

Rare plant survey
of a proposed Native Woodland Scheme site

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Ballycroy National Park

Co. Mayo



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DOCUMENT CONTROL

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STATEMENT OF AUTHORITY

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All Woodrow staff are required to abide by a strict code of professional conduct in all aspects of their work.

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Front page photograph: ivy-leaved bellflower *Wahlenbergia hederacea*, photographed in Ballycroy National Park, July 21, 2020 (Photo ID: 1402_WBNP20_Cover)

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1 Introduction

1.1 Background

Woodrow Sustainable Solutions Ltd. was commissioned by the National Parks & Wildlife Service (NPWS) to carry out a rare plant survey at Srahduggaun, in Ballycroy National Park and the Owenduff/Nephtin SAC. Discrete parcels of land at this site, comprising approximately 4 hectares, have been identified as suitable for tree planting, and are proposed for inclusion in the Native Woodland Scheme (NWS). However, a review of existing records has identified two rare plant species which occur, or may occur, on the site. Therefore, before any plans for the woodland plantation are finalised, it was decided to survey the area for the presence and distribution of these species, and to map the suitable habitat available for them. Specific requirements of this survey were set out as follows:

1. Describe and map the distribution of the rare plant population(s)
2. Inform the planting design of the native woodland, so that the rare plant population(s) can be avoided and are not adversely affected by the NWS project

1.2 Description of Proposed Development

The proposed native woodland plantation is described in the Natura Impact Statement (NIS) prepared for the site (O'Donoghue, 2019). The following extracts from this NIS provide specific details of the proposal:

"The proposed project consists of partially enclosed heathy acid wet grassland in a matrix with extensive wet heath and Rhododendron dominated scrub. It is intended to establish native woodland on the site in an area suitable for tree growth in line with Forest Service Guidelines. No mounding will be used and trees will be pit planted. There will be a 10m set-back from the Owenduff River with 2m set-backs from drains and 5m set-back from small stream on site. Due to likelihood of rare flora occurring along aquatic set-backs, until Summer surveying is complete, it is not intended to plant along the set-backs. No fertiliser will be used in woodland establishment and no pesticide usage is envisaged on the trees."

"Management issues on site are primarily the presence of invasive species and grazers. The site occasionally floods when the Owenduff River is in high spate. There is mature dense Rhododendron ponticum on part of the site with smaller bushes and seedlings spreading along streams. Grazing is mainly by sheep with some cattle and there are also low numbers of Red deer in the area."

1.3 Rare Plant Species of Interest

The present study is concerned with two rare plant species: ivy-leaved bellflower *Wahlenbergia hederacea* and marsh clubmoss *Lycopodiella inundata*. The following details of these species, and prior records of their presence in the area, have been provided by the NPWS:

“Wahlenbergia hederacea (Ivy-leaved bellflower) is listed under the Conservation Objectives for 3260 Water courses of plain to montane levels with Ranunculion fluitantis and Callitriche-Batrachion vegetation in the Owenduff/Nepin SAC. It occurs at a number of sites along the banks and associated flood plains of the Owenduff River, including Srahduggaun. There are records at this location of W. hederacea in acid grassland along the banks of the Owenduff River. This plant is assessed as Near Threatened on the Irish Red List due to recorded losses, a decline in the area of occupancy and suspected future population reduction. This is an important outlying population of a species otherwise concentrated in the south-west and east (Appendix III).”

“Lycopodiella inundata (Marsh clubmoss) may occur in the proposed NWS area. It was recorded 1200m west of this site in 1982. It is known from wet heath, including degraded wet heath, and sites close to water and prone to flooding (Appendix III). It is listed on the Flora Protection Order and is listed as Vulnerable on the Irish Red List. It is listed as an Indicator of local distinctiveness under the Conservation Objectives for 4010 Wet heaths, 7130 Blanket bogs and 7140 Transition mires and quaking bogs in the Owenduff/Nepin Complex SAC.”

1.4 Site Description

A general description of the site was provided by O'Donoghue (2019):

“The flat site is accessed via a roadway to the west. It is located within Ballycroy National Park in a low-lying area at 60m OD. Soils on site are generally peats and peaty podzols, with mineral alluvial deposits along the Owenduff River (FW2). The proposed site at survey was largely composed of wet heath (HH3), acid, wet grassland (GS3/4) which has not been recently improved and is currently used for cattle and sheep grazing. It is in a flood risk area sensitive for fisheries considered of moderate sensitivity (IFORIS).”

“There is a significant Rhododendron ponticum infestation on site. There several drains (FW4) running through the site from historical agricultural management, which flow into the Owenduff River along the northern boundary. In addition, a small tributary stream (FW2) flows through the site. The watercourses are overgrown with quaking bog (PF3) and acid flush (PF2) in places. There is a further portion of the site located across the far side of the Owenduff River to the north, which was not accessible to survey. Peat banks run along the site boundaries and hand cutover bog (PB4), blanket bog (PB3) and wet heath (HH3) are found in the surrounding landscape. There are some derelict dwellings (BL3) located adjacent to the site with old defunct power lines running through the site. There are externally held shooting and fishing rights on the land.”

Figure 1 shows the location of the site in a broad geographical setting. Figure 2 shows the area to be covered in the survey.

Figure 1: Location of the study site at Srahduggaun, Ballycroy, Co. Mayo. Source: EPA maps

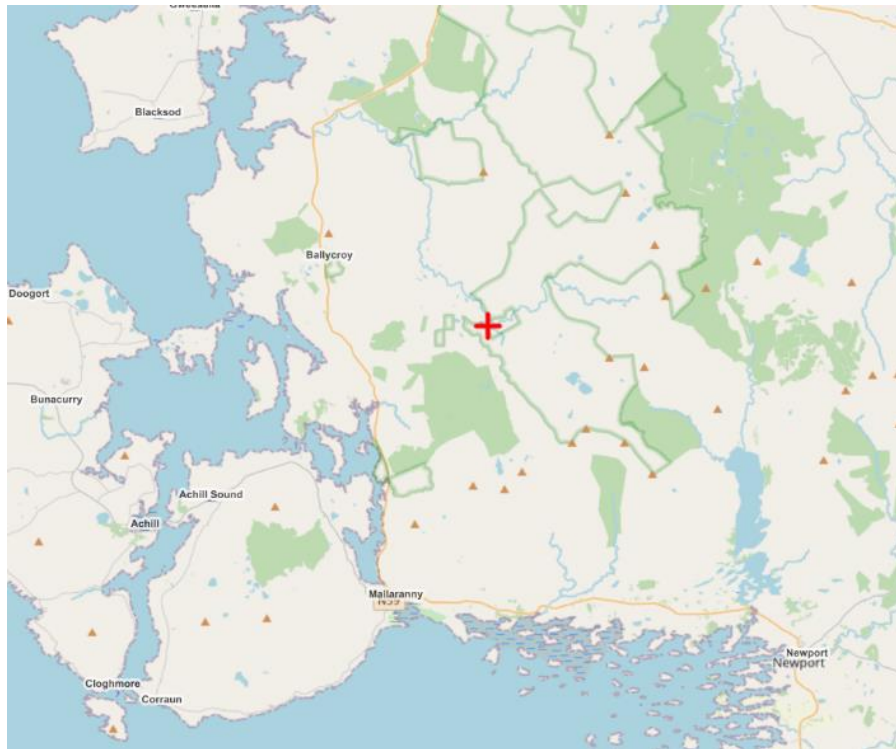


Figure 2: Indicative map of the survey area. Source: NPWS

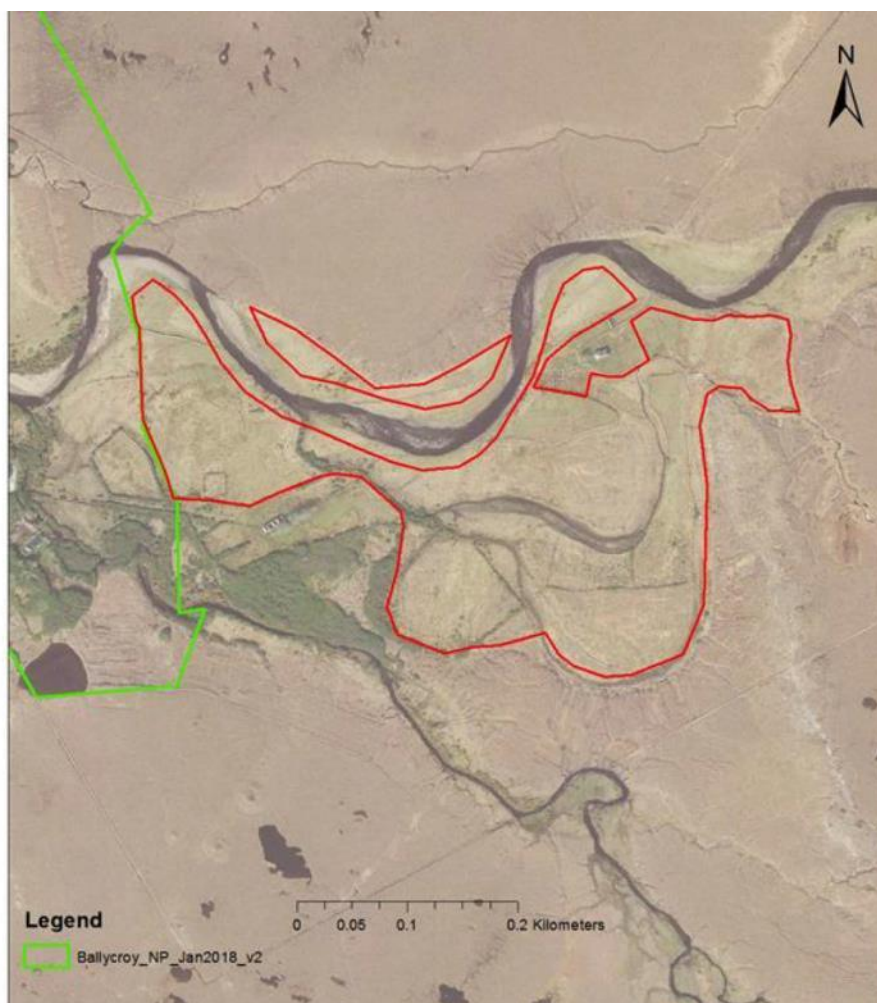
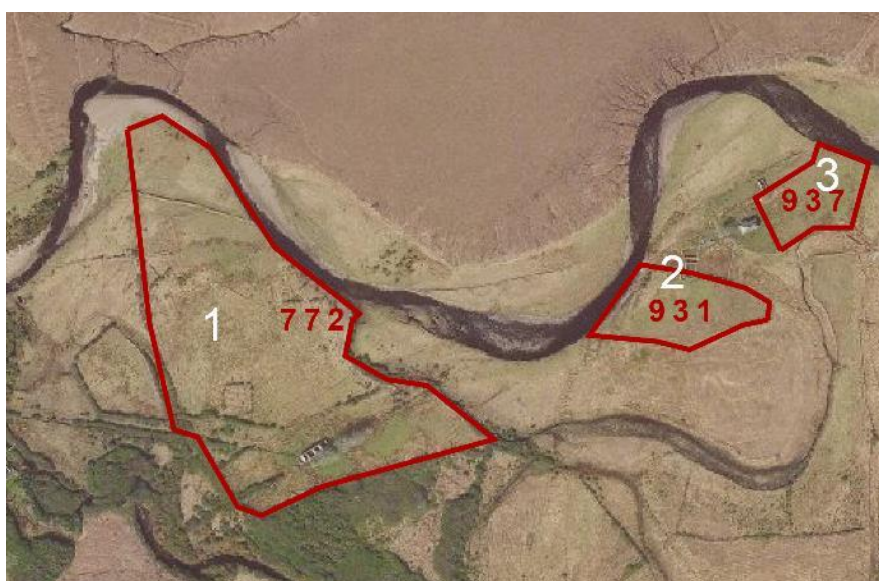


Figure 3: Proposed woodland planting areas within the survey area (labelled 1 - 3)
Source: NPWS



2 Methodology

2.1 Desk Study

Historic records of the rare species of interest were obtained, in consultation with NPWS. Details of designated sites in the area were consulted. Maps were produced for the purposes of habitat mapping and recording of rare species, using ArcGIS. Field trips were planned in consultation with the local conservation ranger, taking into consideration difficulties in accessing the site during wet spells of weather and high river conditions.

2.2 Field Surveys

The site was visited on July 21 and 23, 2020, during which the following work was undertaken. Garmin Etrex 30x GPS devices were used to maximise the accuracy of rare species records and mapping, and Woodrow's in-house ecological surveying mobile application (EcoLog) was used to record and georeference general site information and photographs, and optimise efficiency of the survey visits.

2.2.1 Habitat Mapping

Habitat mapping was carried out in the survey area, in accordance with Fossitt (2000). All areas of suitable habitat for the rare species of interest were also mapped. Photographs were taken of the habitats present on the site, and characteristic species were recorded.

2.2.2 Rare Species

The full area was surveyed for the presence and distribution of the two species of interest, ivy-leaved bellflower *Wahlenbergia hederacea* and marsh clubmoss *Lycopodiella inundata*, except where access was not possible (one extremely wet area and some small river islands). Relévéés were set up in areas where *W. hederacea* was frequent. The frequency and cover of *W. hederacea* in these areas were recorded, and the presence and frequency of other plant species were also listed.

2.3 Mapping & Data Processing

Maps of the study area were produced in ArcGIS, using point and area records from the site, as well as the paper maps used during site visits. Habitats maps were produced, using the classification system of Fossitt (2000). Areas of suitable habitats for *Wahlenbergia hederacea* were mapped. These were identified as areas of level neutral to acidic grassland that appeared to be frequently inundated.

All areas identified as suitable habitat were confirmed to contain *Wahlenbergia hederacea* during the field survey, with the exception of some small river islands, and an extremely wet flushed area to the east of the site, that could not be accessed. These areas were viewed from a distance and identified as likely suitable habitat.

3 Results

3.1 Habitat Mapping

The distribution of habitats on the site is shown in Figure 4.

3.1.1 Overview of habitats

The area surveyed is associated with the Owenduff River and two of its tributary streams, which meander through its flood plain. The ground in this area lies at approximately 50 m above sea level and is generally fairly level. There is evidence of some past peat cutting in this area, particularly to the north of the river where exposed banks were visible; however, throughout the site there is terracing visible, creating level areas of habitat at slightly differing heights, which may also have been formed by riverine erosion. There is also evidence of past habitation in this area, with defunct farmsteads at approximate ITM Grid References 486812 807165 and 487110 807318, the latter with livestock pens delineated by stone walls. The entire site is grazed by a mixed herd of cattle and sheep, which have access to a much larger area so grazing is fairly extensive; there is no evidence of overgrazing.

The Schedule III invasive species *Rhododendron* (*Rhododendron ponticum*) is ubiquitous in this area, forming dense stands in the southern and eastern part of the site but also spreading along the riverbanks and into other parts of the site (Plates 1-3).

Plate 1: Dense *Rhododendron* close to the derelict farmstead at ITM 486812 807165



Figure 4: Habitats present in the survey area in Ballycroy

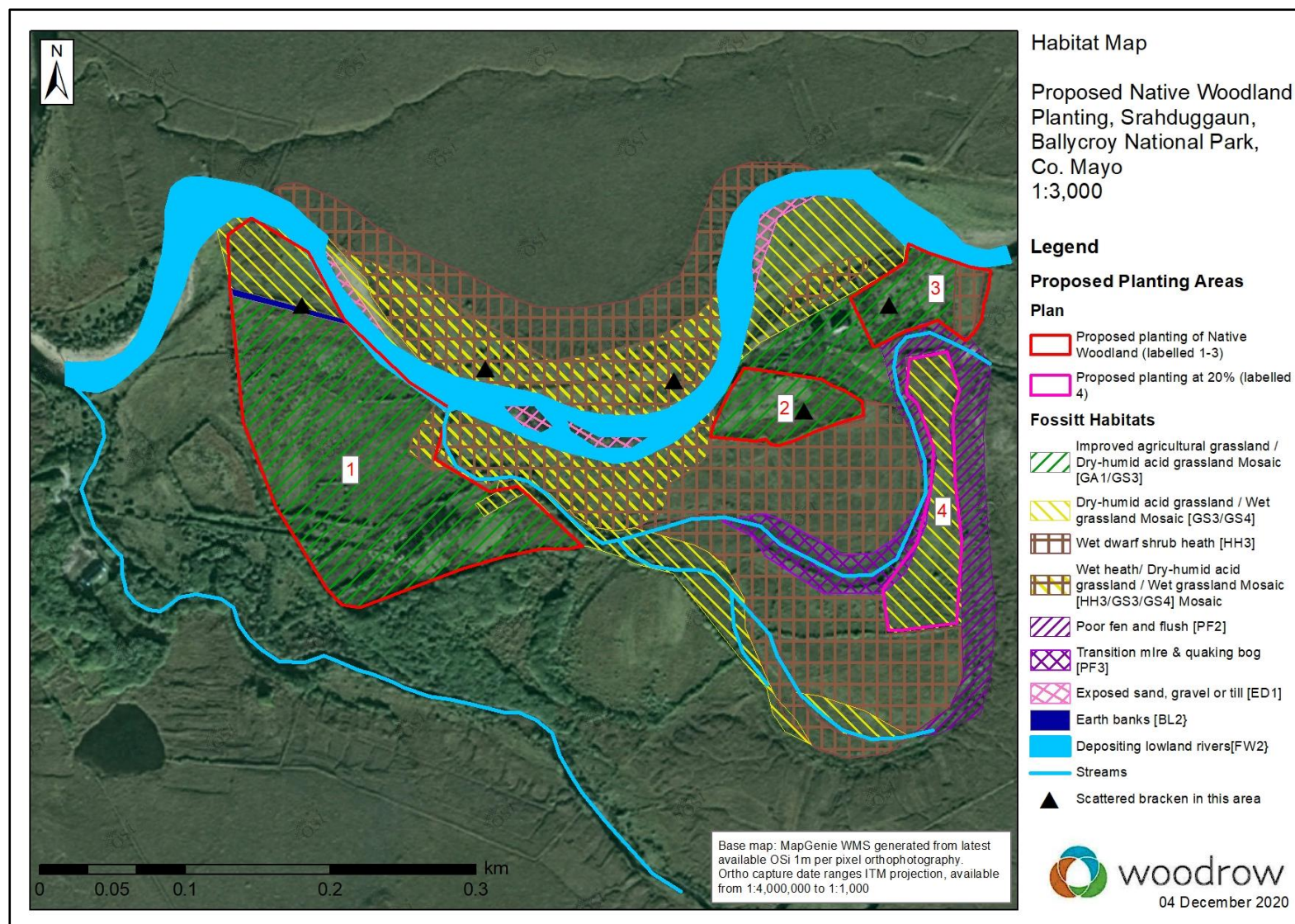


Plate 2: *Rhododendron* established along riverbank



The majority of the site is composed of wet heath (Fossitt category HH3) and wet acidic grassland that is somewhat transitional between Fossitt category **GS3 Dry humid acid grassland** and **GS4 Wet grassland**. The wet heath areas are characterised by the presence of purple moor-grass (*Molinia caerulea*), cross-leaved heath (*Erica tetralix*), bog-mosses (*Sphagnum* spp.), heath rush (*Juncus squarrosus*) and hare's-tail cottongrass (*Eriophorum vaginatum*). The acid grassland component typically supports abundant mat-grass (*Nardus stricta*) with sedges (*Carex* sp.), Yorkshire-fog (*Holcus lanatus*), brown bent (*Agrostis canina*), tormentil (*Potentilla erecta*), heath bedstraw (*Galium saxatile*) and mosses such as springy turf-moss (*Rhytidiadelphus squarrosus*) and glittering wood-moss (*Hylocomium splendens*). In some areas, bracken (*Pteridium aquilinum*) and rhododendron (*Rhododendron ponticum*) are spreading into these habitats.

The lower-lying parts of the site, and the river banks, appear to be periodically inundated during flood events, and these areas were found to support the rare plant species ivy-leaved bellflower (*Wahlenbergia hederacea*) in some abundance. An example of this habitat is illustrated in Plate 4. This species was generally found to be associated with wet acid grassland and acid grassland/wet heath mosaic habitats. However, it was also observed growing on riverbank shingle in one location.

Alongside some sections of the various streams that feed the Owenduff River, particularly in the southeastern part of the site, there is an extremely wet vegetation type, typically supporting sedges (*Carex* sp.), bog-mosses (*Sphagnum* spp.), water horsetail (*Equisetum fluviatile*), bogbean (*Menyanthes trifoliata*), marsh cinquefoil (*Potentilla palustris*) and marsh pennywort (*Hydrocotyle vulgaris*). This has been mapped as the Fossitt habitat type **PF3 Transition Mire and Quaking Bogs**. This habitat has potential correspondence to the EU Annex I habitat **7140 Transition Mire and Quaking Bogs**. Other very wet areas associated with streams support sedges (*Carex* spp.), rushes (*Juncus* spp.) and bog-mosses (*Sphagnum* spp.) and these have been coded as the Fossitt habitat **PF2 Poor flush**. In places, these two habitat types have developed small raised hummocks of drier vegetation which support communities of ivy-leaved bellflower (*Wahlenbergia hederacea*) and bog

pimpernel (*Anagallis tenella*) (see Plate 5). Within the surrounding poor flush habitat, which is very wet, there is some evidence of poaching.

Plate 3: Rhododendron ponticum spreading through wet heath habitat in the southeastern part of the site (ITM 487145 807077)



Plate 4: Typical low-lying wet grassland habitat supporting Wahlenbergia hederacea at the site



Plate 5: Hummocks of slightly drier vegetation within very wet flush and mire habitats that support *Wahlenbergia hederacea*



In the vicinity of both farmsteads there is evidence of agricultural improvement, indicated by improved agricultural grassland (Fossitt category GA1) that is reverting to acid grassland in places, with soft-rush (*Juncus effusus*) and bracken (*Pteridium aquilinum*) spreading extensively in some areas. Some field boundaries can be discerned but these are no longer stock-proof.

The Owenduff river and its tributaries have been classified as the Fossitt habitat category **FW2 Depositing /Lowland Rivers**. At intervals along the bank of the main channel of the Owenduff River, there are stretches of riverbank shingle, which has been coded as **ED1 Exposed sand, gravel or till**. There are also islands composed of rocks and shingle within the main river channel which have developed scattered vegetation transitional between **GS4 wet grassland** and **GS3 dry-humid acid grassland**, which are clearly frequently-inundated and support patches of *Wahlenbergia hederacea*. This is illustrated in Plate 6.

Plate 6: Patches of vegetated shingle associated with the margins and islands of the Owenduff river, which support Wahlenbergia hederacea



3.2 Description of proposed Native Woodland Scheme planting areas

3.2.1 Planting area 1

This area is located in the western part of the site and extends from the farmstead area in the south, northwards into an area enclosed by a large meander of the Owenduff River. The area is effectively split into three sections, by the site access track to the south, and by a low earthbank to the north. Plate 7 provides an overview of Planting Area 1.

Plate 7: View across Area 1



The southern section is associated with the farmstead and is largely composed of **GA1 Improved agricultural grassland** which is beginning to revert back towards damp acid grassland, evidenced by large amounts of soft-rush (*Juncus effusus*) and occasional species such as springy-turf-moss (*Rhytidiadelphus squarrosus*) and heath bedstraw (*Galium saxatile*). There are large amounts of rhododendron fringing this area to the south, and beginning to encroach into it.

The central section is composed of vegetation transitional between **GA1 Improved agricultural grassland** and species-poor **GS4 Wet grassland**, variously dominated by soft-rush (*Juncus effusus*), sharp-flowered rush (*Juncus acutiflorus*) and grasses such as Yorkshire-fog (*Holcus lanatus*) and brown bent (*Agrostis canina*). Eastwards, towards the Owenduff river and its tributary stream, the vegetation becomes a little more diverse with some patches more resembling HH3 Wet heath vegetation close to the stream. This area exhibits some terracing, with the margin of the stream being lower than the adjacent wet heath and grassland habitats, separated by a vertical bank 60-70cm high. This is illustrated in Plate 8. The narrow stream margins support some scattered grassland vegetation, where ivy-leaved bellflower (*Wahlenbergia hederacea*) was recorded at intervals, sometimes colonising fairly bare areas. However, the elevated nature of the adjacent grassland and heath vegetation means that this does not support suitable habitat for this species, which has a requirement for periodic inundation. Rhododendron (*Rhododendron ponticum*) was frequent along the riverbank at this location.

Plate 8: The riverbank in the central part of Area 1, showing two distinct levels. *Wahlenbergia hederacea* occurs at the river margins (foliage visible in photograph to the right). Note *Rhododendron* on the riverbank.



The northern section of Area 1, which lies north of a sandy earthbank extending in a west-northwest/east-southeast direction, appears different in character to the central part. It appears that this area, which is bound to the west, north and east by the Owenduff river, is periodically inundated by floodwater. Ivy-leaved bellflower (*Wahlenbergia hederacea*) was recorded quite abundantly in this area during the survey. The vegetation corresponds most closely to a mosaic of **GS3 Dry humid acid grassland** and **GS4 Wet grassland** (but some possible transition to **HH3 Wet heath**, which occurs in the wider area, is suggested by the presence of the bog-mosses *Sphagnum papillosum* and *S. palustre*). The vegetation is dominated by mat-grass (*Nardus stricta*), sweet-vernal-grass (*Anthoxanthum odoratum*), Yorkshire-fog (*Holcus lanatus*) and brown bent (*Agrostis canina*), with sedges (*Carex nigra*, *C. echinata* and *C. panicea*) and bog-mosses (*Sphagnum* spp.). Relévé 2 was sampled in this area, at ITM 486717 807359. The Rare Plant Recording Form completed for this relévé, reproduced in Appendix 2, provides further information on the habitat at this location.

3.2.2 Planting Area 2

This area is located towards the eastern part of the site, southwest of the derelict farmstead at 487110 807318 and adjacent to the Owenduff river. A photograph is provided in Plate 9. Although quite level, this area is elevated above the adjacent wet heath area and is relatively dry underfoot. This area is unlikely to become flooded due to its raised character. The vegetation appears to have undergone some agricultural improvement in the past, and now resembles a species-poor transition between **GA1 Improved agricultural grassland**, **GS3 Dry humid acid grassland** and **GS4 Wet grassland**, with abundant soft-rush (*Juncus effusus*). Bracken (*Pteridium aquilinum*) is scattered throughout this area and is often quite abundant. The grassland component is dominated by Yorkshire-fog (*Holcus lanatus*), brown bent (*Agrostis canina*) and sweet-vernal-grass (*Anthoxanthum odoratum*), with white clover (*Trifolium repens*), creeping buttercup (*Ranunculus repens*), common sorrel (*Rumex acetosa*), heath bedstraw (*Galium saxatile*), marsh thistle (*Cirsium palustre*), and springy-turf-moss (*Rhytidiadelphus squarrosus*). This area does not contain any suitable habitat for ivy-leaved bellflower (*Wahlenbergia hederacea*), and the riverbank at this location is muddy and has been heavily trampled by cattle (illustrated in Plate 10).

Plate 9: View across Area 2.



Plate 10: The section of riverbank that lies within Area 2



3.2.3 Planting Area 3

This planting area is located to the east of the site, adjacent to a derelict house and disused farmyard. It abuts the Owenduff River to the north. The area is mostly level, and firm underfoot except near the bank of the river. It appears to have been subject to some degree of agricultural improvement and management in the past, but is now dominated by rushes (*Juncus effusus*), with bracken (*Pteridium aquilinum*) colonising some parts to a substantial degree. As such, this area now shares characteristics of **GA1 Improved agricultural grassland** and **GS4 Wet grassland**. The area is still grazed to an extent by sheep and cattle.

In addition to the abundant soft rush (*Juncus effusus*) and bracken (*Pteridium aquilinum*), this area contains brown bent (*Agrostis canina*), sweet-vernal-grass (*Anthoxanthum odoratum*), tormentil (*Potentilla erecta*), cuckoo-flower (*Cardamine pratensis*), springy-turf-moss (*Rhytidiadelphus squarrosus*), common haircap moss (*Polytrichum commune*), and marsh thistle (*Cirsium palustre*). There is some infringement by *Rhododendron ponticum*, especially from the west of the planting area.

Most of this area is not suitable habitat for ivy-leaved bellflower (*Wahlenbergia hederacea*), but there is a narrow strip along the river which is subject to flooding, and *W. hederacea* is present here (see map in Figure 5).

Plate 11: Wet grassland in Planting Area 3, largely dominated by soft-rush *Juncus effusus*



Plate 12: Significant encroachment of bracken in Planting Area 3



Plate 13: Vegetation typical of Planting Area 3



3.2.4 Planting Area 4

Planting Area 4 is a raised ridge of drier land extending north-south in between two low-lying channels of **poor flush PF2** that are associated with small watercourses. Area 4 is composed of a vegetation type that is transitional between **dry-humid acid grassland GS3** and **wet grassland GS4**, dominated by mat-grass (*Nardus stricta*), and brown bent (*Agrostis canina*) with patches of soft-rush (*Juncus effusus*). Other typical species recorded here include heath rush (*Juncus squarrosus*), tormentil (*Potentilla erecta*), heath bedstraw (*Galium saxatile*), Yorkshire-fog (*Holcus lanatus*), glittering wood-moss (*Hylocomium splendens*) and springy turf-moss (*Rhytidiadelphus squarrosus*).

This area is relatively dry underfoot and because of its slightly elevated location it is not prone to periodic inundation, and thus is not considered to represent suitable habitat for ivy-leaved bellflower *Wahlenbergia hederacea*. Nonetheless this area was examined closely in case it contained pockets of suitable habitat, but no evidence of *W. hederacea* or its associated species were observed.

This area is proposed for planting at 20% coverage. It is considered that this area is suitable for native woodland planting; however, due consideration should be given to confirmed and potential *W. hederacea* habitat within the poor flush habitat flanking planting Area 4 to east and west, to ensure that its suitability for this species does not become compromised by shading and deposition of leaf litter. *W. hederacea* was confirmed during the survey as occurring in the flush to the west, but the flush to the east could not be accessed as it was extremely wet. However, like the other poor flush areas, it is likely to support suitable habitat for *W. hederacea*.

Plate 14: View south across proposed Planting Area 4 (note *Rhododendron* spreading in from the south)



3.3 Rare Species Records

3.3.1 Marsh clubmoss *Lycopodiella inundata*

This species was not recorded during site visits. Most of the study area is considered unsuitable or sub-optimal for *Lycopodiella inundata*. The areas of wet heath shown in Figure 4 have some potential as a habitat for this species, but a comprehensive survey revealed no evidence of this species. The terrain north of the study area may provide more suitable habitat for this species, particularly where inundation occurs in the vicinity of water bodies.

3.3.2 Ivy-leaved bellflower *Wahlenbergia hederacea*

This species was found to be widespread and locally abundant in parts of the study area, and was present in almost all areas which are subject to flooding, as described in Sections 3.1 and 3.2 above. There is much suitable habitat for this species within the survey area (Figure 5), and it was present to some degree in almost all of this suitable habitat, including the small islands on the Owenduff River, and even in one place growing in shingle by the river bank (illustrated in Plate 15). Area of confirmed suitable habitat for ivy-leaved bellflower *Wahlenbergia hederacea* are mapped in Figure 5. Areas that were not accessible during the survey were assessed remotely and, if considered suitable, mapped as likely suitable habitat in Figure 5.

As described in Section 3.1.1, in general this species was recorded in frequently-inundated areas of acid wet grassland and grassland/wet heath mosaics, but it was also noted growing on small raised hummocks within permanently wet areas (poor flush and quaking bog habitats) adjacent to the small tributary streams in the area. An example of one such hummock is illustrated in Plate 16.

Two relévés were set up in confirmed *Wahlenbergia hederacea* habitat; their locations are shown on the map in Figure 5. Relève 1 was located at ITM 486968 807243, within an area of wet heath/ dry-humid grassland/ wet grassland mosaic close to the main Owenduff river channel. Ivy-leaved bellflower was recorded frequently within this relèvement, along with other

characteristic herbs such as marsh violet (*Viola palustris*), tormentil (*Potentilla erecta*) and lousewort (*Pedicularis sylvatica*).

Relève 2 was analysed in proposed Planting Area 1, at ITM 486717 807359 (see Section 3.2.1). This area, which is contained within a meander of the Owenduff River, is composed of a dry-humid acid grassland/ wet grassland mosaic with some wet heath characteristics. Again, *Wahlenbergia hederacea* was frequent within the relève along with a variety of grasses (including mat grass *Nardus stricta*, sweet-vernal grass *Anthoxanthum odoratum* and brown bent *Agrostis canina*), sedges (including carnation sedge *Carex panicea*, star sedge *C. echinata* and common sedge *C. nigra*), bog-moss (*Sphagnum* spp.) and herbs including tormentil *Potentilla erecta*, heath bedstraw *Galium saxatile* and lousewort *Pedicularis sylvatica*). Photographs of each relève are provided in Plates 17 and 18. The Rare Species Recording Cards completed for each relève are reproduced in Appendices 1 and 2. A list of associated species that were found in typical *Wahlenbergia hederacea* habitat during the survey is provided in Table 1.

Table 1: Species occurring at the site in association with Ivy-leaved bellflower *Wahlenbergia hederacea*

Common name	Scientific name
Mat-grass	<i>Nardus stricta</i>
Yorkshire-fog	<i>Holcus lanatus</i>
Brown bent	<i>Agrostis canina</i>
Sweet vernal-grass	<i>Anthoxanthum odoratum</i>
Viviparous fescue	<i>Festuca vivipara</i>
Carnation sedge	<i>Carex panicea</i>
Star sedge	<i>Carex echinata</i>
Common sedge	<i>Carex nigra</i>
Heath rush	<i>Juncus squarrosus</i>
Soft-rush	<i>Juncus effusus</i>
Common cottongrass	<i>Eriophorum angustifolium</i>
Lousewort	<i>Pedicularis sylvatica</i>
White clover	<i>Trifolium repens</i>
Common bird's-foot trefoil	<i>Lotus corniculatus</i>
Tormentil	<i>Potentilla erecta</i>
Heather	<i>Calluna vulgaris</i>
Heath bedstraw	<i>Galium saxatile</i>
Bog pimpernel	<i>Anagallis tenella</i>
Common sorrel	<i>Rumex acetosella</i>
Marsh violet	<i>Viola palustre</i>
Foxglove	<i>Digitalis purpurea</i>
Marsh thistle	<i>Cirsium palustre</i>
Self-heal	<i>Prunella vulgaris</i>
Heath milkwort	<i>Polygala serpyllifolium</i>
Rhododendron	<i>Rhododendron ponticum</i>
European gorse	<i>Ulex europaeus</i>
Bracken	<i>Pteridium aquilinum</i>
Bryophytes:	
Blunt-leaved bog-moss	<i>Sphagnum palustre</i>
Red bog-moss	<i>Sphagnum capillifolium</i>
Papillose bog-moss	<i>Sphagnum papillosum</i>
Common haircap-moss	<i>Polytrichum commune</i>
Springy turf-moss	<i>Rhytidiadelphus squarrosus</i>
Glittering wood-moss	<i>Hylocomium splendens</i>

Plate 15: Wahlenbergia hederacea growing among shingle and pebbles along the Owenduff River



Plate 16: Wahlenbergia hederacea growing on hummocks in poor flush habitat



Plate 17: Relévé 1 located at ITM 486968 807243



Plate 18: Relévé 2 located at ITM 486717 807359



During site surveys in July 2020, ivy-leaved bellflower *Wahlenbergia hederacea* was recorded at a number of locations along the track by which the site is accessed. This is a distinct stony track at the western end of the site, but becomes less defined eastwards. The track crosses through tributary streams at two locations and can be impassable depending on river conditions.

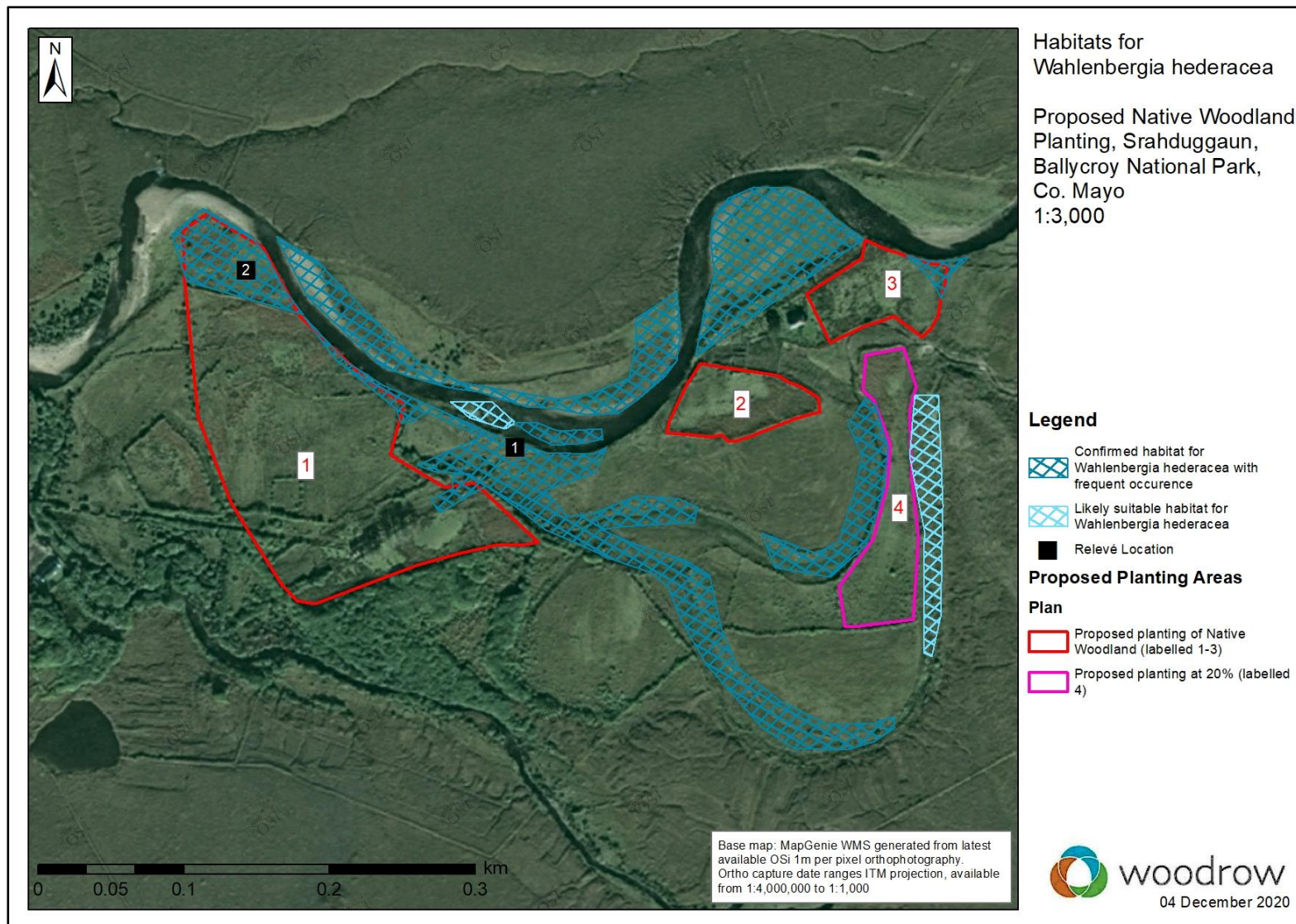
W. hederacea was recorded in five separate locations along the access track outside and to the west of the main site area. In addition, the access track passes through suitable *Wahlenbergia hederacea* habitat within the Srahduggaun site and here the species was recorded at a number of locations immediately adjacent to the track.

All individual locations of ivy-leaved bellflower *Wahlenbergia hederacea* were not mapped within the Srahduggaun site as the species was so widespread. However, GPS readings were taken for those occurrences of *W. hederacea* close to the access track outside the main part of the site. These are provided in Table 2 below.

Table 2: Occurrences of ivy-leaved bellflower *Wahlenbergia hederacea* outside the Srahduggaun site boundary

ITM Grid Reference	Brief description of location
ITM 486622 807153	On bank adjacent to track, near stream crossing
ITM 486628 807146	On bank adjacent to track, near stream crossing
ITM 486633 807150	On bank adjacent to track, near stream crossing
ITM 486660 807179	On bank adjacent to track, near stream crossing
ITM 486687 807175	Sparse grassland close to track at short distance from stream crossing

Figure 5: *Wahlenbergia hederacea* habitat within the survey area. The location of Relévés 1 and 2 are indicated.



4 Conclusions

This survey showed that the ivy-leaved bellflower *Wahlenbergia hederacea* is widespread on the site, and is present in some of the areas proposed for establishing trees as part of the Native Woodland Scheme. The marsh clubmoss *Lycopodiella inundata* was not found to be present on the site.

The results presented above can inform the planting design of the proposed woodland area. It is recommended that the planting plan is modified to avoid areas in which *W. hederacea* is present, as well as the areas of suitable habitat for this species, as indicated in Figure 5. In addition, it is important that the proposed works do not alter the hydrology of these areas; however, the proposed planting method, quoted in Section 1.2 above, seems unlikely to be a problem in this regard. The proposed set-back areas from drains and streams may not be sufficient to avoid adverse impacts on areas of *W. hederacea* habitat, and should be increased as a precautionary measure. Detailed recommendations to inform the woodland planting plans are provided in Appendix 3.

5 References

- Atherton, I., Bosanquet, S.D., and Lawley, M. (2010). *Mosses and Liverworts of Britain and Ireland: a field guide*. British Bryological Society.
- Fossitt, J. (2000). *A Guide to Habitats in Ireland*. The Heritage Council, Kilkenny, Ireland.
- O'Donoghue, S. (2019). *NIS of Proposed Forestry Development at Srahduggaun, Ballycroy National Park, Co. Mayo*.
- Stace, C. (2019). *New Flora of the British Isles*. 4th edition. C & M Floristics.

6 Appendices

Appendix 1: Rare Plant Recording Card (Relévé 1)

Species <i>Wahlenbergia hederacea</i>	County Mayo	6" Map	Discovery Map Sheet 23
Locality/ Site name Srahduggaun	Vice-county (No.) H27	SAC/NHA Owenduff/Nephin Complex SAC Owenduff/Nephin Complex SPA Owenduff/Nephin Complex pNHA	
Grid ref (GPS, ITM) ITM 486968 807243	2005 Aerial Photo	Recorder(s) Bridget Keehan Philip Doddy	
Elevation (m) 53m	Solid geology General area underlain by schist and gneiss	Survey date 21/07/2020	
Site description	South bank of the river, an area with acid grassland and wet heath characteristics, grazed.		
Population description	17 individual plants counted in the quadrat. Also frequent in the surrounding area.		
Associated species	<i>Potentilla erecta</i> , <i>Nardus stricta</i> , <i>Juncus squarrosus</i> , <i>Sphagnum palustre</i> , <i>Holcus lanatus</i> , <i>Anthoxanthum odoratum</i> , <i>Agrostis canina</i> , <i>Hylocomium splendens</i> , <i>Rhytidiadelphus squarrosus</i>		
Vegetation	Complete coverage of wet acid grassland vegetation. Bracken and rhododendron occur in surrounding area.		
Current management	The area is grazed by cattle and sheep.		
Threats	Incursions of <i>Rhododendron ponticum</i> is a major threat. Anglers along the river may cause trampling if frequenting particular areas.		
Conservation measures	No specific measures noted.		
Ownership	NPWS		
Access	No ownership restrictions on access. However, access requires crossing a forded stream (there is no footbridge), so is not possible at times when river levels are high. While on site, attention should be paid to rainfall / river levels to ensure safe egress.		
Other remarks	Within the flooding zone of the river.		

Quadrat containing <i>Wahlenbergia hederacea</i> at ITM 486968 807243	
Altitude (m)	53
Slope (°)	Level
Aspect	NA
Soil type	Alluvial
Soil depth (cm)	Not measured
Soil pH	Not measured
Quadrat size (m)	2 x 2
Vegetation height (cm)	15
Vegetation cover (%)	100

Bare rock cover (%)	0
Bare soil cover (%)	0
Low shrub cover (%)	2
Herb/grass cover (%)	95 (including rushes)
Bryophyte cover (%)	40
Species	Cover (DOMIN scale)
<i>Nardus stricta</i>	8
<i>Juncus squarrosus</i>	5
<i>Juncus articulatus</i>	2
<i>Potentilla erecta</i>	4
<i>Galium saxatile</i>	3
<i>Anthoxanthum odoratum</i>	2
<i>Danthonia decumbens</i>	2
<i>Agrostis canina</i>	4
<i>Lotus corniculatus</i>	3
<i>Rhytiadelphus squarrosus</i>	5
<i>Hylocomium splendens</i>	5
<i>Wahlenbergia hederacea</i>	3
<i>Sphagnum palustre</i>	1
<i>Trifolium repens</i>	1
<i>Calluna vulgaris</i>	2
<i>Holcus lanatus</i>	2
<i>Plantago lanceolata</i>	1
<i>Luzula campestre</i>	1
<i>Juncus effusus</i>	1
<i>Carex nigra</i>	2
<i>Carex panicea</i>	3
<i>Carex echinata</i>	2

Appendix 2: Rare Plant Recording Card (Rel    2)

Species <i>Wahlenbergia hederacea</i>	County Mayo	6" Map	Discovery Map Sheet 23
Locality/ Site name Srahduggaun	Vice-county (No.) H27	SAC/NHA Owenduff/Nephin Complex SAC Owenduff/Nephin Complex SPA Owenduff/Nephin Complex pNHA	
Grid ref (GPS, ITM) ITM 486717 807359	2005 Aerial Photo	Recorder(s) Bridget Keehan Philip Doddy	
Elevation (m) 47	Solid geology General area underlain by schist and gneiss	Survey date 23/07/2020	
Site description	A level area within a meander of the river, containing wet acid grassland and wet heath. Some <i>Rhododendron ponticum</i> present, with <i>Pteridium aquilinum</i> and <i>Ulex europaeus</i> spreading in from the margins.		
Population description	Frequent in this area, locally abundant.		
Associated species	<i>Nardus stricta</i> , <i>Potentilla erecta</i> , <i>Sphagnum palustre</i> , <i>Holcus lanatus</i> , <i>Anthoxanthum odoratum</i> , <i>Agrostis canina</i> , <i>Hylocomium splendens</i> , <i>Pedicularia palustre</i> , <i>Carex echinata</i>		
Vegetation	Continuous cover of wet acid grassland. Scrub, bracken and <i>Rhododendron</i> present in the surrounding area		
Current management	Grazed periodically by cattle and sheep		
Threats	Invading <i>Pteridium aquilinum</i> and <i>Rhododendron ponticum</i> ; grazing if it becomes excessive.		
Conservation measures	None noted		
Ownership	NPWS		
Access	No ownership restrictions on access. However, access requires crossing a forded stream (there is no footbridge), so is not possible at times when river levels are high. While on site, attention should be paid to rainfall / river levels to ensure safe egress.		
Other remarks	Likely to be inundated by flooding from all sides.		

Quadrat containing <i>Wahlenbergia hederacea</i> at ITM 486717 807359	
Altitude (m)	47
Slope (�)	Level
Aspect	NA
Soil type	Sandy/alluvial, with some peat
Soil depth (cm)	Not measured
Soil pH	Not measured
Quadrat size (m)	2 x 2
Vegetation height (cm)	10 – 30
Vegetation cover (%)	100
Bare rock cover (%)	0
Bare soil cover (%)	0

Low shrub cover (%)	0 in quadrat; some <i>Ulex europaeus</i> & <i>Rhododendron ponticum</i> at area margins
Herb/grass cover (%)	85 (including sedges)
Bryophyte cover (%)	55%
Species	Cover (DOMIN scale)
<i>Nardus stricta</i>	6
<i>Anthoxanthum odoratum</i>	4
<i>Holcus lanatus</i>	4
<i>Agrostis canina</i>	4
<i>Carex echinata</i>	5
<i>Carex nigra</i>	4
<i>Carex panicea</i>	2
<i>Luzula campestris</i>	2
<i>Juncus squarrosus</i>	4
<i>Galium saxatile</i>	1
<i>Cirsium palustre</i>	1
<i>Luzula multiflora</i>	1
<i>Sphagnum palustre</i>	5
<i>Sphagnum papillosum</i>	5
<i>Polytrichum commune</i>	2
<i>Rhytidiadelphus squarrosus</i>	3
<i>Sphagnum fallax</i>	3
<i>Potentilla erecta</i>	3
<i>Wahlenbergia hederacea</i>	3
<i>Pedicularis sylvatica</i>	1
<i>Viola palustris</i>	3
<i>Galium palustre</i>	1
<i>Trifolium repens</i>	1
<i>Lotus corniculatus</i>	2
<i>Festuca ovina</i>	2
<i>Hylocomium splendens</i>	3
<i>Juncus effusus</i>	Not in quadrat but present in the wider area

Appendix 3: Recommendations to inform the planting design of native woodland at Srahduggaun, Ballycroy National Park

The following recommendations are provided in order to ensure that the proposed Native Woodland Scheme project does not negatively impact upon rare plant populations at the Srahduggaun site.

Figure 3 shows the three proposed planting areas on the site. *Wahlenbergia hederacea* is present on two of these, Area 1 & Area 3. Figure 5 shows *W. hederacea* habitats identified at the site.

1. In Area 1, *W. hederacea* is frequent in the northern section. This piece of land is contained within a loop of the Owenduff river, and is clearly subject to periodic flooding. There is an earthen bank on the site which acts as a convenient marker; *W. hederacea* is frequent in the area north of this bank, but was not found south of the bank. It is recommended that the area north of this bank, and a 20-metre buffer to the south, be left unplanted, in order to avoid adverse impacts on *W. hederacea* populations which may result from the presence of the plantation, including shading and seasonal leaf litter.
2. Proposed planting Area 1 also extends along the river bank (Figure 3). *W. hederacea* was recorded along this river bank, but only on a narrow strip of land close to the river (Figure 5). While the proposed planting plan incorporates a 10-metre set-back from the river, it is recommended that this be expanded to 20 metres, in order to prevent any impacts which may result from the presence of the plantation, including shading and seasonal leaf litter. No tree planting should be undertaken within this set-back, even at low density.
3. The south-east of the proposed planting Area 1 borders a small tributary stream of the Owenduff River. Some *W. hederacea* plants were present along this stream, and it is recommended that the proposed 5-metre set-back be expanded to 10 metres as a precautionary measure. No tree planting should be undertaken within this set-back, even at low density.
4. Planting Area 3 also contains some *W. hederacea* (Figure 5), in a fairly narrow strip close to the river. Again, while the proposed planting plan incorporates a 10-metre set-back from the river, it is recommended that this be expanded to a minimum of 20 metres from the river and the confirmed area of *W. hederacea* for the reasons set out in Recommendation 2 above. No tree planting should be undertaken within this set-back, even at low density.
5. Planting Area 4 is located on an elevated area composed of acid grassland that is not considered to hold suitable habitat for either *Wahlenbergia hederacea* or *Lycopodiella inundata*. However, this area comprises a narrow strip of elevated land located in between two wet flushed areas, identified as confirmed (west of Area 4) or likely suitable (east of Area 4) habitat for *W. hederacea*. Although Area 4 itself represents suitable habitat for tree planting, the presence and/or suitability of adjacent habitats for *Wahlenbergia* would require that set-backs be imposed on both sides in order to avoid impacts such as shading, and nutrient enrichment through

deposition of leaf litter. In practice, as much of this area is less than 40m wide, maintaining 20m setbacks on either side, as recommended for other planting areas adjacent to confirmed *Wahlenbergia* habitat, would prevent any planting from being possible.

Furthermore, it is considered possible that tree planting in this area may interfere with the hydrology of the adjacent flushed areas and of connecting areas of transition mire, some parts of which may have potential to correspond with the Annex I habitat **7140 Transition Mire and Quaking Bog**.

It is therefore proposed that tree planting will be undertaken only at the northern and southern ends of Area 4. Any tree planting that is undertaken in this area will be of low-growing and shallow-rooted species that will not cause either excessive drying or excessive shading (for example, native willow species *Salix* spp. with smaller quantities of downy birch *Betula pubescens*, alder *Alnus glutinosa* and Scots pine *Pinus sylvestris*). A 20m set-back will be maintained from confirmed *W. hederacea* habitat on the western side of Area 4; while on the eastern side, where the ground was observed to be extremely wet and, immediately adjacent to Area 4, of lower suitability for *Wahlenbergia*, the set-back will be reduced to 15m. No planting will be undertaken within the identified set-back areas.

6. The present level of grazing appears to be appropriate for the conservation of the *W. hederacea* habitat on this site. It is recommended that the site continue to be grazed in this manner so as to prevent the spread of scrub, which could impinge on areas of *W. hederacea* habitat. These areas should therefore not be fenced.
7. *Rhododendron ponticum* is rampant in this area, and is an obvious threat to *W. hederacea* habitat, as well as to other native species and habitats in the area. It is recommended that regular cutting of this species (where necessary combined with stump treatment with herbicide, as considered appropriate and following recommended protocols), is carried out, particularly to avoid riverside and streamside areas being colonised, as these are the most important *W. hederacea* areas.
8. As described in Section 3.3.2, *W. hederacea* was recorded at a number of locations adjacent to the access track. These locations are indicated in Figure A3 below. It is recommended that, in order to avoid impacting upon these plants and their habitat, that standard vehicles do not access the site. Instead, planting and fencing materials and equipment should be transported on foot, or using a small, low-ground pressure vehicle, avoiding impacting the habitat on either side of the access track. Figure A3 identifies areas of habitat considered to be at risk during transportation of materials and equipment required for the planting process, if appropriate mitigation measures are not put into place.
9. Similarly, as far as possible planting and fencing work should be undertaken by hand, in order to minimise the impact that the process has upon the surrounding land.

A revised planting strategy is therefore proposed for the Srahduggaun area which takes account of the above recommendations. This is illustrated in Figure A3. Table A3 lists the

area and perimeter of each proposed planting area (Areas 1-4) and the area of the proposed setback from the river and sensitive habitats.

Table A3 – Details of planting areas and set-backs

Planting Area (as shown in Figure A3)	Area (ha)	Boundary length (m)	Total set-back area from sensitive habitats (ha)	Total set-back within original proposed planting area (ha)
1	2.031	710.95	0.606	0.510
2	0.366	258.55	-	-
3	0.240	225.21	0.169	0.162
4a	0.051	94.90	0.494	0.407
4b	0.102	142.80		
TOTAL	2.79	1432.41	1.269	1.079

Figure A3: Recommended revised planting areas, in relation to locations of *Wahlenbergia hederacea*, watercourses, the site access track, and associated areas of risk.

