands – less diverse acid grasslands are semi-natural habitats and have some value. They would result in some loss of diversity if planted with conifers.
 - d. Other amber areas – there are a number of polygons with mosaics of heath and acid grassland, or one or two where bracken was underlain with good populations of bluebells. These have value that would be lost if planted with spruce, but conversion to woodland (especially lower density woodland of broadleaved or Scot's pine) will retain and possibly enhance biodiversity value in some cases.
 3. The presence of an assemblage of breeding waders represents a constraint. This is a much more difficult constraint to define spatially. Data from 2021 and 2023 indicate that there is some variation within the pattern of distribution and density of breeding waders (including for curlew). Comments from consultees suggest that there was an expectation that the power lines in this area may result in a displacement of curlew and other waders. The fieldwork undertaken indicates that waders including curlew are present, however (perhaps in common with many other areas where curlew are present) the breeding success is low. The survey area is currently quite an extensive open area, however

²⁵ Corner, R 2022 '*Kiaeria blyttii*, *Racomitrium lanuginosum* and forestry in Roxburghshire' *Field Bryology* **128** 34-38 [note that this article does not recommend a buffer but highlights that common and widespread mosses appear to out-compete mosses restricted to scree sites when forestry is planted nearby, perhaps by changing the micro-climate or nutrient status of these areas]

when areas within 500m of existing woodland edges are mapped, all of the probable territory centres fall within 500m of existing woodland edge. In one sense all new planting in this area results in loss of potential habitat for waders; a number of alternative mitigation measures are considered below in section **5.2**. Snipe appear to be generally less sensitive to planting than curlew and can be recorded breeding near woodland edges in suitable habitat.

4. The assemblage of butterflies at this site represents to some extent a constraint, but as noted above, the delineation of herb-rich habitats is considered sufficient to identify areas of value for this species group. Creation of sheltered glades would be predicted to benefit some butterfly species.
5. There are a number of badger setts in this area. Ground preparation work should avoid a 30m buffer around these areas.

5.2 Opportunities

1. Habitat Connectivity – Woodland flora: There are areas where bracken adjacent to existing woodland supports ancient woodland indicator species such as bluebells (*Hyacinthoides non-scripta*), wild primula (*Primula vulgaris*) and other ground flora associated with ancient woodland. Creation of woodland in these areas would be predicted to result in higher-value woodlands from a biodiversity point of view.
2. Ash Dieback Mitigation: The loss of many of the larger ash trees in the wider area is already occurring. Inclusion of species that may act as surrogate hosts for a proportion of the invertebrates currently thought to be dependent on ash will improve the resilience of the woodland fauna. Aspen and sycamore are two species that will be included that are thought to be alternative hosts for a large proportion of the invertebrates associated with ash. Inclusion of oak and cherry will further diversify the available range of broadleaved trees that are known to support diverse invertebrate communities. Inclusion of some elm in the planting mix will also improve the availability of larger trees in the future.
3. Habitat Connectivity Kippenrair Glen SSSI: W9 planting including low density native elm will improve connectivity between designated areas of woodland within Kippenrair Glen and remnant elm that occur scattered within the site. Invertebrates and other fauna that may rely on elm will in the longer term have better connectivity and new habitat areas.
4. Red Squirrel Habitat: In the medium term the provision of additional woodland cover will provide opportunities for dispersal of red squirrel into new areas and generally improve habitat connectivity. In the longer term the woodland created will provide new red squirrel habitat.
5. Grey Squirrel Management: Pine marten appear to benefit red squirrel populations, perhaps through preferential predation of grey squirrel²⁶. The creation of new areas of woodland will create new areas of habitat for pine

²⁶ Sheehy, E., Lawton, C. 2014 Population crash in an invasive species following the recovery of a native predator: the case of the American grey squirrel and the European pine marten in Ireland. *Biodiversity Conservation* **23**, 753–774

- marten. Pine marten boxes could be used to encourage colonisation as natural denning sites are a limiting factor for this species²⁷.
6. Retention and Management of Species-rich Acid Grassland: Areas of species-rich acid grassland have been mapped and retained within the proposed design. Grazing management designed to retain and enhance the diversity of these areas can retain much of this interest.
 7. Removal of grazing from Modified Peatland: Enclosing the modified peatlands in an area where grazing will be removed is predicted to lead to an improvement of condition for areas of peatland in the survey area. These are relatively small areas.
 8. Open Space – green hairstreak habitat - Design of open space between the cairns and standing stones (primarily for archaeological reasons) will allow some of the areas where blaeberry (*Vaccinium myrtillus*) is most abundant to be retained. This is the main foodplant of green hairstreak butterflies, and although not recorded in this study (the species has an earlier flight period than northern brown argus, which was the target species of the specific butterfly surveys) this will retain areas of suitable habitat in a relatively sheltered context which should provide opportunities for this species. Light grazing of this area would be helpful as over long time periods (>5yrs) the *Vaccinium* – dominated dry heath (NVC H18) in these areas would be predicted to revert to a more mixed heath with heather and blaeberry (NVC H12), and eventually heather will become completely dominant in the absence of grazing.
 9. Open Space – Northern Brown Argus/ Sticky Catchfly habitat: NatureScot have advised working with Butterfly Conservation and others to enhance opportunities for common rock-rose and sticky catchfly. The design has left the area where common rock rose was recorded as open and will leave the rocky south-facing slopes open also to preserve habitat opportunities for sticky catchfly. Removal of grazing may make a greater range of potentially suitable micro-habitats suitable for these species.
 10. Creation of ponds/scrapes: The Scottish Wildlife Trust have noted that pond creation would potentially have a range of biodiversity benefits in this area. The proposed open area between the standing stone and the cairns west of the powerline wayleave is one location where pond creation may be appropriate.
 11. Increased Diversity of Food Sources for Pollinators: The Scottish Wildlife Trust and Edinburgh University staff have included a suite of species to be planted that will improve availability of resources for pollinators throughout the season, by planting hazel and willow to benefit pollinators in the early part of the season, then alder, cherry species, apple, blackthorn and hawthorn for the later spring period, and rowan, sycamore, guelder rose, other roses and holly for pollinators in the summer period.
 12. Opportunities for Monitoring and Research: Because the site is owned by University of Edinburgh, there may be opportunities to undertake monitoring and research in relation to habitats and wader mitigation techniques in relation to interactions between waders, predators and woodland creation projects. The

²⁷ Birks J.D.S., Messenger J.E. & Halliwell E.C. (2005) Diversity of den sites used by pine martens *Martes martes*: a response to the scarcity of arboreal cavities? *Mammal Review*, **35**, 313-320

following monitoring and mitigation techniques are examples of measures that could be considered:

- a. Carbon quantification including measurements of soil carbon in areas of peatland restoration.
- b. Undertaking breeding bird surveys annually over a ten-year period.
- c. Tagging (including satellite tagging) for waders and/or predators to study wader/predator interactions, potentially in association with the British Trust for Ornithology,
- d. Targeted grazing (in terms of timing and location) using GPS collars or temporary electric fencing to create suitable conditions for nesting waders

6 Important Ecological Features

6.1 *Important Ecological Features Defined*

Six Important Ecological Features have been identified through this work and these are defined below.

Designations – Kippenrait Glen SAC and SSSI

This receptor is of international value, due to its designation as an SAC. NatureScot have highlighted the potential for indirect effects on this receptor through silt and other water quality issues as the receptor lies downstream from the site.

Because industry good practice measures will be committed to for this project, the risk of run-off or other pollution impacting the notified interests of the SSSI are considered to be sufficiently low that the potential for effects on this receptor can be scoped out from further assessment.

In the long run, the design will provide improved connectivity for the woodland habitats along this corridor.

Designations – Cocksburn Reservoir Local Nature Conservation Site (LNCS)

This receptor is of regional value due to its designation as an LNCS. No direct or indirect effects have been identified in relation to this receptor. Herb-rich habitats around the margins of this reservoir will continue to form a network of species rich areas in this vicinity, many of which will be brought into positive management from a biodiversity point of view.

As with the SAC/SSSI above, it is considered that potential effects on this receptor can be scoped out at this stage. The current draft of the planting design does not propose any planting within this LNCS.

Upland Habitat Mosaic

This receptor is considered to be of regional value, due to its size, and the diversity and quality of habitats within it. It is therefore carried forward to the assessment section below.

Upland Bird Assemblage

As discussed above, the assemblage of breeding waders includes an estimated two to three territories of curlew, with four to eight snipe, and one common sandpiper, with lapwing and oystercatcher also present but not necessarily breeding. In the context of the Eastern Lowlands Natural Heritage Zone, this is a breeding wader assemblage approaching regional importance in the opinion of the author, and it is therefore carried forward to the assessment section below.

Other Ecological Receptors

All other ecological receptors are of less than local importance for nature conservation, and are thus scoped out from further consideration in this assessment.

6.2 Important Ecological Feature Assessments

Two important ecological features have been carried forward to this assessment section of the report, and these are considered in more detail below.

Specifically, this section seeks to present information to enable the ecological impacts to be characterised in line with CIEEM guidance, including an evaluation as to whether the impact is:

- Positive or negative
- Extent
- Magnitude
- Duration
- Frequency and timing and
- Reversibility

Upland Habitat Mosaic

Positive or negative, and Magnitude?

The first question to assess is whether the impact is positive or negative. These proposals include planting native tree species and aiming to create woodland types that will in the long-term function as semi-natural woodlands or will be to some extent functionally analogous to native woodlands (such as Scot's pine woodland). The impact of the proposals will thus be to exchange baseline vegetation types for broadleaved or native woodland types in the longer term. There are a number of tools available to assist with such an evaluation, for example the use of Biodiversity Net Gain metrics such as Natural England's BNG4.0²⁸. However, such an evaluation is complex, because such tools lack the complexity to reflect how such systems are predicted to change over time.

Taking the examples of species-poor wet heath and *Molinia* grasslands (one of the most common vegetation types where planting is proposed), the overall biodiversity value of such areas is not likely to change much initially. There might be an overall loss of biodiversity in the medium term, but as the woodland matures and gains some structural diversity with trees of different ages, and a broader range of ecological niches are consistently present over longer periods of time, it will continue to slowly gain ecological 'value', over a period that is more or less indefinite in the context of land use planning decisions of this kind.

In the long term, these proposals are predicted to have a positive effect in relation to habitats. As discussed, the magnitude of the change is predicted to be dynamic, and with appropriate management will increase in the longer term.

Extent

The design proposes planting over an area of up to 55% of the area surveyed. The 'hard constraints' in relation to habitats have all been left unplanted – these are the features of highest biodiversity value as identified through baseline survey.

A simple magnitude figure of this kind gives an indication of the scale of proposed change. However, it should be borne in mind that the open space intrinsically contributes to the ecological value of the overall woodland creation proposal.

²⁸ <https://publications.naturalengland.org.uk/publication/6049804846366720>, accessed 13/10/23

Duration, Frequency, Timing and Reversibility

The proposals are intended to be a permanent change. The woodland creation is a one-off event, with planting normally undertaken during the period when trees are dormant, typically in late winter. Any habitats that would be considered likely to be irreversibly damaged by planting have been protected in the design process, and so in theory the woodland creation process could be reversed at some later date if this was deemed necessary, but reverting the habitats to their original condition would be expected to take some time.

Upland Bird Assemblage

The upland bird assemblage has a number of components – species or groups of species that will be influenced in different ways by the proposed planting. In general, the shift from open upland habitat to afforested habitat will result in a change in the bird community using this area; the current assemblage will generally be impacted negatively whilst birds associated with woodland will increase. This assessment considers the impact for curlew and skylark in more detail here.

Curlew

As discussed in the text, there are an estimated three pairs of curlew present. The planting proposals are predicted to lead to the loss of all three territories. In a number of other planting schemes it has been noted that in the very short term curlew can persist as a breeding bird in woodland creation areas (personal observations) and may even benefit from removal of grazing (perhaps leading to greater breeding success). However, in the long term the habitat becomes unsuitable for this species. In this case the extent of retained open ground is probably not sufficient to retain this species.

For context, the regional curlew population considered as the population estimate for the Eastern Lowlands Natural Heritage Zone is 3,253 pairs of curlew²⁹.

The assessment needs to take into account the future situation without the scheme. Overall productivity of this species is very low, and this is probably one factor leading to conservation concern for this species. Without the scheme, this situation is likely to continue, with the species continuing to decline and have low productivity.

This proposal, with the potential for the involvement of ecology students from the University of Edinburgh could undertake a more detailed study of curlew responses to forestry planting.

Scottish Forestry Guidance in relation to curlew³⁰, states that proposals displacing five or more pairs of curlew are likely to be important breeding sites. This site falls below that threshold.

²⁹ Wilson, M. W., Austin, G. E., Gillings S. and Wernham, C. V. (2015). Natural Heritage Zone Bird Population Estimates. SWBSG Commissioned report number SWBSG_1504. Note that this is a population estimate from 2009 and populations have been in decline in the intervening period.

³⁰ <https://forestry.gov.scot/publications/713-woodland-creation-and-curlew/viewdocument/713>, accessed 22 Aug 23

Skylark

Skylark is a species strongly associated with open habitats and the number of skylark is predicted to decrease with planting of these areas. There is limited available information on the extent of open ground required by this species, individual territories can in some cases be very small. As a result, the loss of territories is probably more or less proportional to the loss of open ground. With 55% of the ground planted, 45% remains open. Thus in the long term a 55% reduction in the number of skylark is probable. Based on 2021 data this would lead to the loss of 28 skylark territories.

Whilst there have been declines at a UK level, this species is 'least concern' globally. Despite recent UK declines, overall density has been increasing in the uplands, with overall numbers in Scotland increasing³¹, and it remains a relatively abundant bird with a large population.

A loss to the population of this scale is not likely to be significant at a regional level.

³¹ <https://www.bto.org/understanding-birds/birdfacts/skylark>, accessed 13 October 2023

7 Conclusions and Recommendations

This interim report presents the ecological baseline as described through the results of consultations and baseline surveys to date, and scopes-out a number of receptors from further consideration.

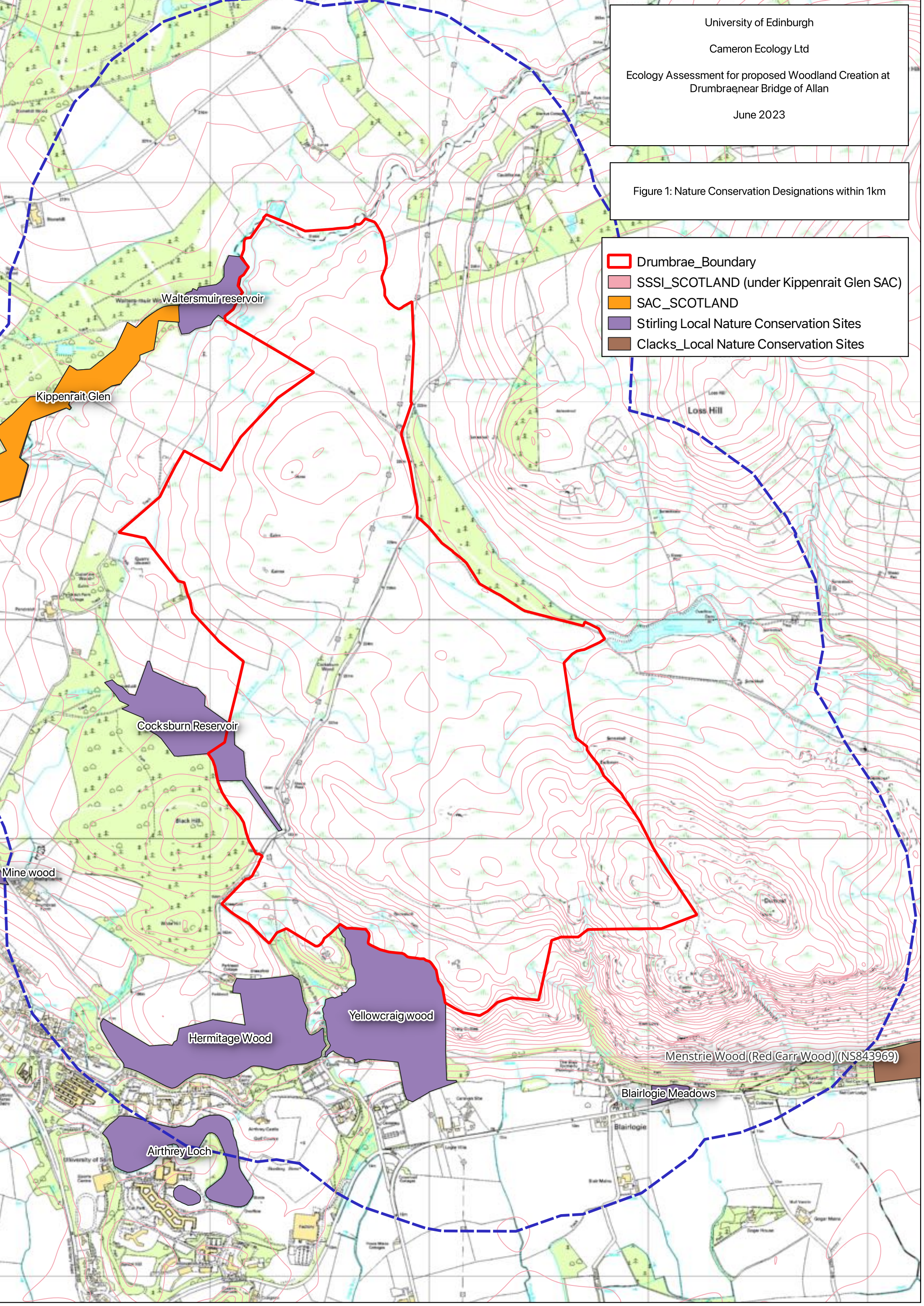
The design has been able to respond well to the habitat constraints identified as being present; all of the high value habitats present have been retained as open ground in the current design. For most of the areas identified as being of intermediate value for nature conservation, the net effect of proposed planting with predominantly broadleaved woodland and scots pine forestry is likely to be positive in biodiversity terms.

Effects on breeding birds have been considered. Within the overall upland bird assemblage, the species of most conservation concern is curlew, and the proposals are likely to result in the area becoming unsuitable for this species in the long term, resulting in the likely loss of up to three territories. In this case there is an opportunity to study the responses of curlew to planting in more detail, and potentially to undertake research on management options that may mitigate effects on breeding waders such as curlew.





















The proposal provides a number of opportunities for enhancement and positive management. The resources of the University may mean that a number of innovative approaches to management and monitoring can be undertaken at this site. There is an opportunity to enhance existing habitats through positive management.

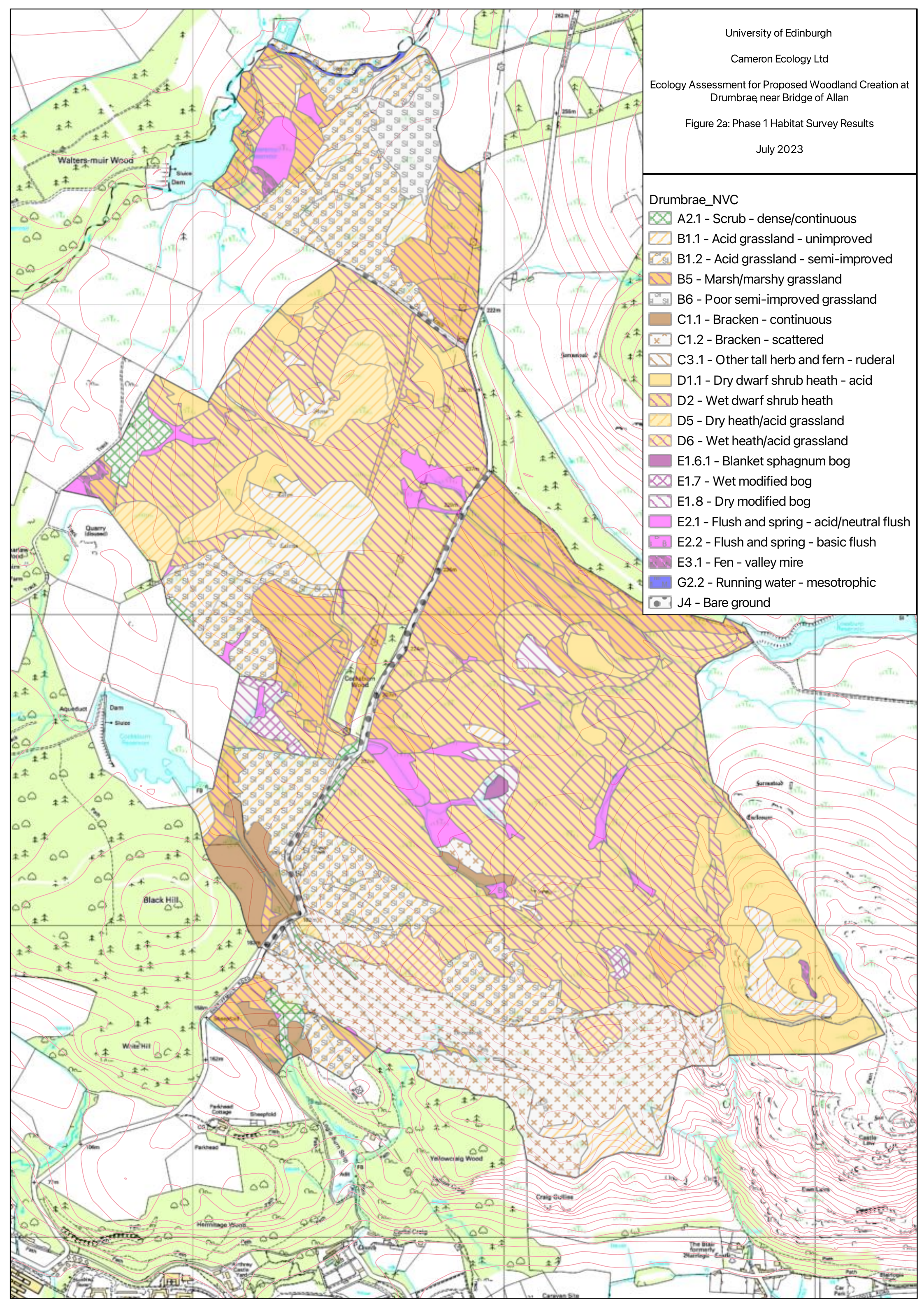
Figure 1: Nature Conservation Designations within 1km

- Drumbrae_Boundary
- SSSI_SCOTLAND (under Kippenrait Glen SAC)
- SAC_SCOTLAND
- Stirling Local Nature Conservation Sites
- Clacks_Local Nature Conservation Sites



Drumbrae_NVC

-  A2.1 - Scrub - dense/continuous
-  B1.1 - Acid grassland - unimproved
-  B1.2 - Acid grassland - semi-improved
-  B5 - Marsh/marshy grassland
-  B6 - Poor semi-improved grassland
-  C1.1 - Bracken - continuous
-  C1.2 - Bracken - scattered
-  C3.1 - Other tall herb and fern - ruderal
-  D1.1 - Dry dwarf shrub heath - acid
-  D2 - Wet dwarf shrub heath
-  D5 - Dry heath/acid grassland
-  D6 - Wet heath/acid grassland
-  E1.6.1 - Blanket sphagnum bog
-  E1.7 - Wet modified bog
-  E1.8 - Dry modified bog
-  E2.1 - Flush and spring - acid/neutral flush
-  E2.2 - Flush and spring - basic flush
-  E3.1 - Fen - valley mire
-  G2.2 - Running water - mesotrophic
-  J4 - Bare ground



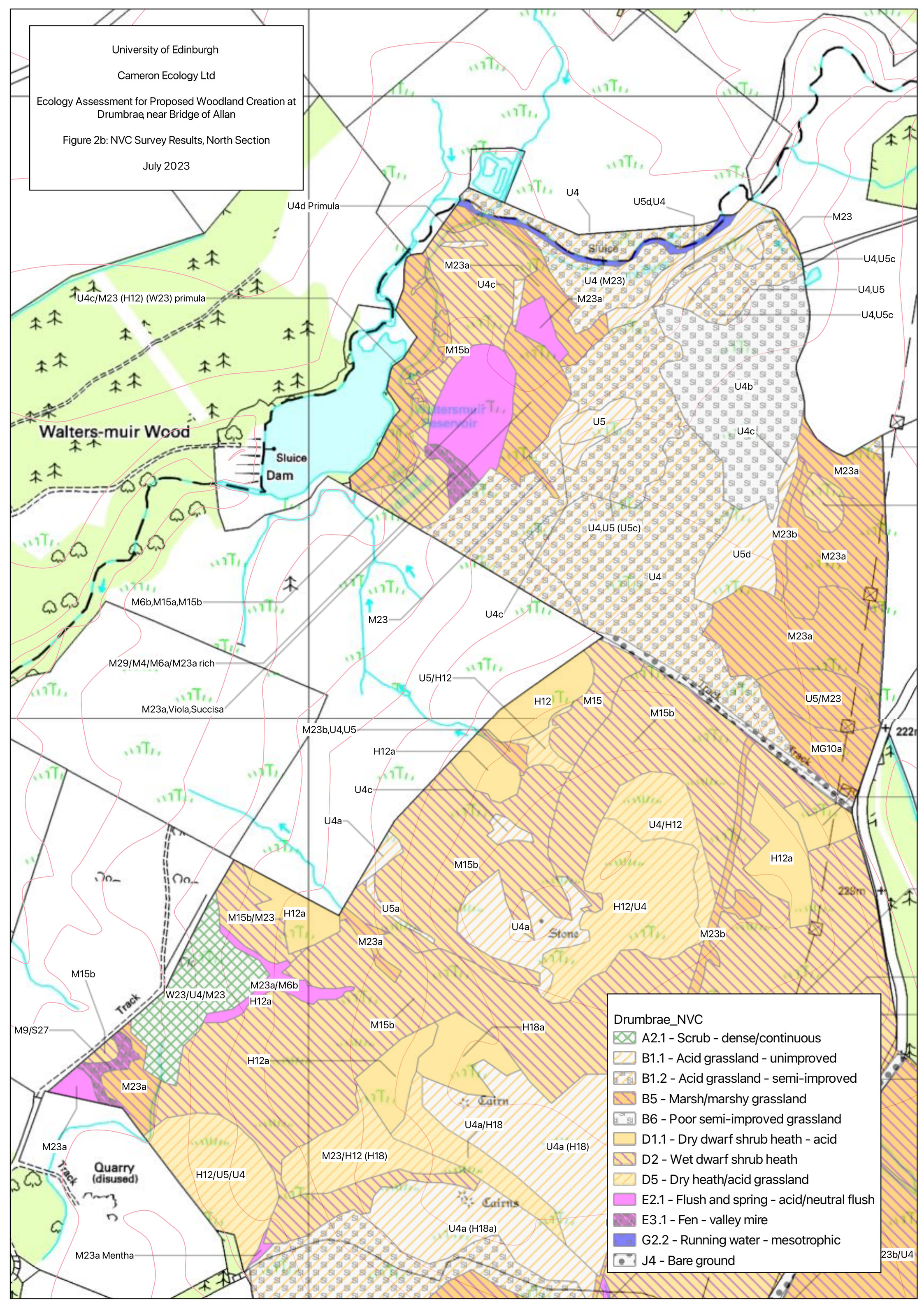
University of Edinburgh

Cameron Ecology Ltd

Ecology Assessment for Proposed Woodland Creation at
Drumbrae, near Bridge of Allan

Figure 2b: NVC Survey Results, North Section

July 2023



University of Edinburgh


















Cameron Ecology Ltd

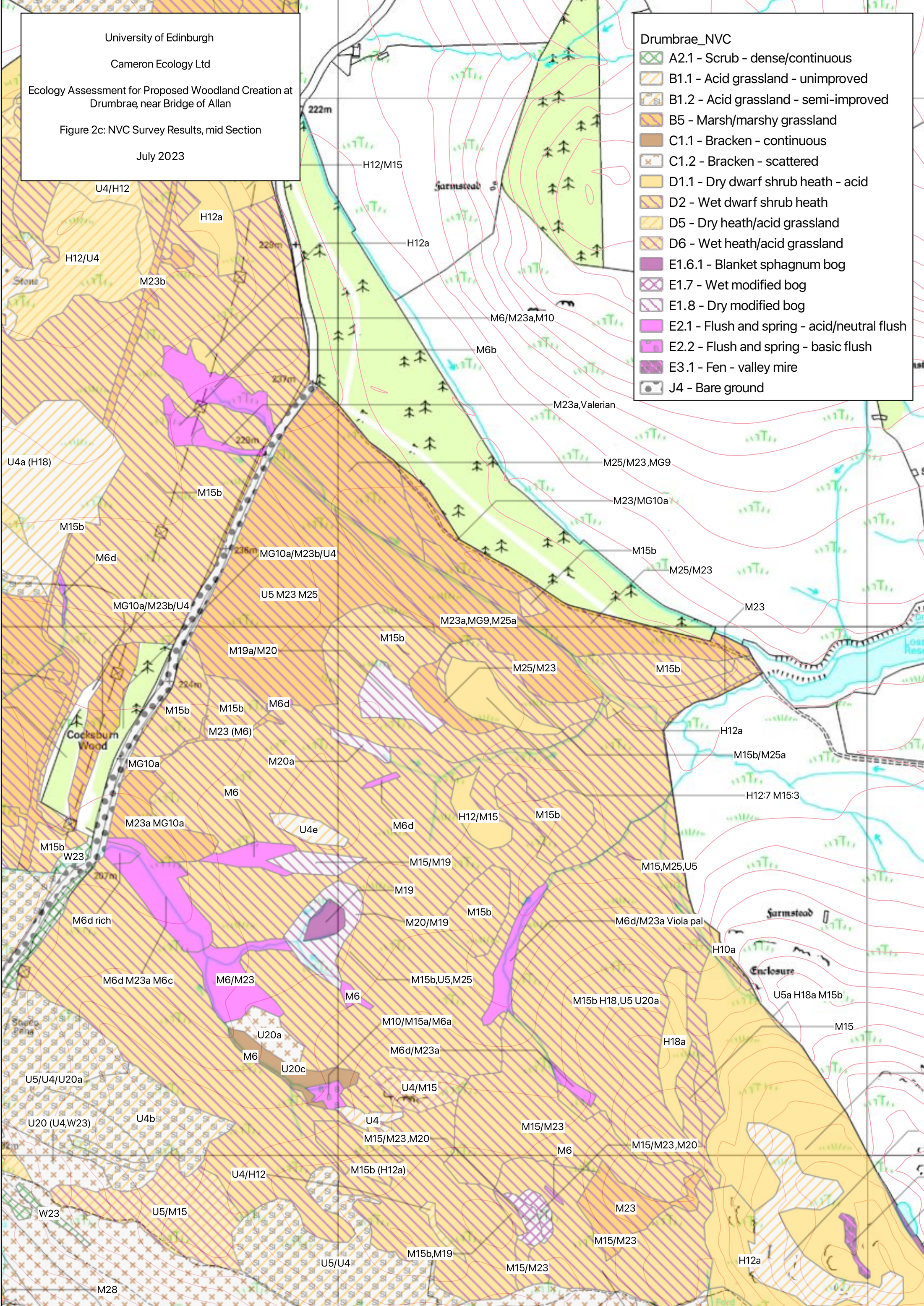
Ecology Assessment for Proposed Woodland Creation at
Drumbrae, near Bridge of Allan

Figure 2c: NVC Survey Results, mid Section

July 2023

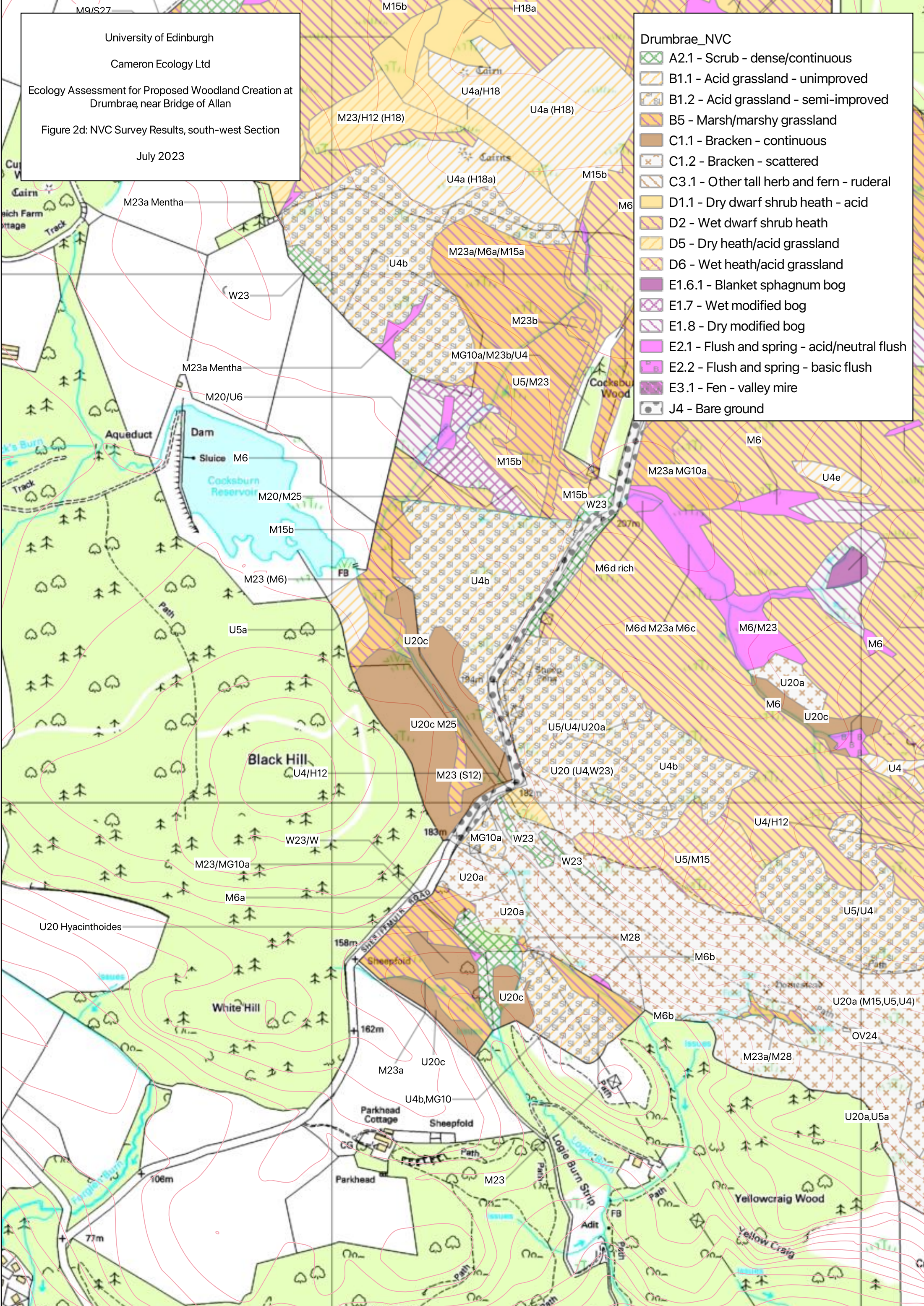
Drumbrae_NVC

-  A2.1 - Scrub - dense/continuous
-  B1.1 - Acid grassland - unimproved
-  B1.2 - Acid grassland - semi-improved
-  B5 - Marsh/marshy grassland
-  C1.1 - Bracken - continuous
-  C1.2 - Bracken - scattered
-  D1.1 - Dry dwarf shrub heath - acid
-  D2 - Wet dwarf shrub heath
-  D5 - Dry heath/acid grassland
-  D6 - Wet heath/acid grassland
-  E1.6.1 - Blanket sphagnum bog
-  E1.7 - Wet modified bog
-  E1.8 - Dry modified bog
-  E2.1 - Flush and spring - acid/neutral flush
-  E2.2 - Flush and spring - basic flush
-  E3.1 - Fen - valley mire
-  J4 - Bare ground



University of Edinburgh
 Cameron Ecology Ltd
 Ecology Assessment for Proposed Woodland Creation at
 Drumbrae, near Bridge of Allan
 Figure 2d: NVC Survey Results, south-west Section
 July 2023

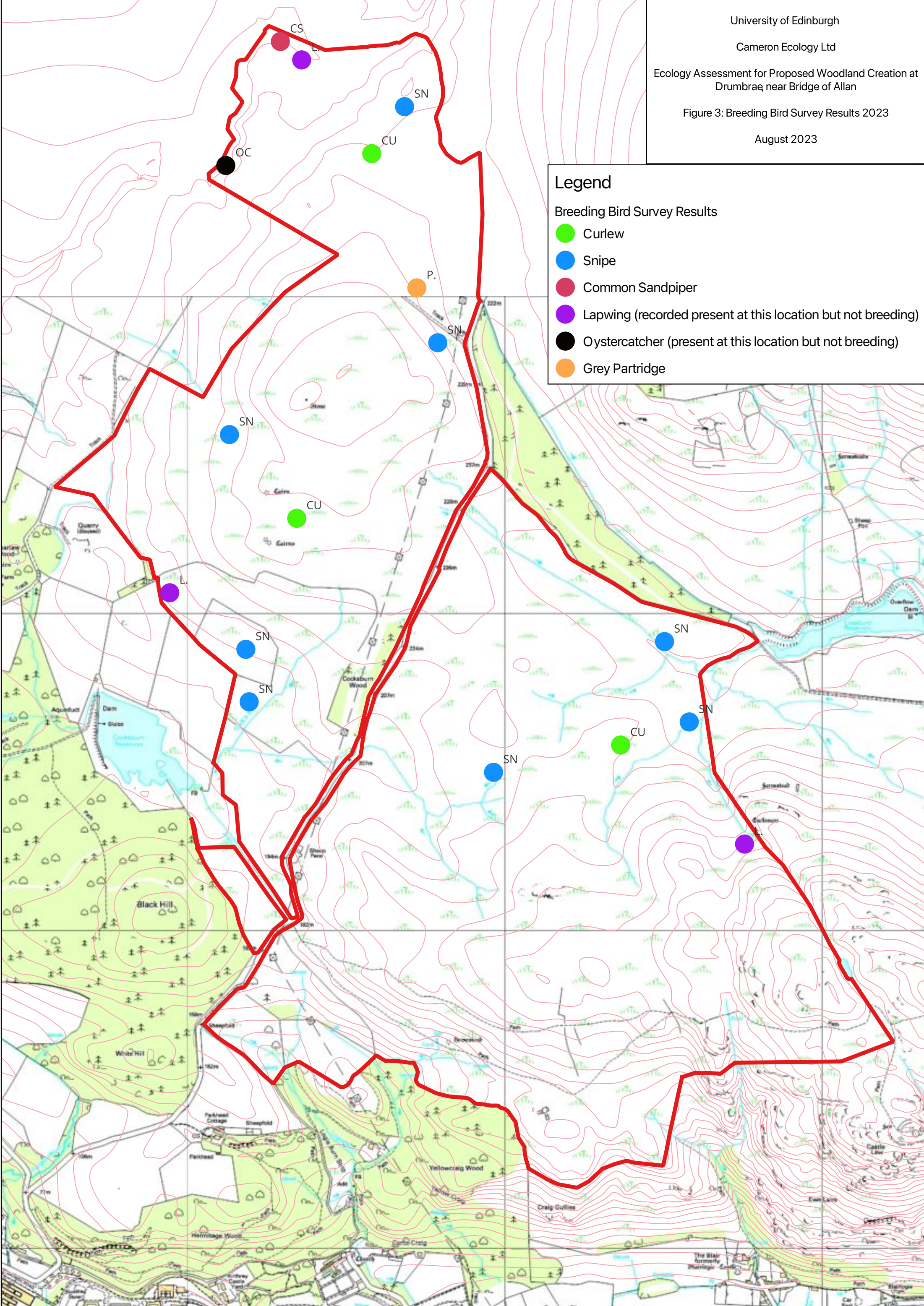
- Drumbrae_NVC**
- A2.1 - Scrub - dense/continuous
 - B1.1 - Acid grassland - unimproved
 - B1.2 - Acid grassland - semi-improved
 - B5 - Marsh/marshy grassland
 - C1.1 - Bracken - continuous
 - C1.2 - Bracken - scattered
 - C3.1 - Other tall herb and fern - ruderal
 - D1.1 - Dry dwarf shrub heath - acid
 - D2 - Wet dwarf shrub heath
 - D5 - Dry heath/acid grassland
 - D6 - Wet heath/acid grassland
 - E1.6.1 - Blanket sphagnum bog
 - E1.7 - Wet modified bog
 - E1.8 - Dry modified bog
 - E2.1 - Flush and spring - acid/neutral flush
 - E2.2 - Flush and spring - basic flush
 - E3.1 - Fen - valley mire
 - J4 - Bare ground



Legend

Breeding Bird Survey Results

- Curlew
- Snipe
- Common Sandpiper
- Lapwing (recorded present at this location but not breeding)
- Oystercatcher (present at this location but not breeding)
- Grey Partridge



Drumbrae_Boundary

Wader_analysis 2021

Curlew

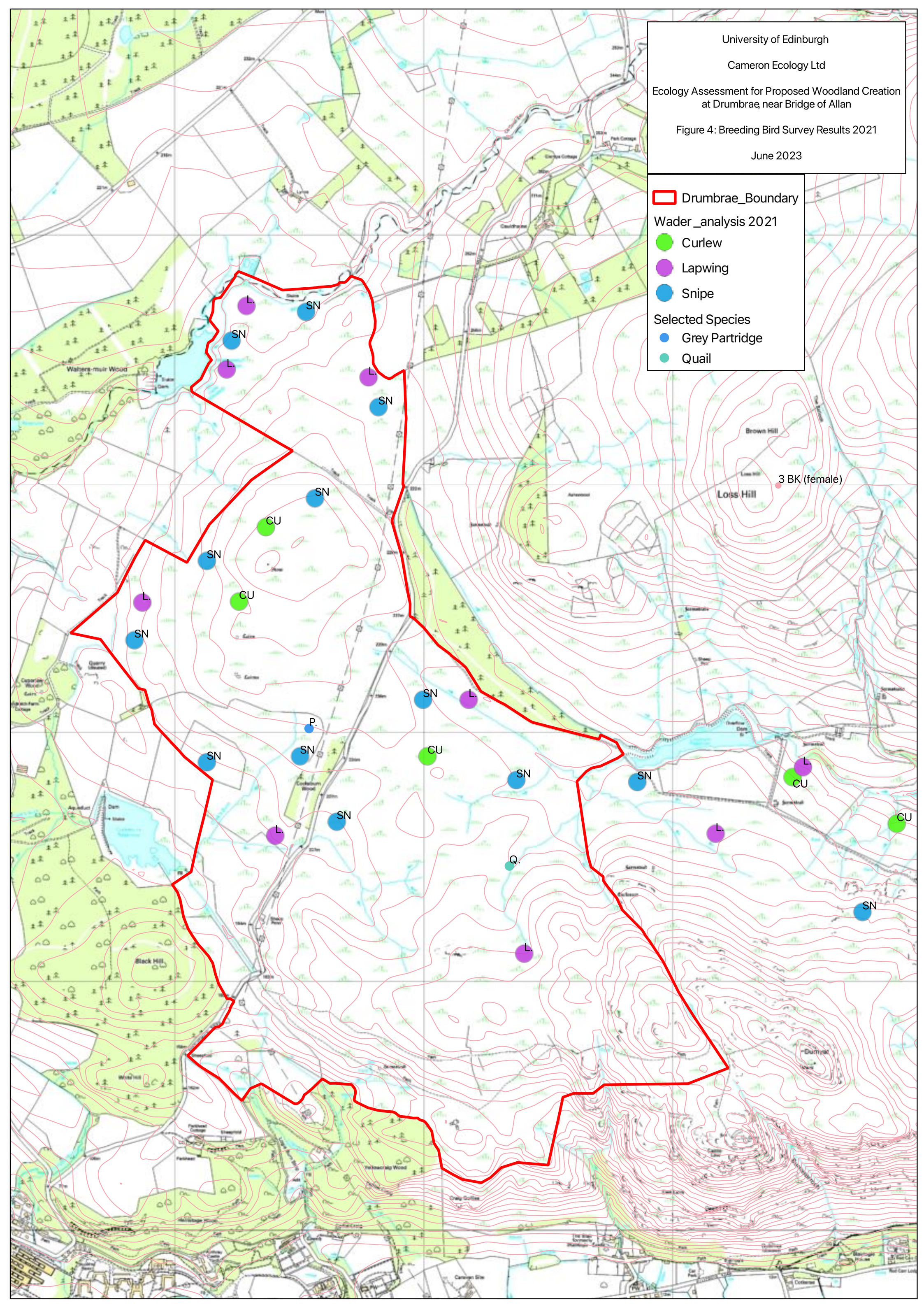
Lapwing

Snipe

Selected Species

Grey Partridge

Quail



APPENDIX 1: Species List and Target Notes and Summary Statistics

Phase 1 Habitat Survey Summary Statistics

Habitat Code	Habitat	Area (ha)	Area (%)
A1.3.2	Mixed Plantation Woodland	2.657	1%
A2.1	Scrub	5.26	1%
B1.1	Unimproved acid grassland	26.961	6%
B1.2	Semi-improved acid grassland	53.814	12%
B5	Marshy grassland	61.344	14%
B6	Species-poor semi-improved grassland	5.713	1%
C1.1	Dense bracken	8.865	2%
C1.2	Scattered bracken	42.237	10%
C3.1	Ruderal	0.087	0.02%
D1.1	Dry heath (acid)	28.294	6%
D2	Wet heath	160.154	37%
D5	Dry heath / Acid grassland mosaic	12.669	3%
D6	Wet heath / Acid grassland mosaic	5.961	1%
E1.6.1	Blanket bog	0.47	0.1%
E1.7	Wet modified bog	2.409	1%
E1.8	Dry modified bog	3.996	1%
E2.1	Acid Flush	11.125	3%
E2.2	Base-rich flush	0.246	0.1%
E3.1	Valley mire	0.895	0.2%
G2.2	Running water	0.443	0.1%
I1.2	Quarry	0.21	0.05%
J4	Tracks/Bare Ground	4.328	1%
Grand Total		438.138	

Vascular Plants and Bryophytes

251 Species

Species	English Name
<i>Acer platanoides</i>	Norway maple
<i>Acer pseudoplatanus</i>	Sycamore
<i>Achillea millefolium</i>	Yarrow
<i>Achillea ptarmica</i>	Sneezewort
<i>Aesculus hippocastanum</i>	Horse chestnut
<i>Agrostis canina</i>	Velvet bent
<i>Agrostis capillaris</i>	Common bent
<i>Aira praecox</i>	Early hair-grass
<i>Ajuga reptans</i>	Bugle
<i>Alchemilla glabra</i>	Smooth lady's-mantle
<i>Alchemilla xanthochlora</i>	A lady's mantle
<i>Allium ursinum</i>	Ramsons
<i>Alnus glutinosa</i>	Alder
<i>Andreaea cf rupestris</i>	A moss
<i>Anemone nemorosa</i>	Wood anemone
<i>Anthoxanthum odoratum</i>	Sweet vernal-grass
<i>Anthriscus sylvestris</i>	Cow parsley
<i>Arctium minus</i>	Lesser burdock
<i>Arrhenatherum elatius</i>	False oat-grass
<i>Asplenium adiantum-nigrum</i>	Black spleenwort
<i>Asplenium trichomanes</i>	Maidenhair spleenwort
<i>Atrichum sp</i>	A moss
<i>Aulacomnium palustre</i>	A moss
<i>Avenella flexuosa</i>	Wavy hair-grass
<i>Avenula pubescens</i>	Downy oat-grass
<i>Betula pendula</i>	Silver birch
<i>Bistorta vivipara</i>	Alpine bistort
<i>Blechnum spicant</i>	Hard fern
<i>Brachypodium sylvaticum</i>	False-brome
<i>Brachythecium rivulare</i>	A moss
<i>Brachythecium rutabulum</i>	A moss
<i>Briza media</i>	Quaking-grass
<i>Bromus hordeaceus</i>	Hairy brome
<i>Bryum pseudotriquetrum</i>	A moss
<i>Bryum sp</i>	A moss
<i>Buddleia davidii</i>	Buddleja
<i>Calliergonella cuspidata</i>	A moss
<i>Callitriche stagnalis</i>	Common water-starwort

Species	English Name
<i>Caltha palustris</i>	Marsh marigold
<i>Calluna vulgaris</i>	Heather
<i>Cardamine amara</i>	Large bitter-cress
<i>Cardamine hirsuta</i>	Hairy bitter-cress
<i>Cardamine pratensis</i>	Cuckooflower
<i>Carex binervis</i>	Green-ribbed sedge
<i>Carex demissa</i>	Common yellow-sedge
<i>Carex dioica</i>	Dioecious sedge
<i>Carex echinata</i>	Star sedge
<i>Carex disticha</i>	Brown sedge
<i>Carex flacca</i>	Glaucous sedge
<i>Carex hostiana</i>	Tawny sedge
<i>Carex leporina</i>	Oval sedge
<i>Carex nigra</i>	Common sedge
<i>Carex panicea</i>	Carnation sedge
<i>Carex pilulifera</i>	Pill sedge
<i>Carex pulicaris</i>	Flea sedge
<i>Carex rostrata</i>	Bottle sedge
<i>Centaurea nigra</i>	Common knapweed
<i>Cerastium fontanum</i>	Common mouse-ear
<i>Ceratocapnos claviculata</i>	Climbing corydalis
<i>Chamaenerion angustifolium</i>	Rosebay willowherb
<i>Chrysosplenium oppositifolium</i>	Opposite-leaved golden-saxifrage
<i>Cirsium arvense</i>	Creeping thistle
<i>Cirsium palustre</i>	Marsh thistle
<i>Cirsium vulgare</i>	Field thistle
<i>Climacium dendroides</i>	A moss
<i>Comarum palustris</i>	Marsh cinquefoil
<i>Conopodium majus</i>	Pignut
<i>Corylus avellana</i>	Hazel
<i>Cratoneuron filicinum</i>	A moss
<i>Cruciata laevipes</i>	Crosswort
<i>Ctenidium molluscum</i>	A moss
<i>Cynosurus cristatus</i>	Crested dog's-tail
<i>Dactylorhiza fuchsii</i>	Common spotted-orchid
<i>Dactylorhiza maculata</i>	Heath spotted-orchid
<i>Dactylorhiza purpurella</i>	Northern marsh-orchid
<i>Deschampsia cespitosa</i>	Tufted hair-grass
<i>Dicranum scoparium</i>	A moss
<i>Digitalis purpurea</i>	Foxglove
<i>Doronicum sp</i>	Leopard's-bane

Species	English Name
<i>Drosera rotundifolia</i>	Round-leaved sundew
<i>Dryopteris affinis affinis</i>	Scaly male-fern
<i>Empetrum nigrum</i>	Crowberry
<i>Epilobium ciliatum</i>	American willowherb
<i>Epilobium montanum</i>	Broad-leaved willowherb
<i>Epilobium palustre</i>	Marsh willowherb
<i>Equisetum arvense</i>	Field horsetail
<i>Equisetum fluviatile</i>	Water horsetail
<i>Equisetum palustre</i>	Marsh horsetail
<i>Equisetum sylvaticum</i>	Wood horsetail
<i>Erica cinerea</i>	Bell heather
<i>Erica tetralix</i>	Cross-leaved heath
<i>Eriophorum angustifolium</i>	Common cottongrass
<i>Eriophorum vaginatum</i>	Hare's-tail cottongrass
<i>Festuca rubra</i>	Red fescue
<i>Festuca ovina</i>	Sheep's fescue
<i>Ficaria verna</i>	Lesser celandine
<i>Filipendula ulmaria</i>	Meadowsweet
<i>Fontinalis antipyretica</i>	A moss
<i>Fraxinus excelsior</i>	Ash
<i>Galeopsis tetrahit</i>	Rough hemp-nettle
<i>Galium odoratum</i>	Woodruff
<i>Galium saxatile</i>	Heath bedstraw
<i>Galium uliginosum</i>	Fen bedstraw
<i>Galium verum</i>	Lady's bedstraw
<i>Geranium robertianum</i>	Herb Robert
<i>Geum urbanum</i>	Wood avens
<i>Grimmia pulvinata</i>	A moss
<i>Hedera helix</i>	Ivy
<i>Helianthemum nummularia</i>	Common rock-rose
<i>Heracleum sphondylium</i>	Hogweed
<i>Holcus lanatus</i>	Yorkshire fog
<i>Holcus mollis</i>	Creeping soft-grass
<i>Hyacinthoides non-scripta</i>	Bluebell
<i>Hylocomium splendens</i>	A moss
<i>Hypericum maculatum</i>	Perforate St John's-wort
<i>Hypericum pulchrum</i>	Slender St-John's-wort
<i>Hypericum sp</i>	A St-John's-wort species
<i>Hypericum tetrapterum</i>	Square-stalked St-John's-wort
<i>Hypnum jutlandicum</i>	A moss
<i>Ilex aquifolium</i>	Holly

Species	English Name
<i>Iris pseudacorus</i>	Flag iris
<i>Jacobaea vulgaris</i>	Ragwort
<i>Juncus acutiflorus</i>	Sharp-flowered rush
<i>Juncus effusus</i>	Soft-rush
<i>Juncus inflexus</i>	Hard rush
<i>Juncus squarrosus</i>	Heath rush
<i>Kindbergia prealunga</i>	A moss
<i>Lathyrus linifolius</i>	Bitter-vetch
<i>Lathyrus pratensis</i>	Meadow vetchling
<i>Leucobryum glaucum</i>	A moss
<i>Linum catharticum</i>	Fairy flax
<i>Lolium perenne</i>	Perennial rye-grass
<i>Lonicera periclymenum</i>	Honeysuckle
<i>Lotus corniculatus</i>	Bird's-foot trefoil
<i>Lotus pedunculatus</i>	Greater bird's-foot trefoil
<i>Luzula campestris</i>	Field woodrush
<i>Luzula multiflora</i>	Heath woodrush
<i>Luzula multiflora ssp multiflora</i>	Heath woodrush
<i>Luzula pilosa</i>	Hairy woodrush
<i>Luzula sylvatica</i>	Greater woodrush
<i>Lycopodium clavatum</i>	Stag's horn clubmoss
<i>Lysimachia europaea</i>	Chickweed wintergreen
<i>Lysimachia nemorum</i>	Yellow pimpernel
<i>Matricaria discoidea</i>	Pineappleweed
<i>Medicago lupulina</i>	Black medick
<i>Melica uniflora</i>	Wood melick
<i>Mentha aquatica</i>	Water mint
<i>Mercurialis perennis</i>	Dog's mercury
<i>Metzgeria sp</i>	A moss
<i>Molinia caerulea</i>	Purple moor-grass
<i>Myosotis arvensis</i>	Field forget-me-not
<i>Myosotis secunda</i>	Creeping forget-me-not
<i>Nardus stricta</i>	Mat-grass
<i>Narthecium ossifragum</i>	Bog asphodel
<i>Oxalis acetosella</i>	Wood sorrel
<i>Papaver cambricum</i>	Welsh poppy
<i>Pedicularis palustris</i>	Marsh lousewort
<i>Pedicularis sylvatica</i>	Lousewort
<i>Persicaria maculosa</i>	Redshank
<i>Philonotis fontana</i>	A moss
<i>Picea aibes</i>	Norway spruce

Species	English Name
<i>Pilosella officinalis</i>	Mouse-ear hawkweed
<i>Pinguicula vulgaris</i>	Butterwort
<i>Pinus sylvestris</i>	Scot's pine
<i>Plantago lanceolata</i>	Ribwort plantain
<i>Plantago major</i>	Broad-leaved plantain
<i>Pleurozium schreberi</i>	A moss
<i>Poa pratensis</i>	Smooth meadow-grass
<i>Polygala serpyllifolia</i>	Heath milkwort
<i>Polypodium vulgare</i>	Polypody
<i>Polytrichum commune</i>	A moss
<i>Polytrichum juniperinum</i>	A moss
<i>Potamogeton polygonifolius</i>	Bog pondweed
<i>Potentilla erecta</i>	Tormentil
<i>Potentilla sterilis</i>	Barren strawberry
<i>Primula vulgaris</i>	Wild Primrose
<i>Prunus avium</i>	Wild cherry, gean
<i>Prunus spinosa</i>	Blackthorn
<i>Pseudoscleropodium purum</i>	A moss
<i>Pteridium aquilinum</i>	Bracken
<i>Pyrus sp</i>	Wild pear?
<i>Quercus sp</i>	Oak
<i>Racomitrium aciculare</i>	A moss
<i>Racomitrium lanuginosum</i>	A moss
<i>Ranunculus acris</i>	Field buttercup
<i>Ranunculus flammula</i>	Spearwort
<i>Ranunculus repens</i>	Creeping buttercup
<i>Rhytidiadelphus loreus</i>	A moss
<i>Rhytidiadelphus squarrosus</i>	A moss
<i>Rhytidiadelphus triquetrus</i>	A moss
<i>Rubus idaeus</i>	Raspberry
<i>Rumex acetosa</i>	Sorrel
<i>Rumex longifolius</i>	Northern dock
<i>Rumex obtusifolius</i>	Broad-leaved dock
<i>Sagina procumbens</i>	Procumbent pearlwort
<i>Sagina subulata</i>	Heath pearlwort
<i>Salix caprea</i>	Goat willow
<i>Saxifraga hypnoides</i>	Mossy saxifrage
<i>Scapania gracilis</i>	A moss
<i>Scorpidium cossonii</i>	A moss
<i>Scrophularia nodosa</i>	Common figwort
<i>Sedum anglicum</i>	English stonecrop

Species	English Name
<i>Selaginella selaginoides</i>	Lesser clubmoss
<i>Senecio vulgaris</i>	Groundsel
<i>Silene dioica</i>	Red campion
<i>Sorbus aucuparia</i>	Rowan
<i>Spergularia rubra</i>	Sand spurrey
<i>Sphagnum capillifolium</i>	A bog-moss
<i>Sphagnum cuspidatum</i>	A bog-moss
<i>Sphagnum fallax</i>	A bog-moss
<i>Sphagnum medium</i>	A bog-moss
<i>Sphagnum palustre</i>	A bog-moss
<i>Sphagnum papillosum</i>	A bog-moss
<i>Sphagnum rubellum</i>	A bog-moss
<i>Stachys sylvatica</i>	Hedge woundwort
<i>Stellaria graminea</i>	Lesser stitchwort
<i>Stellaria holostea</i>	Greater stitchwort
<i>Stellaria media</i>	Common chickweed
<i>Succisa pratensis</i>	Devil's-bit scabious
<i>Symphytum tuberosum</i>	Comfrey
<i>Taraxacum officinale ag.</i>	Dandelion sp
<i>Taraxacum palustre?</i>	Marsh dandelion ?
<i>Taxus baccata</i>	Yew
<i>Teucrium scorodonia</i>	Wood sage
<i>Thamnobryum alopecurum</i>	A moss
<i>Thuidium tamariscinum</i>	A moss
<i>Thymus drucei</i>	Wild thyme
<i>Tilia x europaea</i>	Lime
<i>Tomentypnum nitens</i>	A moss
<i>Trichophorum germanicum</i>	Deergrass
<i>Trifolium campestre</i>	Hop trefoil
<i>Trifolium repens</i>	White clover
<i>Triglochin palustris</i>	Marsh arrowgrass
<i>Tussilago farfara</i>	Colt's foot
<i>Typha latifolia</i>	Bullrush
<i>Ulex europaeus</i>	Gorse
<i>Ulmus glabra</i>	Wych elm
<i>Ulota sp</i>	A moss
<i>Urtica dioica</i>	Stinging-nettle
<i>Vaccinium myrtillus</i>	Blaeberry
<i>Vaccinium oxycoccos</i>	Cranberry
<i>Vaccinium vitis-idea</i>	Cowberry
<i>Valeriana officinalis</i>	Valerian

APPENDIX 2: Breeding Bird Survey Methods and Results

2021 BLACK GROUSE SURVEYS

Date	31 March 2021	21 April 2021
Observer	P Carroll & G Dunbar	RC Whytock
Survey	Black Grouse	Black Grouse
Start time	05:50	04:50
Finish time	08:50	07:50
Sunrise	06:51	05:54
Wind Speed (Beaufort)	2	2
Wind Direction	SE	N, NE
Rain	No	No
Cloud cover (octads)	8	7-8
Cloud height	>500m	>500m
Visibility	>2km	>2km
Frost or Snow?	No	Ground frost in hr 1

2021 BREEDING BIRD SURVEYS

Date	19 April 2021	10 May 2021	11 &13 June 2021
Observers	V Hastie G Dunbar M Wood	V Hastie G Dunbar M Wood	V Hastie G Dunbar M Wood
Survey	Breeding Birds	Breeding Birds	Breeding Birds
Start time	08:30	07:45	08:10
Finish time	14:30	14:00	12:50
Sunrise	06:00	05:20	04:30
Wind Speed (Beaufort)	1-3	1-3	3-4
Wind Direction	SW, W, SE	N, S, SW	W, SW
Rain	No	Light hail in hr 1, 3 and 6 in north	No
Cloud cover (octads)	3-7	4-7	5-8
Cloud height	>500m	>500m	>500m
Visibility	>2km	>2km	>2km
Frost or Snow?	No	No	No

2021 RAPTOR WATCHES

Date	19 May 2021	18 June 2021
Observer	P Higginson	P Higginson
Survey	Raptors	Raptors
Start time	12:25	04:25
Finish time	18:25	10:25
Sunrise	04:54	04:26
Wind Speed (Beaufort)	3	2-3
Wind Direction	W	N
Rain	Light showers in hours 5 & 6	No
Cloud cover (octads)	4-7	1-7
Cloud height	>500m	>500m
Visibility	>2km	>2km
Frost or Snow?	No	No

2023 BREEDING BIRD SURVEYS

Date	14 April 2023	12 May 2021	9 June 2021
Observers	AJ McNab	S Taylor	S Taylor
Survey	Breeding Birds	Breeding Birds	Breeding Birds
Start time	08:30	08:30	08:30
Finish time	14:30	14:40	14:30
Sunrise	06:13	05:08	04:30
Wind Speed (Beaufort)	2	2-3 (4)	3
Wind Direction	E	S, SE, SSE, E	E, ESE
Rain	No	No	No
Cloud cover (octads)	6-8	8 at start reducing to 2 at end	8, 7 for first couple of hours reducing to 3 by end of survey
Cloud height	>500m	>500m	>500m
Visibility	>2km	1-2km for first couple of hours, then >2km for rest of survey	>2km
Frost or Snow?	No	No	No

Bird Survey Results: Species List

Sixty-nine species were recorded between 2021 and 2023, with details provided below. These numbers in most cases are not based on territory analysis but are simply maximum counts from across the four visits. Selected species in bold are shown on **Figures 3-4**.

Species Code	Species	Conservation Status (BOCC)	Number of Territories in 2021 ³²	Number of Territories in 2023
B.	Blackbird	G	5	2
BC	Blackcap	G	1	_33
BH	Black-headed gull		0	0
BT	Blue tit	G	2	-
BZ	Buzzard	G	2	2
C.	Carrion Crow	G	33	2
CC	Chiffchaff	G	1	9
CH	Chaffinch	G	26	6
CK	Cuckoo	R	3	3
CM	Common gull	A	0	0
CT	Coal tit	G	1	1
CU	Curlew	R	3	3
CS	Common sandpiper	A	0	1
CR	Common crossbill	G	0	0
D.	Dunnock	A	6	13
DI	Dipper	A	0	1
DV	Feral pigeon	G	0	0
G.	Green woodpecker	G	2	1
GB	Great black-backed gull	A	0	0
GC	Goldcrest	G	2	-
GH	Grasshopper warbler	R	4	7
GJ	Greylag goose	A	0	0
GO	Goldfinch	G	14	10
GS	Great spotted woodpecker	G	1	-
GT	Great tit	G	2	-
GW	Garden warbler	G	1	-
H.	Grey heron	G	0	0
HG	Herring gull	R	0	0
HM	House martin	A	0	-

³² Note that this included a larger survey area including adjacent land to the east, now planted.

³³ Not recorded in 2023. Species present but not breeding are denoted by a 0.

Species Code	Species	Conservation Status (BOCC)	Number of Territories in 2021 ³²	Number of Territories in 2023
J.	Jay	G	0	0
K.	Kestrel	A	1	1
KT	Red kite	G	0	0 ³⁴
L.	Lapwing	R	4³⁵	3
LB	Lesser black-backed gull	A	0	0
LI	Linnet	R	9	12
LR	Lesser redpoll	R	4	2
LT	Long-tailed tit	G	1	-
M.	Mistle thrush	R	1	7
MA	Mallard	A	5	4
MG	Magpie	G	1	-
MP	Meadow pipit	A	160	160 ³⁶
OC	Oystercatcher	A	0	0
P.	Grey partridge	R	1	1
PE	Peregrine	G	0	0
PH	Pheasant	G	11	0
PW	Pied wagtail	G	1	0
Q.	Quail	A	1	-
R.	Robin	G	4	-
RB	Reed bunting	A	5	17
RG	Red grouse	A	1	14 ³⁷
RL	Red-legged partridge	G	4	0
RN	Raven	G	0	0
S.	Skylark	R	51	103 ³⁸
SC	Stonechat	G	5	17
SF	Spotted flycatcher	R	0	1
SI	Swift	A	0	0
SG	Starling	R	0	0
SK	Siskin	G	6	-
SL	Swallow	G	0	0
SM	Sand martin	G	0	-

³⁴ Breeding very nearby

³⁵ Breeding not confirmed

³⁶ Co-incidence that the territory numbers are 160 for both survey periods, despite numbers varying between visits in both survey periods.

³⁷ This number seems high, but is based on a max count from the May visit.

³⁸ As noted in the text, this number is technically an average of total observations, not territories.

Species Code	Species	Conservation Status (BOCC)	Number of Territories in 2021 ³²	Number of Territories in 2023
SN	Snipe	A	7	9³⁹
ST	Song thrush	R	2	5
SW	Sedge warbler	G	1	-
TP	Tree pipit	R	6	6
W.	Wheatear	G	15	5
WC	Whinchat	R	4	7
WH	Whitethroat	G	2	9
WP	Woodpigeon	G	2	8
WR	Wren	A	4	12
WW	Willow warbler	A	13	21
Y.	Yellowhammer	R	1	4

³⁹ None territories based on a max count from any one individual visit (in this case the April visit). Territory analysis suggests the figure could be as high as 15.

APPENDIX 3: Butterfly Surveys

Date/Time	24-Jun-23	
Weather	9.00 to 13.30 Overcast occasional sun, 23 C, mainly light to moderate breeze occasionally still and sheltered	
Survey by	Colin and Yvonne Edwards	
Sighting	Latitude	Longitude
2 ringlets and chocolate mining bee	56.15939	-3.91097
Meadow brown x1	56.15813	-3.90936
Yellow shell day flying moth x1	56.15757	-3.90754
Small heath x1 and ringlet x1	56.15747	-3.90737
Chimney sweep x1	56.15744	-3.90731
Small pearl bordered fritillary 1	56.15704	-3.90572
Meadow brown x1	56.15689	-3.90567
Small heath x1	56.15676	-3.90509
Small heath x1	56.15676	-3.90483
Meadow brown x1	56.15555	-3.90264
Meadow brown x1 and ringlets x3	56.15544	-3.90243
Ringlets x2	56.15535	-3.90227
Yellow shell day flying moth x1	56.1552	-3.90197
Ringlet x3	56.1548	-3.90092
Small heath x1	56.15446	-3.89935
Ringlet 2	56.15423	-3.89891
Fritillary probable green x1 and meadow brown x1	56.15535	-3.89795
Caterpillars peacock butterfly	56.15529	-3.89792
Small p b fritillary	56.15859	-3.89352
Ringlet x1 and small pearl bordered fritillary x1 and 2 X small heath	56.159	-3.89395
Small p b fritillary x1	56.15944	-3.89458
Common blue x1	56.15945	-3.89467
Dark green fritillary x1	56.15954	-3.8946
Small pearl bordered fritillary x2	56.15978	-3.89517
Small heath x2	56.15934	-3.90012
Small heath x4	56.15933	-3.90088
Small heath x2	56.15933	-3.90088
Small heath x1	56.15977	-3.90611
Peacock butterflies caterpillars on nettles	56.16015	-3.90682
Small heath x2	56.16103	-3.90909
Ringlet x1	56.16138	-3.90975
Meadow brown and ringlet x2	56.16155	-3.90992
Small pearl bordered fritillary x1	56.16003	-3.91314
Small pearl bordered fritillary x2 and ringlets x12	56.16013	-3.9144
Chimney sweep x2	56.16064	-3.91514
Small heath, ringlets common blue damsel flies	56.16181	-3.91591
Small heath x1	56.16196	-3.91703

Date/Time: 09/07/2023, 11am to 1.30pm		
Weather: Sunny with some cloud, 19 to 22 C, clam to light breeze		
Survey by: Colin and Yvonne Edwards		
Notes: Did not record ringlets and meadow browns as they were abundant everywhere searched the front face above Future Forest site for rock rose and northern brown argus (search Noon to 13.00) and none found. Habitat not suitable as the Future forest area recorded moths and any other unusual insects		
Title	Latitude	Longitude
Small heath x1	56.16096	-3.90875
Small heath x1	56.16003	-3.90623
Small heath x1	56.15981	-3.90553
Small heath x2	56.15931	-3.90058
Small heath x2	56.15924	-3.90055
Small heath x1	56.15924	-3.90055
Small heath x2	56.15921	-3.8984
Burnet moth 6 spot x1	56.15935	-3.89445
Dark green fritillary X 1	56.15934	-3.89452
Narrow boarded 5 spot burnet x1 and small heath x1	56.15943	-3.89439
Small heath x2	56.15909	-3.89407
Burnet 6 spot X 1 and small heath X 5	56.15872	-3.89367
Narrow bordered 5 spot Burnett moth x1	56.15843	-3.89337
Small heath X 2	56.15844	-3.89338
Dar green fritillary x2, small heath x 3, Burnett poss 5 spot X 1, and Burnett 6 spot X 1, common blue X 3, all in wet flush	56.15844	-3.8934
Small heath x2	56.15534	-3.89797
Small heath X 2	56.15506	-3.89858
Small heath x1	56.15465	-3.89948
Dark green fritillary X 1	56.15451	-3.89975
Sexton beetle x1	56.15428	-3.89947
Spiny shield bug x 1	56.15461	-3.89988
Common blue x1	56.15421	-3.90027
Common blue x1	56.15657	-3.90447
Dark green fritillary x1	56.15668	-3.90508
Common blue X 2	56.15721	-3.90658
Tortoise shell x1	56.15736	-3.90691
Small heath X 3 dark green fritillary x1	56.15738	-3.90714
Common blue X 1	56.15742	-3.90741
Dark green fritillary X 1	56.15772	-3.90789
Small heath X 1	56.15775	-3.90801
Dark green fritillary X 1	56.15808	-3.90901
Small heath X 3	56.15952	-3.91172