



**FLYNN
FURNEY**

ENVIRONMENTAL CONSULTANTS

Blessington Greenway

**An Bord Pleanála Response to Request
for Further Information on Ecology**

Annex I Habitats and Rare Flora

Document Details

Client: Wicklow Country Council

Project Title: Blessington eGreenway

Document Title: Ecological Impact Assessment Blessington Greenway
RFI: Annex I Habitats and Rare Flora Survey Report

Prepared by: Flynn Furney Environmental Consultants

Rev	Status	Date	Author(s)	Approved by
01	DRAFT	07/12/2023	LME, ID	BF
02	DRAFT	11/12/2023	LME, ID	EK
03	FINAL	13/12/2023	LME, ID	BF

Contents

Introduction	4
Annex I Grassland Habitats and Rare Plants	5
1 Introduction	5
2 Methodology	6
2.1 Desktop Assessment	6
2.2 Rare Plants Survey	6
2.3 Field Surveys	7
3 Results	9
4 Conclusion	11
References	11
Annex I Alluvial Woodlands	12
1 Introduction and Background	12
2 Methodology	12
3 Results	14
4 Conclusion	15
References	16
Springs and Seepages	17
1 Introduction	17
2 Methodology	17
3 Results	17
4 Conclusion	17
References	18
Appendix A: High Quality and Positive Indicator Species	19
Grasslands	19
Alluvial Woodlands Habitats	21
Petrifying Springs	22
Appendix B: Quadrat Survey Results	25
Grassland Sites	25
Wet Woodland Sites	32
Springs and Seepages	39
Chrysosplenium oppositifolium	40
Appendix C: Site Photos	43
Grassland Sites	43
Woodland Sites	46

Springs and Seepages48

Introduction

On behalf of Wicklow County Council and AECOM, Flynn Furney Environmental Consultants completed a range of ecological surveys and reports on the Proposed Blessington eGreenway (hereafter referred to as the Proposed Development) to address a further information request from An Bord Pleanála in relation to Proposed Development.

This report assess the possible links to Annex I habitat that may occur within the development site and if any rare or protected plants are found within the Proposed Development. This report aims to address the following items listed in the An Bord Pleanála a further information request:

11, The applicant is referred to the detailed submission on the proposed development from the Development Applications Unit of the Department of Housing, Local Government and Heritage and in particular to matters relating to permanent habitat loss and significant disturbance. The applicant is requested to provide a comprehensive and detailed response to each of the issues raised in the submission received by the Department with regard to nature conservation. In particular, the applicant shall address the following:

- iv. The wet willow-alder-ash woodland (WN6) and mosaics with other habitats recorded on site shall be subject to further field survey at an appropriate time of the year by a suitably qualified ecologist to determine whether Annex I priority habitat Alluvial Forest is present and suitable mitigation shall be put in place if required*
- v. Further investigations are required to determine the presence of seepage within the development footprint, as well as Marsh Fritillary*¹ and rare plants.*

¹ Marsh fritillary surveys are discussed in the Fauna Survey Report (FFEC, 2023).

Annex I Grassland Habitats and Rare Plants

1 Introduction

The following report presents the findings of a comprehensive survey conducted to assess the ecological and conservation aspects of protected species and grassland habitats within the footprint of the Proposed Development. These surveys were carried out in response to a Request for Further Information received by Wicklow County Council from An Bord Pleanála on the 16th of March 2023. The proposed Blessington eGreenway consists of 33km of walking and cycling paths around the Poullapouca Reservoir/ Blessington Lake. This is an area of ecological significance, acknowledged through its designation as a Special Protection Area (SPA) and its inclusion in the Potential Natural Heritage Area (pNHA). The Proposed Development lies partly within the Poulaphouca Reservoir SPA (site code: 002122) and within 500m of the Wicklow Mountains Special Areas of Conservation (SAC) (site code: 002122).

This assessment highlights any features of particular importance and identifies whether any grassland habitats listed in Annex I of Directive 92/43/EEC (Habitats Directive) are located within the study area.

Grasslands of conservation interest are protected in Ireland through conservation designations that vary in the level of protection they provide to the species and habitats found within them. For example, the Flora (Protection) Order 2022 affords protection to individual plant species listed in the Order, and the protection extends to their habitats. The Wildlife Act, 1976 and the subsequent Wildlife (Amendment) Act, 2000 are the two main articles of legislation that provide protection to wild flora, fauna and semi-natural habitats, including grasslands. Additional statutory protection is available under the recent Environmental Impact Assessment Agriculture Regulations (Statutory Instrument 456 of 2017), which offer protection to semi-natural grasslands in the event of their intended conversion for intensive agriculture, requiring screening to take place if the area to be affected exceeds a certain size. Semi-natural grassland habitats are also afforded legal protection by the Environmental Liability Directive, which prevents and remedies environmental damage to natural habitats and protected species. Grasslands located within National Parks and Nature Reserves can have the highest level of protection, as they are State-owned and managed for conservation. Special Areas of Conservation (SACs) and Special Protection Areas for Birds designated as a result of EU directives provide the next highest level of protection, while Natural Heritage Areas (NHAs) designated under domestic legislation provide the third tier of protection. As not all NHAs have been designated, pNHA is used to distinguish non-designated sites.

Six Annex I grassland habitats of conservation importance have been recorded within Ireland by the National Parks and Wildlife Service (NPWS):

- Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) ([*] 6210).
- Species-rich *Nardus* grasslands on siliceous substrates in mountain areas (and sub-mountain areas, in Continental Europe) (*6230).
- *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (6410).
- Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (6430).
- Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*) (6510).
- Calaminarian grasslands of the *Violetalia calaminariae* (6130).

2 Methodology

2.1 Desktop Assessment

2.2 Rare Plants Survey

In 2021, comprehensive habitat and flora surveys were conducted across the entire survey area. Additionally, to address the RFI Response, targeted habitat and botanical surveys were carried out in the Proposed Development footprint in areas exhibiting high-quality examples of semi-natural habitats, including wet woodland, calcareous grasslands, wet grasslands, and exposed sands, gravels, or tills. The objective of these surveys was to determine whether any of the habitats aligned with Annex I habitat classifications. Furthermore, the surveys aimed to identify the presence of rare, threatened, and red-listed plants as outlined in the Flora Protection Order (2022).²

A search of the NDBC and the Flora protection order map viewer³ was carried out. The results of which are detailed in Table 1 below.

Table 1: Protected and rare species recorded during the desktop review

Species Designation	Location	Survey and Source	Potential for Impact
Blue Fleabane (<i>Erigeron acer</i>) Threatened Species: Least concern	In a quarry to the west of the reservoir	Desktop NDBC 2022	None Recorded outside the Proposed Development area
Cornflower (<i>Centaurea</i>)	Recorded in lands	Desktop	None

² Flora (Protection) Order (2022): Minister of State at the Department of Housing, Local Government and Heritage. No. 235 of 2022. Dublin, Ireland: Government Publications Office.

³ <https://heritagedata.maps.arcgis.com/apps/webappviewer/index.html?id=a41ef4e10227499d8de17a8abe42bd1e>
APB RFI Response: Annex 1 Habitats and Flora

Species Designation	Location	Survey and Source	Potential for Impact
cyanus)* Threatened Species: Waiting list	at the very south of the reservoir.	NDBC 2010	Recorded outside the Proposed Development area
Corn Marigold (<i>Glebionis segetum</i>)* Threatened Species: Near threatened	Record 1) Recorded in lands at the very south of the reservoir. Record 2) Recorded around Valleymount	Desktop NDBC 2010	1)Recorded outside the Proposed Development area 2) None recorded during surveys in 2021 or 2023.
Irish Whitebeam (<i>Sorbus hibernica</i>)	Recorded around Ballyknockan.	Desktop NDBC 1969	None No Whitebeam species were recorded during any surveys of the Proposed Development area
Six-stamened Waterwort (<i>Elatine hexandra</i>) Threatened Species: Near threatened	Recorded along the shoreline around Tulfarris Golf Club	Desktop NDBC 2015	None Recorded outside the Proposed Development area
Slender Tufted-sedge (<i>Carex acuta</i>) Threatened Species: Near threatened	Recorded along the shoreline southwest of Valleymount	Desktop NDBC 2015	
Bog Orchid (<i>Hammarbya paludosa</i>)	Recorded around Ballyknockan.	Flora Protection Order Map viewer 1995	None Recorded outside the Proposed Development area

***Both species are often found in wildflower seed mixes and are unlikely to be locally native in origin**

2.3 Field Surveys

Surveys were carried out on the 9th, 10th and 11th of August by competent ecologists of Flynn Furney Environmental Consultants. Botanical surveys were carried out in areas within or adjacent to the Proposed Development footprint that could provide refuge for rare plants or plants listed on the Flora protection order. All plant species recorded within detailed quadrats are listed in Appendix A and B.

The methodology employed for this survey was adapted from "The monitoring and assessment

of three EU Habitats Directive Annex I grassland habitats" by O'Neill et al., 2013. Vegetation data was collected through the analysis of 2x2 metres quadrat surveys. This approach allowed for a comprehensive evaluation of plant diversity and community structure. Previous ground surveys completed in the summer of 2020 as part of the original planning application aided in the selection of areas for targeted surveys. This was done by assessing the habitat maps and species lists submitted as part of the original planning application for the presence of semi-natural grasslands as indicated by the following Fossitt codes (Fossitt, 2000):

- GS1 Dry calcareous and neutral grassland
- GS2 Dry meadows and grassy verges
- GS3 Dry-humid acid grassland
- GS4 Wet grassland

This allowed for the selection of 13 relevés for further analysis. For each of the 13 pre-selected relevés, 2x2 quadrats were used to record the species present and their abundance.

This survey also aimed to assess whether any plants listed as rare, threatened or protected species as per the Red Data List (Wyse Jackson et al., 2016) or the Flora Protection Order (2022) were found within the relevés or the surrounding area.

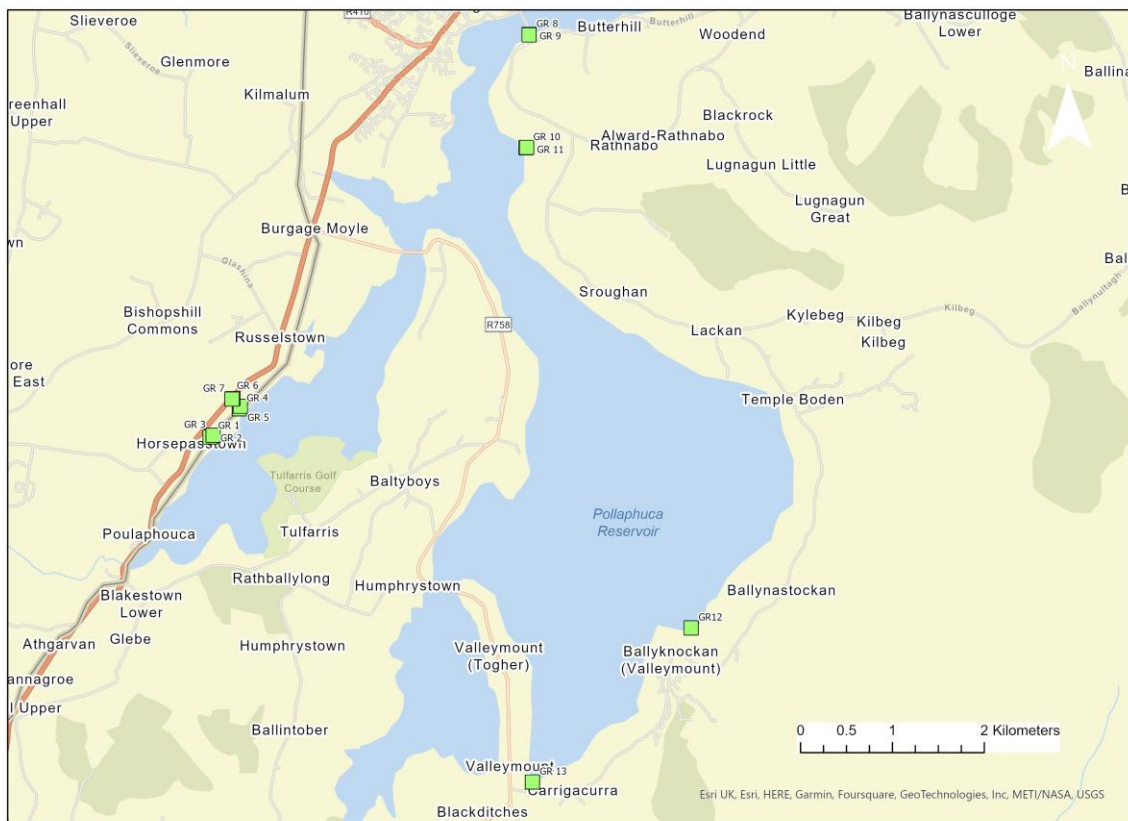


Figure 1: Location of grassland relevés.

The abundance and cover of each species was recorded using the Domin scale. The Domin scale provides a qualitative estimate of the abundance and cover of plant species within a particular area allowing for a systematic assessment of the vegetation composition. It involves estimating the percentage cover of each species in a given plot (See Figure 1).

Domin Scale Number	Cover Percentage (%)
10	91–100%
9	76–90%
8	51–75%
7	34–50%
6	26–33%
5	11–25%
4	4–10%
3	<4% (many individuals)
2	<4% (several individuals)
1	<4% (few individuals)

Figure 2: The Domin Scale, used to measure species abundance. (O' Neil et al, 2013)

Species results for each quadrat were compared to high quality and positive indicators species to determine whether grasslands corresponded to 6410 or 6210 grasslands. High quality and positive indicator species are flora species which are commonly found within the aforementioned annex 1 grassland and indicate their presence. A list of these species as outlined in O' Neil et al., 2013 can be found in Appendix A. The number of high quality species in each plot should be ≥ 2 + Positive indicators should be ≤ 7 .

3 Results

Appendix B contains species lists from the sampled quadrats, with high-quality indicators highlighted in yellow and positive indicators marked in green. One relevé identified corresponds to Annex I Semi-natural dry grasslands and scrubland facies on calcareous substrates 6210. While it falls short of the required six positive indicator species, this grassland type exhibits a notable presence of high-quality indicator species, with three recorded inside the quadrat. Quadrats 1 and 2, although not confirming the specific type, demonstrate high species richness and harbour a diverse and abundant insect population. Refer to Figure 3 (GR1, GR2, GR3) for the geographical distribution of grasslands aligning with the annexed type 6210. This section of grassland is not directly within the greenway footprint but measures should be put in place to prevent damage during construction.



Figure 3: Habitat outside the Proposed Development aligning with scrubland facies on calcareous substrates 6210

The second most species-rich grasslands identified during the survey did not meet the criteria for positive and high-quality indicators for Annex I grasslands type. Nevertheless, these areas exhibit high species richness and diversity, marked by a profusion of anthills—an indication of soil conducive to the flourishing of diverse wildflowers. Figure 4 shows the location of this grassland. A small section of this high-quality grassland is along the Proposed Development route, however, the majority will remain unimpacted.



Figure 4: Location of species-rich grassland.

No rare, threatened or protected species of plants as per the Red Data List (Wyse Jackson et al 2016) were found. No species listed in the Flora Protection Order (2022) were found to be growing within the site.

4 Conclusion

Appendix B details species lists from surveyed quadrats, indicating high-quality indicators in yellow and positive indicators in green. One relevé aligns with Annex I Semi-natural dry grasslands and scrubland facies on calcareous substrates 6210, recording three high-quality indicators. This grassland falls outside of the works corridor. However, measures should be put in place to prevent damage during construction. The working corridor will be as small as possible, with activity concentrated on the path networks. The working corridor will be demarcated in advance of all other works in this area. Annex 1 grassland (6210) will be cordoned off prior to works (area specified in Figure 3).

The second most species-rich grasslands lack positive and high-quality indicators for Annex I type but boast diversity and anthills (Figure 4). While a small section of this grassland will be impacted, the majority of the species-rich grassland type falls within a depression left from an old quarry. A grazing management plan should be drawn up alongside an ecologist and the NPWS which would encourage diverse grasslands in this area, resulting in a net positive project impact.

References

Conaghan, J., Hamilton, J., Cole, E. & Pierce, S..(2020). BSBI Ireland Annex I Grassland Resources. The Irish Grasslands Project.

Fossitt, J. (2000). *A guide to habitats in Ireland*. The Heritage Council, Kilkenny

O'Neill, F.H., Martin, J.R., Devaney, F.M. & Perrin, P.M. (2013) The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland

Annex I Alluvial Woodlands

1 Introduction and Background

Following a Request for Further Information received by Wicklow County Council from An Bord Pleanála on the 16th of March 2023. Surveys of areas of wet woodland for conformity with the Annex I priority habitat Alluvial Forests was carried out

The proposed Blessington eGreenway consists of 33km of walking and cycling paths around the Poullapouca Reservoir/ Blessington Lake. This is an area of ecological significance, acknowledged through its designation as a Special Protection Area (SPA) and its inclusion in the Potential Natural Heritage Area (pNHA). The Proposed Development lies partly within the Poulaphouca Reservoir SPA (site code: 002122) and within 500m of the Wicklow Mountains Special Areas of Conservation (SAC) (site code: 002122). This assessment highlights any features of particular importance and identifies whether any woodland habitats listed in Annex I of Directive 92/43/EEC (Habitats Directive) are located within the study area, namely alluvial-type woodlands.

91E0 and 91A0 are priority habitats listed on Annex I of Directive 92/43/EEC of the Habitats Directive. Several variants of this woodland habitat exist, of which riparian forests of *Fraxinus excelsior* and *Alnus glutinosa* are the most common type to be found in Ireland. This habitat should contain a good quantity of dead wood, and a range of dead wood types (coarse, fine, standing, fallen, etc.). Alluvial woodlands in Ireland occur within the hydrological system of a river or lake and are periodically inundated by the rise and fall of water levels. Their identification varies between the north and south of Ireland with *Salix cinerea* stands not recognised as an indicator species in the north. Strips which are short, narrow, discontinuous and surrounded by open habitat should not be assigned to 91E0 or 91A0 as they cannot be considered to be functioning woodlands. Nettles are a positive indicator but should not be overabundant.

2 Methodology

Surveys were carried out on the 9th, 10th and 11th of August by competent ecologists of Flynn Furney Environmental Consultants. The methodology employed for this survey was adapted from "Results of a monitoring survey of old sessile oak woods and alluvial forests" by Fionnuala H. O'Neill and Simon J. Barron (2013). Vegetation data was collected through the analysis of 10x10 metres quadrat surveys. This approach allowed for a comprehensive evaluation of plant diversity and community structure. Previous ground surveys completed in the summer of 2020 as part of the original planning application aided in the selection of areas for further targeted surveys.

The methodology was based on the presence of positive indicator species (flora species which are commonly found within alluvial woodlands and indicate their presence) and target species (species which must be present for habitats to conform to 91A0 and 91E0 woodlands). Target

species should make up >50% of the canopy. Appendix A gives the list of target and indicator species for 91A0 and 91E0 woodlands (O’Neil et al., 2013). At least 1 target species and ≥ 6 positive indicator species should be present in relevés. The abundance and cover of each species were recorded using the Domin scale. The Domin scale provides a qualitative estimate of the abundance and cover of plant species within a particular area allowing for a systematic assessment of the vegetation composition. It involves estimating the percentage cover of each species in a given plot (See Figure 1).

This survey also aimed to assess whether any plants listed as rare, threatened or protected species as per the Red Data List (Wyse Jackson et al., 2016) or the Flora Protection Order (2022) were found within these sample sites or the surrounding area.

The woodland assessment surveys described in this report have been undertaken with reference to the following guidelines:

- National Roads Authority (2009) Guidelines for assessment of ecological impacts of national road schemes, Dublin, Ireland.
- O’Neill, F.H. & Barron, S.J. (2013) Results of monitoring survey of old sessile oak woods and alluvial forests. Irish Wildlife Manuals, No. 71. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Perrin, P.M, Martin, J.R., Barron, S.J., O’Neill, F.H., McNutt, K.E. & Delaney, A.M. (2008) National Survey of Native Woodlands 2003-2008: Volume I: Main report. Report submitted to National Parks & Wildlife Service, Dublin.
- Perrin, P.M, Martin, J.R., Barron, S.J., O’Neill, F.H., McNutt, K.E. & Delaney, A.M. (2008) National Survey of Native Woodlands 2003-2008: Volume II: Woodland classification. Report submitted to National Parks & Wildlife Service, Dublin.

These surveys also consisted of an assessment for the presence of rare, threatened or protected species of plants as per the Red Data List (Wyse Jackson et al., 2016).

Domin Scale Number	Cover Percentage (%)
10	91–100%
9	76–90%
8	51–75%
7	34–50%
6	26–33%
5	11–25%
4	4–10%
3	<4% (many individuals)
2	<4% (several individuals)
1	<4% (few individuals)

Figure 5: The Domin Scale, used to measure species abundance. (O’Neil et al, 2013)

Seven locations in total were surveyed for the presence of alluvial woodland habitat based on

identification during previous habitat surveys of the site carried out as part of the Ecological Impact Assessment report for this development in the summer of 2021. Woodlands which were recorded in any of the following Fossitt habitat categories during the 2021 surveys were targeted for further assessment:

- WN4 Wet pedunculate oak-ash woodland
- WN5 Riparian woodland
- WN6 Wet willow-alder-ash woodland

This included sample sites within and outside the actual works footprint. Sample sites were generally found around river outfalls into Poullapouca Reservoir.

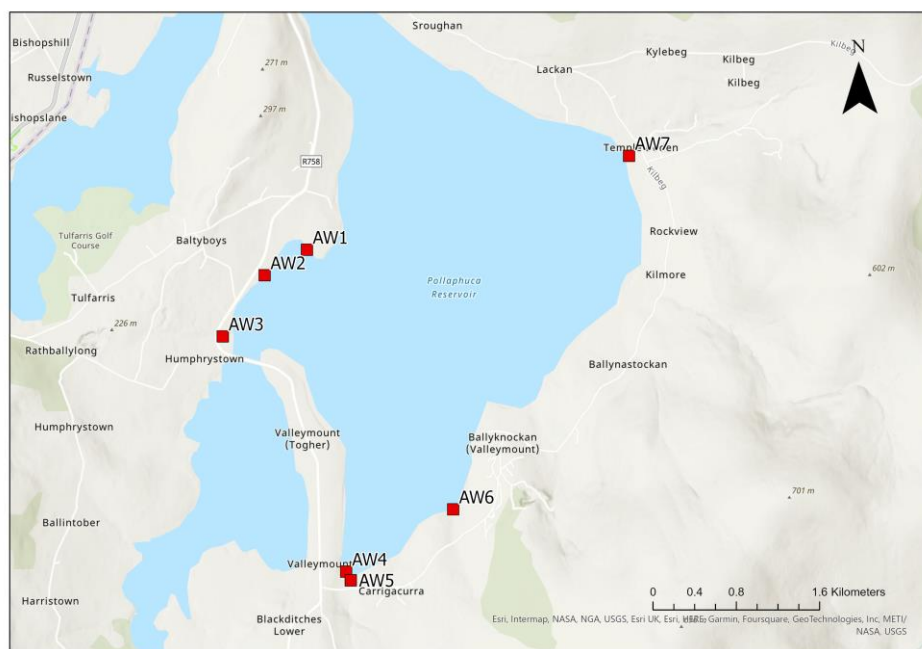


Figure 6: Locations of surveys for annex 1 type alluvial woodland.

3 Results

Figure 1 shows the location of all survey points. The species lists recorded for each of the seven survey locations can be found in Appendix B. The aforementioned target species have been highlighted in yellow, positive indicators in orange and negative indicators in red in Appendix B. This was done to indicate their presence/ absence within the sample plots. As previously noted within Section 2 at least 1 target species and ≥ 6 positive indicator species should be present in relevés to correspond to 91A0 and 91E0 woodlands. Target species must make up $>50\%$ of the canopy to be included in these annex 1 categories.

Most examples of high quality wet woodland found around the survey site were typically small in

size and discontinuous. While some target species and positive indicators were noted in each quadrat (See Appendix B), none of the woodlands surveyed corresponded to the annex type 91A0 and 91E0 woodlands based on the general site characteristics and the absence of a sufficient number of both target and positive indicator species.

No rare, threatened or protected species of plants as per the Red Data List (Wyse Jackson et al., 2016) were found. No species listed in the Flora Protection Order (2022) were found to be growing within 1km of the survey locations.

4 Conclusion

No woodland habitat surveyed aligned with alluvial woodland (91A0 and 91E0) based on the site characteristics and the absence of a sufficient number of both target and positive indicator species.

Survey sites did however contain portions of high quality habitat and good species diversity. All woodland categories are now very limited in extent in Ireland and should be regarded as being of conservation importance. A total of 0.87ha of wet woodland habitat is found within the Proposed Development footprint accounts for a small area of habitat and is generally associated with the fringes of these habitat areas. This scheme has intentionally avoided areas of wet woodlands due to both biodiversity and engineering concerns associated with building in wetland areas.

Mitigation measures to prevent impacts to woodlands should be set out in the CEMP.

At a minimum, this will consider the following:

1. Establish buffer zones or setbacks around woodland areas to minimize direct disturbance. Demarcate no-build zones to safeguard the woodland's integrity.
2. Implement protective measures for the existing vegetation, including protective fencing or barriers.
3. Avoid soil compaction or disturbance in areas adjacent to woodlands to prevent the spread of invasive species.
4. Control and limit access to construction sites near woodlands, allowing only essential personnel and machinery.
5. Utilise designated access routes to minimise the spread of construction-related debris.
6. Identify and protect significant or mature trees within or near the greenway footprint by establishing route protection zones.
7. Implement erosion control techniques such as silt fences, sediment basins, and sediment control matting to prevent soil erosion into woodlands.
8. Ensure that water runoff from construction sites is properly managed to prevent pollutants from entering nearby water bodies or impacting the woodlands.

References

- National Roads Authority (2009) Guidelines for assessment of ecological impacts of national road schemes, Dublin, Ireland.
- O'Neill, F.H. & Barron, S.J. (2013) Results of monitoring survey of old sessile oak woods and alluvial forests. Irish Wildlife Manuals, No. 71. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland
- Perrin, P.M, Martin, J.R., Barron, S.J., O'Neill, F.H., McNutt, K.E. & Delaney, A.M. (2008) National Survey of Native Woodlands 2003-2008: Volume I: Main report. Report submitted to National Parks & Wildlife Service, Dublin.
- Perrin, P.M, Martin, J.R., Barron, S.J., O'Neill, F.H., McNutt, K.E. & Delaney, A.M. (2008) National Survey of Native Woodlands 2003-2008: Volume II: Woodland classification. Report submitted to National Parks & Wildlife Service, Dublin.

Springs and Seepages

1 Introduction

Petrifying springs are lime-rich water sources that deposit tufa, a porous calcareous rock. They constitute a highly specialised habitat with a distinctive flora, typically dominated by bryophytes and often containing rare species. Their small extent and their vulnerability are recognised by their designation as a priority habitat in Annex I of the European Union Habitats Directive (92/43/EEC).

This section aimed to assess the likelihood of springs and seepages recorded within the Proposed Development site and their likelihood to correspond to this habitat type and to assess their habitat value.

2 Methodology

A desktop review of existing data on Petrifying springs and spring habitats was conducted based on data held on the EU Habitats Directive Annex Habitats Article 17 Report 2019 – Terrestrial Habitat, via historical mapping. Field surveys followed:

Field surveys of springs and seepages were carried out in 5 locations noted in December 2023. While this is outside the optimal season for surveying petrifying springs. There geomorphological features which define spring habitat in addition to several bryophytes and vascular plant species are visible throughout the year

3 Results

Springs and seepages were generally rare around the reservoir except in the Baltyboys route section. Here 5 springs/seepages were identified within a 600m extent. Seepages and springs were found to occur along the boundary between the shoreline and the adjacent woodland and scrubby verge habitat. In all instances, springs were found on sandy substrates. No Geomorphological features including cemented rudites, cascades, dams, stream crust, paludal or oncoids/ooids were found at any location. All had limited or absent moss and algal communities. No high-quality indicator species were identified. Positive vascular plant indicator species: opposite-leaved golden saxifrage (*Chrysosplenium oppositifolium*) was recorded at 3 of the spring locations. *Eucladium verticillatum* was recorded at one location. The negative indicator species *Juncus effusus* and *Phragmites australis* were recorded at one location.

4 Conclusion

None of the springs and seepages surveyed conforms to the annex I habitat 7220 Petrifying springs with tufa formation (Cratoneurion). No high quality indicator species were found. None

were recorded with the key Geomorphological features that denote this habitat type.

While these springs and seepages do not conform to this annex I habitat category, they are still considered habitat types of High Local significance and should be protected where possible. Works should aim to avoid adverse impacts to their hydromorphology, habitat conditions and water quality.

- Where possible works should avoid these habitats
- Silt fencing should be placed around each spring to avoid water quality impacts during construction
- Where impacts are unavoidable, the spring should be redirected to outfall within a designated compensation area created in a shallow depression with substrate matching the original spring. Plant material from the original spring should be collected by the site ecologist and used to seed the new compensation area.

References

- M.D. & Kelly, D.L. (2016) Monitoring guidelines for the assessment of petrifying springs in Ireland. Irish Wildlife Manuals, No. 94. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Ireland and;
- Denyer, J., Eakin, M., & Gill, M. (2023). Guidelines for the Assessment of Annex I Priority Petrifying Springs in Ireland. Irish Wildlife Manuals, No. 142. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.

Appendix A: High Quality and Positive Indicator Species

Grasslands

Source: O'Neil et al, 2013.

6410 Positive indicator species:

Scientific Name	Common Name
<i>Achillea ptarmica</i>	Sneezewort
<i>Carex echinata</i>	Star Sedge
<i>Carex flacca</i>	Glaucous Sedge
<i>Carex nigra</i>	Common Sedge
<i>Carex panicea</i>	Carnation Sedge
<i>Carex viridula</i>	Yellow Sedge
<i>Equisetum palustre</i>	Marsh Horsetail
<i>Filipendula ulmaria</i>	Meadowsweet
<i>Galium palustre</i>	Marsh Bedstraw
<i>Juncus acutiflorus</i>	Sharp-flowered Rush
<i>Juncus articulatus</i>	Jointed Rush
<i>Lotus pedunculatus</i>	Greater Bird's-foottrefoil
<i>Luzula multiflora</i>	Heath Wood-rush
<i>Mentha aquatica</i>	Water Mint
<i>Molinia caerulea</i>	Purple Moor-grass
<i>Potentilla anglica</i>	Trailing Tormentil
<i>Potentilla erecta</i>	Tormentil
<i>Ranunculus flammula</i>	Lesser Spearwort
<i>Succisa pratensis</i>	Devil's-bit Scabious
<i>Viola palustris</i>	Marsh Violet

6410 High quality indicator species:

Scientific Name	Common Name
<i>Carex pulicaris</i>	Flea Sedge
<i>Carum verticillatum</i>	Whorled Caraway
<i>Cirsium dissectum</i>	Meadow Thistle
<i>Crepis paludosa</i>	Marsh Hawk's-beard
<i>Galium uliginosum</i>	Fen Bedstraw
<i>Juncus conglomeratus</i>	Compact Rush
<i>Lathyrus palustris</i>	Marsh Pea
<i>Ophioglossum vulgatum</i>	Adder's-tongue Fern
<i>Viola persicifolia</i>	Fen Violet
	Orchid species

6210 Positive indicator species:

Scientific Name	Common Name
<i>Arabis hirsuta</i>	Hairy Rock-cress
<i>Brachypodium pinnatum</i>	Heath false brome
<i>Bromopsis erecta</i>	Upright Brome
<i>Carex flacca</i>	Blue Sedge
<i>Ctenidium molluscum</i>	Chalk Comb-moss
<i>Daucus carota</i>	Wild Carrot
<i>Galium verum</i>	Lady's Bedstraw
<i>Helictotrichon pubescens</i>	Downy Oat-grass
<i>Homalothecium lutescens</i>	Yellow Feather-moss
<i>Leontodon hispidus</i> / <i>L. saxatilis</i>	Rough Hawkbit/Lesser Hawkbit
<i>Lotus corniculatus</i>	Bird's-foot trefoil
<i>Origanum vulgare</i>	Oregano
<i>Pilosella officinarum</i>	Mouse-ear Hawkweed
<i>Ranunculus bulbosus</i>	Bulbous Buttercup
<i>Sesleria caerulea</i>	Blue Moor-grass
<i>Thymus polytrichus</i>	Wild Thyme
<i>Trisetum flavescens</i>	Yellow Oat-grass

6210 High quality indicator species:

Scientific Name	Common Name
<i>Antennaria dioica</i>	Mountain Everlasting
<i>Anthyllis vulneraria</i>	Kidney Vetch
<i>Asperula cynanchica</i>	Squinancywort
<i>Blackstonia perfoliata</i>	Yellow-wort
<i>Briza media</i>	Quaking-grass
<i>Campanula rotundifolia</i>	Harebell
<i>Carex caryophyllea</i>	Vernal sedge
<i>Carlina vulgaris</i>	Carlina Thistle
<i>Centaurea scabiosa</i>	Greater Knapweed
<i>Filipendula vulgaris</i>	Dropwort
<i>Gentiana verna</i>	Spring Gentian
<i>Gentiana amarella/campestris</i>	Autumn Gentian/Field Gentian
<i>Geranium sanguineum</i>	Bloody Crane's-bill
<i>Knautia arvensis</i>	Field Scabious
<i>Koeleria macrantha</i>	Crested Hair-grass
<i>Linum catharticum</i>	Fairy Flax
<i>Primula veris</i>	Cowslip
<i>Sanguisorba minor</i>	Salad burnet
	Orchid species (Record individual orchid species separately)

Alluvial Woodlands Habitats

List of positive indicator species for 91A0 and 91E0 woodlands (O'Neil et al., 2013)

91A0	91E0
<u>Target species:</u>	<u>Target species:</u>
<i>Quercus petraea</i>	<i>Alnus glutinosa</i>
<i>Quercus x rosacea</i>	<i>Fraxinus excelsior</i>
	<i>Salix cinerea</i>
<u>Other woody species:</u>	<i>Salix spp.</i>
<i>Betula pubescens</i>	<u>Other woody species:</u>
<i>Corylus avellana</i>	<i>Betula pubescens</i>
<i>Ilex aquifolium</i>	<i>Crataegus monogyna</i>
<i>Lonicera periclymenum</i>	<i>Solanum dulcamara</i> (2012 only)
<i>Sorbus aucuparia</i>	<i>Viburnum opulus</i>
<i>Vaccinium myrtillus</i>	
<u>Herbs & Ferns:</u>	<u>Herbs & Ferns:</u>
<i>Blechnum spicant</i>	<i>Agrostis stolonifera</i>
<i>Luzula sylvatica</i>	<i>Angelica sylvestris</i>
<i>Oxalis acetosella</i>	<i>Carex remota</i>
<i>Hyacinthoides non-scripta</i>	<i>Filipendula ulmaria</i>
<i>Polypodium sp.</i>	<i>Galium palustre</i>
	<i>Iris pseudacorus</i>
<u>Mosses & Liverworts:</u>	<i>Lycopus europaeus</i> (2012 only)
<i>Dicranum scoparium</i>	<i>Mentha aquatica</i>
<i>Diplophyllum albicans</i>	<i>Phalaris arundinacea</i>
<i>Hylocomium brevirostre</i>	<i>Ranunculus repens</i>
<i>Mnium hornum</i>	<i>Rumex sanguineus</i>
<i>Plagiothecium undulatum</i>	<i>Urtica dioica</i>
<i>Polytrichastrum formosum</i>	
<i>Pseudotaxiphyllum elegans</i>	<u>Mosses & Liverworts:</u>
<i>Rhytidiadelphus loreus</i>	<i>Calliergonella cuspidata</i>
<i>Saccogyna viticulosa</i>	<i>Climacium dendroides</i>
<i>Scapania gracilis</i>	<i>Thamnobryum alopecurum</i>

Petrifying Springs

High Quality Indicator Species of petrifying springs

Species	Status in Ireland	Source
<i>Saxifraga aizoides</i>	Rather rare; found in only six vice-counties	Parnell & Curtis 2012; Scannell & Synnott 1987
<i>Seligeria oelandica</i>	Vulnerable	Lockhart <i>et al.</i> 2012
<i>Seligeria patula</i>	Near Threatened	Lockhart <i>et al.</i> 2012
<i>Orthothecium rufescens</i>	Near Threatened	Lockhart <i>et al.</i> 2012
<i>Hymenostylium recurvirostrum var. insigne</i>	Near Threatened	Lockhart <i>et al.</i> 2012
<i>Tomentypnum nitens</i>	Vulnerable	Lockhart <i>et al.</i> 2012
<i>Catoscopium nigratum</i>	Near Threatened	Lockhart <i>et al.</i> 2012
<i>Leiocolea bantriensis</i>	Near Threatened	Lockhart <i>et al.</i> 2012

Positive indicator species of petrifying springs (V = vascular plant, M = moss, L = liverwort, A = alga)

Positive Indicator Species	
V <i>Anagallis tenella</i>	M <i>Eucladium verticillatum</i>
L <i>Aneura pinguis</i>	V <i>Festuca rubra</i>
M <i>Bryum pseudotriquetrum</i>	M <i>Fissidens adianthoides</i>
M <i>Campylium stellatum</i>	L <i>Jungermannia atrovirens</i>
V <i>Carex lepidocarpa</i>	M <i>Palustriella commutata</i>
V <i>Carex panicea</i>	M <i>Palustriella falcata</i>
A <i>Chara vulgaris</i>	V <i>Parnassia palustris</i>
V <i>Chrysosplenium oppositifolium</i>	L <i>Pellia endiviifolia</i>
V <i>Crepis paludosa</i>	M <i>Philonotis calcarea</i>
M <i>Didymodon tophaceus</i>	V <i>Pinguicula vulgaris</i>
V <i>Equisetum telmateia</i>	M <i>Scorpidium cossonii</i>
V <i>Equisetum variegatum</i>	M <i>Scorpidium scorpioides</i>
V <i>Eriophorum latifolium</i>	V <i>Selaginella selaginoides</i>

Herbaceous species which are Negative Indicators for petrifying springs

Herbaceous Negative Indicator Species

<i>Apium nodiflorum</i>	<i>Juncus effusus</i>
<i>Dactylis glomerata</i>	<i>Petasites hybridus</i>
<i>Epilobium brunnescens</i>	<i>Phragmites australis</i>
<i>Epilobium hirsutum</i>	<i>Rumex obtusifolius</i>
<i>Eupatorium cannabinum</i>	<i>Urtica dioica</i>
<i>Heracleum sphondylium</i>	

Geomorphological classification of tufa formation types occurring in Ireland (adapted from Pentecost & Viles 1994, Pentecost 1995, 2005)

Category	Description
Cascade	Developing on steep slopes at varying distances from the water source; characterised by massive, frequently complex build-ups. (Generally corresponding to the 'perched springline' model of Ford & Pedley 1996, Pedley 1990 and Pedley <i>et al.</i> 2003) (Photos 1, 7, 8, 12 and 24).
Dam	Similar to cascades but forming along streams and rivers and causing the impoundment of water behind a tufa crest. (Photo 28).
Stream crust	Sheet-like deposits forming in streams of intermediate to low gradient; these may merge with cascades (Photos 2, 3, 19 and 34).
Paludal	Formed in low gradient mires where tufa accumulates around the bases of plants, often surrounded by carbonate muds (Photo 5, 15 and 16).
Cemented rudites	Gravels etc. cemented by tufa; often found on coasts where spring water seeps onto shingle banks (Photo 7).
Oncoids/ooids	Unattached, coated grains (<1mm up to 30 cm); the cortex may consist of biotic or abiotic particles, such as stones or plant fragments (Photo 4).

Field Survey Sheet for Petrifying Springs Habitat

1	High Quality Indicator Species Present/Absent + List
2	Positive indicator species Present/Absent + List
3	Negative indicator species Present/Absent + List
4	Geomorphological classification of tufa formation types: <ul style="list-style-type: none"> • Cascade • Dam • Stream crust • Paludal • Cemented rudites • Oncoids/ooids Present/Absent + List
5	The presence of surface water was recorded as flowing/trickling, pools/standing water or dripping Present/Absent
6	Species Recorded in 2x2m around springhead

Appendix B: Quadrat Survey Results

Grassland Sites

Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	1
Date:	02/08/2023
Surveyors	Marco Ra
Coordinates	6.5724313°W 53.1310933°N
Habitat:	GS1
Annex 1 affiliation:	6210
Species list	DOMIN
<i>Leontodon saxatilis</i>	7. 34-50%
<i>Lotus corniculatus</i>	1. <4 rare
<i>Centaurea nigra</i>	4. 5-10%
<i>Carex nigra</i>	4. 5-10%
<i>Potentilla erecta</i>	3. <4 frequent
<i>Ranunculus repens</i>	4. 5-10%
<i>Bellis perennis</i>	7. 34-50%
<i>Euphrasia agg.</i>	4. 5-10%
Glaucus Sedge Carex flacca	7. 34-50%
<i>Equisetaceae agg.</i>	5. 11-25%
<i>Lathyrus pratensis</i>	3. <4 frequent
<i>Homalothecium lutescens</i>	9. 76-90%
<i>Trifolium pratense</i>	4. 5-10%
<i>Festuca rubra</i>	7. 34-50%

Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	2
Date:	02/08/2023
Coordinates	6.5725654°W 53.1310251°N
Habitat:	GS1
Annex 1 affiliation:	6210
Species list	
<i>Medicago lupulina</i>	4. 5-10%
<i>Lotus corniculatus</i>	6. 26-33%
<i>Centaurea nigra</i>	5. 11-25%
<i>Bellis perennis</i>	8. 51-75%
<i>Euphrasia agg.</i>	4. 5-10%
<i>Linum catarticum</i>	3. <4 frequent
<i>Veronica chamaedrys</i>	3. <4 frequent
<i>Carex flacca</i>	5. 11-25%
<i>Equisetaceae agg.</i>	4. 5-10%
<i>Galium verum</i>	2. <4 scattered
<i>Leontodon saxatilis</i>	4. 5-10%
<i>Lathyrus pratensis</i>	2. <4 scattered
<i>Homalothecium lutescens</i>	7. 34-50%
<i>Trifolium pratense</i>	4. 5-10%

<i>Anthoxanthum odoratum</i>	4. 5-10%
<i>Trifolium repens</i>	3. <4 frequent
<i>Achillea millefolium</i>	4. 5-10%
<i>Rhinanthus minor</i>	1. <4 rare
<i>Holcus lantanus</i>	5. 11-25%
<i>Caarex flacca</i>	1. <4 rare
*Numerous Invertebrate population	

<i>Festuca rubra</i>	5. 11-25%
<i>Anthoxanthum odoratum</i>	4. 5-10%
<i>Vicia cracca</i>	2. <4 scattered
<i>Trifolium repens</i>	4. 5-10%
<i>Achillea millefolium</i>	4. 5-10%

Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	3
Date:	02/08/2023
Quadrat Size:	2x2
Coordinates	6.5720685°W 53.1311793°N
Habitat:	GS1
Annex 1 affiliation:	6210
Species list	
<i>Lotus corniculatus</i>	6. 26-33%
<i>AScorzoneroides autumnalis</i>	4. 5-10%
<i>Vicia sepium</i>	5. 11-25%
<i>Veronica persica</i>	2. <4 scattered
<i>Centaurea nigra</i>	5. 11-25%
<i>Carex nigra</i>	3. <4 frequent
<i>Ranunculus repens</i>	2. <4 scattered
<i>Linum catarticum</i>	5. 11-25%

Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	4
Date:	02/08/2023
Quadrat Size:	2x2
Coordinates	6.5677128°W 53.1337169°N
Habitat:	GS1
Annex 1 affiliation:	6210
Species list	
<i>Potentilla simplex</i>	6. 26-33%
<i>Taraxacum officinale</i>	4. 5-10%
<i>False Fox-sedge Carex otrubae</i>	6. 26-33%
<i>Moss coverage</i>	8. 51-75%
<i>Arrhenantherum elatius</i>	5. 11-25%
<i>Festuca rubra</i>	7. 34-50%
<i>Potentilla anserina</i>	6. 26-33%
<i>Anthoxanthum odoratum</i>	6. 26-33%

Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	7
Date:	02/08/2023
Quadrat Size:	2x2
Coordinates	6.5688764°W 53.1346776°N
Habitat:	GS1
Annex 1 affiliation:	6410
Species list	
<i>Moss coverage</i>	7. 34-50%
<i>Scorzoneroides autumnalis</i>	2. <4 scattered
<i>Lotus corniculatus</i>	6. 26-33%
<i>Euphrasia agg.</i>	2. <4 scattered
<i>Linum catarticum</i>	4. 5-10%
<i>Carex flacca</i>	4. 5-10%
<i>Pilosella officinarum</i>	9. 76-90%
<i>Plantago lanceolata</i>	2. <4 scattered
<i>Prunella vulgaris</i>	3. <4 frequent
<i>Potentilla erecta</i>	3. <4 frequent
<i>*Ant hills abundant in the area</i>	

Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	8
Date:	02/08/2023
Quadrat Size:	2x2
Coordinates	6.5193407°W 53.1697075°N
Habitat:	GS1
Annex 1 affiliation:	6210
Species list	DAFOR
<i>Lotus corniculatus</i>	5. 11-25%
<i>Burnet Saxifrage Pimpinella saxifraga</i>	7. 34-50%
<i>Cock's-foot grass Dactylis glomerata</i>	5. 11-25%
<i>Common Field-speedwell Veronica persica</i>	5. 11-25%
<i>Common sorrel Rumex acetosa</i>	3. <4 frequent
<i>Creeping Buttercup Ranunculus repens</i>	5. 11-25%
<i>False oat grass Arrhenantherum elatius</i>	5. 11-25%
<i>Horsetails Equisetaceae agg.</i>	6. 26-33%
<i>Moss coverage</i>	6. 26-33%
<i>Red Fescue Festuca rubra</i>	6. 26-33%
<i>River plantain Alisma plantago-aquatica</i>	5. 11-25%
<i>Sheep sorrel Rumex acetosella</i>	6. 26-33%
<i>* Ants present</i>	

Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	9
Date:	02/08/2023
Quadrat Size:	2x2
Coordinates	6.5193407°W 53.1697075°N
Habitat:	GS1
Annex 1 affiliation:	6210
Species list	DAFOR
<i>Lotus corniculatus</i>	7. 34-50%
<i>Agrostis spp.</i>	3. <4 frequent
<i>Dactylis glomerata</i>	4. 5-10%
<i>Centaurea nigra</i>	3. <4 frequent
<i>Rumex acetosa</i>	4. 5-10%
<i>Agrostis stolonifera</i>	3. <4 frequent
<i>Calliargonella cuspidata</i>	9. 76-90%
<i>Mouse-Ear hawkweed Pilosella officinarum</i>	3. <4 frequent
<i>Red Clover Trifolium pratense</i>	3. <4 frequent
<i>Red Fescue Festuca rubra</i>	7. 34-50%
<i>River plantain Alisma plantago-aquatica</i>	4. 5-10%
<i>Sneezewort Achillea ptarmica</i>	3. <4 frequent
<i>Sweet Vernal-grass</i>	5. 11-25%

Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	10
Date:	02/08/2023
Quadrat Size:	2x2
Coordinates	6.5202270°W 53.1586557°N
Habitat:	GS1
Annex 1 affiliation:	6410
Species list	DAFOR
<i>Common Bird's-Foot trefoil Lotus corniculatus</i>	3. <4 frequent
<i>Vicia sepium</i>	3. <4 frequent
<i>Dactylis glomerata</i>	7. 34-50%
<i>Agrostis stolonifera</i>	4. 5-10%
<i>Ranunculus repens</i>	4. 5-10%
<i>Deschampia spp.</i>	5. 11-25%
<i>Lathyrus pratensis</i>	3. <4 frequent
<i>Filipendula ulmaria</i>	4. 5-10%
<i>Juncus acutiflorus</i>	2. <4 scattered
<i>Anthoxanthum odoratum</i>	7. 34-50%
<i>Potentilla erecta</i>	5. 11-25%

<i>Anthoxanthum odoratum</i>	
<i>Tormentil Potentilla erecta</i>	3. <4 frequent
<i>White Clover Trifolium repens</i>	4. 5-10%

Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	11
Date:	02/08/2023
Quadrat Size:	2x2
Coordinates	6.5201269°W 53.1586710°N
Habitat:	GS1
Annex 1 affiliation:	6410
Species list	DAFOR
<i>Persicaria amphibia</i>	4. 5-10%
<i>Vicia sepium</i>	3. <4 frequent
<i>Dactylis glomerata</i>	5. 11-25%
<i>Lathyrus pratensis</i>	3. <4 frequent
<i>Filipendula ulmaria</i>	9. 76-90%
<i>Rush Juncus acutiflorus</i>	3. <4 frequent
<i>Phleum pratense</i>	3. <4 frequent

Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	12
Date:	08/08/2023
Quadrat Size:	2x2
Coordinates	6.4950063°W 53.1114041°N
Habitat:	GS1
Annex 1 affiliation:	6410
Species list	DAFOR
<i>Stellaria holostea</i>	4. 5-10%
<i>Geum urbanum</i>	4. 5-10%
<i>Chrysosplenium oppositifolium</i>	4. 5-10%
<i>Oxalis acetosella</i>	6. 26-33%
<i>Urtica Dioca</i>	6. 26-33%
<i>Betula spp.</i>	5. 11-25%
<i>Alnus spp.</i>	6. 26-33%
<i>Dryopteris filix-mas</i>	4. 5-10%
<i>Geranium robertianum</i>	

Surveyors:	Josh Wolfe, Ian Douglas
Quadrat:	13
Date:	02/8/2023
Quadrat Size:	2x2
Coordinates	6.5213212°W 53.0966705°N
Habitat:	GS1
Annex 1 affiliation:	
Species list	DAFOR
<i>Rubus fruticosus agg.</i>	5. 11-25%
<i>Salix Spp</i>	4. 5-10%
<i>Scorzoneroides autumnalis</i>	4. 5-10%
<i>Hypochaeris radicata</i>	4. 5-10%
<i>Cirsium palustre</i>	3. <4 frequent
<i>Centaurea nigra</i>	3. <4 frequent
<i>Cynosurus cristatus</i>	5. 11-25%
<i>Festuca rubra</i>	3. <4 frequent
<i>Poa annua</i>	5. 11-25%
Senecio spp.	2. <4 scattered
<i>Plantago Lanceolate</i>	3. <4 frequent
<i>Geranium lucidum</i>	2. <4 scattered
<i>Trifolium repens</i>	2. <4 scattered
moss	7. 34-50%

Wet Woodland Sites

Surveyors:	Josh Wolfe, Ian Douglas		Surveyors:	Josh Wolfe, Ian Douglas
-------------------	----------------------------	--	-------------------	----------------------------

Quadrat: AW1		Quadrat: AW2	
Date:	02/8/2023	Date:	02/8/2023
Quadrat Size:	20 x 20	Quadrat Size:	20 x 20
ITM (X)	698666.4362	ITM (X)	698252.32
ITM (Y)	709304.7149	ITM (Y)	709059.81
Habitat:	WN6	Habitat:	WN6
Annex 1 affiliation:	Alluvial woodland	Annex 1 affiliation:	Alluvial woodland
Species list	DAFOR	Species list	DAFOR
<i>Salix Spp</i>	7. 34-50%	<i>Alnus glutinosa</i>	3. <4 frequent
<i>Alnus glutinosa</i>	6. 26-33%	<i>Salix Spp.</i>	4. 5-10%
<i>Quercus robur</i>	4. 5-10%	<i>Agrostis stolonifera</i>	9. 76-90%
<i>Ulex europaeus</i>	5. 11-25%	<i>Rubus fruticosus agg.</i>	7. 34-50%
<i>Fagus sylvatica</i>	2. <4 scattered	<i>Filipendula ulmaria</i>	2. <4 scattered
<i>Rubus fruticosus agg.</i>	8. 51-75%	<i>Phragmites australis</i>	4. 5-10%
<i>Tussilago farfara</i>	6. 26-33%	<i>Ranunculus repens</i>	6. 26-33%
<i>Equisetaceae agg.</i>	5. 11-25%	<i>Rumex acetosa</i>	4. 5-10%
<i>Agrostis stolonifera</i>	8. 51-75%	<i>Equisetaceae agg.</i>	3. <4 frequent
<i>Festuca rubra</i>	8. 51-75%	<i>Deschampsia cespitosa</i>	3. <4 frequent
<i>Achillea millefolium</i>	3. <4 frequent	<i>Valeriana officinalis</i>	3. <4 frequent
<i>Viola riviniana</i>	6. 26-33%	<i>Lycopus europaeus</i>	3. <4 frequent
<i>Potentilla sterilis</i>	3. <4 frequent	<i>Stachys palustris</i>	3. <4 frequent
<i>Vicia sepium</i>	3. <4 frequent	<i>Thuidium tamariscinum</i>	6. 26-33%
<i>Lotus corniculatus</i>	3. <4 frequent	<i>Galium palustre</i>	2. <4 scattered
<i>Lycopus europaeus</i>	2. <4 scattered		

<i>Acer pseudoplatanus</i>	2. <4 scattered
<i>Fraxinus excelsior</i>	2. <4 scattered
<i>Angelica sylvestris</i>	3. <4 frequent
<i>Luzula sylvatica</i>	2. <4 scattered
<i>Stachys sylvatica</i>	2. <4 scattered
<i>Phragmites australis</i>	2. <4 scattered
<i>Centaurea nigra</i>	2. <4 scattered
<i>Taraxacum officinale agg.</i>	2. <4 scattered
<i>Achillea ptarmica</i>	1. <4 rare
<i>Urtica dioica</i>	3. <4 frequent
<i>Hedera hibernica</i>	3. <4 frequent
<i>Thuidium tamariscinum</i>	4. 5-10%

Surveyors:	Josh Wolfe, Ian Douglas	Surveyors:	Josh Wolfe, Ian Douglas
Quadrat:	AW3	Quadrat:	AW4
Date:	02/8/2023	Date:	02/8/2023
Quadrat Size:	20x20	Quadrat Size:	20x20
ITM (X)	697847.28	ITM (X)	699036.87
ITM (Y)	708464.47	ITM (Y)	706219.89

Habitat:	WN6	Habitat:	WN6
Annex 1 affiliation:	Alluvial Woodland	Annex 1 affiliation:	Alluvial Woodland
Species list	DAFOR	Species list	DAFOR
<i>Urtica dioica</i>	7. 34-50%	<i>Alnus glutinosa</i>	7. 34-50%
<i>Rubus fruticosus agg.</i>	4. 5-10%	<i>Rubus fruticosus agg.</i>	3. <4 frequent
<i>Geranium robertianum</i>	6. 26-33%	<i>Salix cinerea</i>	5. 11-25%
<i>Salix cinerea</i>	7. 34-50%	<i>Geranium lucidum</i>	5. 11-25%
<i>Alnus glutinosa</i>	5. 11-25%	<i>Argentina anserina</i>	6. 26-33%
<i>Iris pseudoacorus</i>	4. 5-10%	<i>Agrostis stolonifera</i>	9. 76-90%
<i>Ranunculus repens</i>	8. 51-75%	<i>Mentha aquatica</i>	4. 5-10%
<i>Agrostis stolonifera</i>	9. 76-90%	<i>Tussilago farfara</i>	4. 5-10%
<i>Phragmites australis</i>	5. 11-25%	<i>Stellaria graminea</i>	3. <4 frequent
<i>Chrysosplenium oppositifolium</i>	4. 5-10%	<i>Solanum dulcamara</i>	2. <4 scattered
<i>Stachys palustris</i>	4. 5-10%	<i>Galium palustre</i>	4. 5-10%
<i>Arrhenatherum elatius</i>	3. <4 frequent	<i>Taraxacum officinale agg.</i>	2. <4 scattered
<i>Vicia sepium</i>	4. 5-10%	<i>Lathyrus pratensis</i>	2. <4 scattered
<i>Galium aparine</i>	5. 11-25%	<i>Veronica montana</i>	4. 5-10%
<i>Calliergonella cuspidate</i>	5. 11-25%	<i>Viola riviniana</i>	4. 5-10%
<i>Crataegus monogyna</i>	1. <4 rare	<i>Prunella vulgaris,</i>	2. <4 scattered

Surveyors:	Josh Wolfe, Ian Douglas	Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	AW5	Quadrat:	AW7
Date:	02/8/23	Date:	02/08/2023
Quadrat Size:	20 x 29	Quadrat Size:	20x20

ITM(X)	700061.86	ITM (X)	699468
ITM (Y)	706822.47	ITM (Y)	706316
Habitat:	WN6	Habitat:	WN6
Annex 1 affiliation:	Alluvial Woodland	Annex 1 affiliation:	91EO
Species list	DAFOR	Species list	DAFOR
<i>Salix Spp.</i>	8. 51-75%	<i>Angelica sylvestris</i>	1. <4 rare
<i>Alnus glutinosa</i>	3. <4 frequent	<i>Rubus fruticosus agg.</i>	4. 5-10%
<i>Agrostis stolonifera</i>	9. 76-90%	<i>Vicia sepium</i>	4. 5-10%
<i>Rubus fruticosus agg.</i>	7. 34-50%	<i>Galium aparine</i>	3. <4 frequent
<i>Urtica dioica</i>	6. 26-33%	<i>Dactylis glomerata</i>	3. <4 frequent
<i>Geranium robertianum</i>	7. 34-50%	<i>Viola riviniana</i>	4. 5-10%
<i>Lapsana communis</i>	3. <4 frequent	<i>Ranunculus repens</i>	4. 5-10%
<i>Prunella vulgaris</i>	4. 5-10%	<i>Lysimachia nummularia</i>	5. 11-25%
<i>Galium palustre</i>	5. 11-25%	<i>Taraxacum officinale</i>	4. 5-10%
<i>Oxalis acetosella</i>	3. <4 frequent	<i>Stellaria holostea</i>	4. 5-10%
<i>Lycopus europaeus</i>	3. <4 frequent	<i>Geranium robertianum</i>	5. 11-25%
<i>Equisetaceae agg.</i>	3. <4 frequent	<i>Heracleum sphondylium</i>	4. 5-10%
<i>Viola riviniana</i>	4. 5-10%	<i>Equisetaceae agg.</i>	4. 5-10%
<i>Circaea lutetiana</i>	3. <4 frequent	<i>Hedera helix</i>	5. 11-25%
<i>Hedera helix</i>	4. 5-10%	<i>Dryopteris filix-mas</i>	5. 11-25%
<i>Ranunculus repens</i>	5. 11-25%	<i>Valeriana dioica</i>	5. 11-25%
<i>Angelica sylvestris</i>	4. 5-10%	<i>Thamnobryum alopecurum</i>	5. 11-25%
<i>Valeriana officinalis</i>	2. <4 scattered	<i>Urtica dioica</i>	5. 11-25%
<i>Brachythecium rutabulum</i>	5. 11-25%	<i>Chrysosplenium oppositifolium</i>	3. <4 frequent
<i>Chrysosplenium oppositifolium</i>	2. <4 scattered	<i>Primula vulgaris</i>	3. <4 frequent
<i>Mentha aquatica</i>	1. <4 rare	<i>Carex remota</i>	5. 11-25%

<i>Kindbergia praelonga</i>	4. 5-10%	<i>Epilobium obscurum</i>	3. <4 frequent
		<i>Polystichum setiferum</i>	4. 5-10%
		<i>Hypericum androsaemum</i>	3. <4 frequent
		<i>Agristis stolonifera</i>	4. 5-10%
		<i>Geum urbanum</i>	4. 5-10%
		<i>Oxalis acetosella</i>	5. 11-25%
		<i>Salix spp.</i>	6. 26-33%
		<i>Acer pseudoplatanus</i>	6. 26-33%

Surveyors:	Louise Mac Elwain
Quadrat:	AW6
Date:	08/08/2023
Quadrat Size:	20 x 20
ITM (X)	701675
ITM (Y)	710219
Habitat:	WN6
Annex 1 affiliation:	6410
Species list	DAFOR
<i>Stellaria holostea</i>	4. 5-10%
<i>Geum urbanum</i>	4. 5-10%
<i>Chrysosplenium oppositifolium</i>	4. 5-10%
<i>Oxalis acetosella .</i>	6. 26-33%
<i>Urtica Dioca</i>	6. 26-33%
<i>Betula spp. non-native</i>	5. 11-25%
<i>Alnus spp. non-native</i>	6. 26-33%

<i>Salix spp.</i>	4. 5-10%
<i>Dryopteris filix-mas</i>	4. 5-10%
<i>Geranium robertianum</i>	4. 5-10%
<i>Hedera helix</i>	5. 11-25%
<i>Valeriana dioica</i>	5. 11-25%
<i>Thamnobryum alopecurum</i>	5. 11-25%
<i>Viola riviniana</i>	4. 5-10%
<i>Circaea lutetiana</i>	3. <4 frequent

Surveyors:	Louise Mac Elwain, Marco Ragusa
Quadrat:	1
Date:	02/08/2023
Surveyors	Marco Ra
Coordinates	6.5724313°W 53.1310933°N
Habitat:	GS1
Annex 1 affiliation:	6210
Species list	DOMIN
<i>Leontodon saxatilis</i>	7. 34-50%
<i>Lotus corniculatus</i>	1. <4 rare
<i>Centaurea nigra</i>	4. 5-10%
<i>Carex nigra</i>	4. 5-10%
<i>Potentilla erecta</i>	3. <4 frequent
<i>Ranunculus repens</i>	4. 5-10%
<i>Bellis perennis</i>	7. 34-50%

Springs and Seepages

Field Survey Sheet for Petrifying Springs Habitat

1	High Quality Indicator Species
2	Positive indicator species Present/Absent + List
3	Negative indicator species Present/Absent + List
4	Geomorphological classification of tufa formation types: <ul style="list-style-type: none"> • Cascade • Dam • Stream crust • Paludal • Cemented rudites • Oncoids/ooids Present/Absent + List
5	The presence of surface water was recorded as flowing/trickling, pools/standing water or dripping Present/Absent
6	Species Recorded in 2x2m around springhead

Sample No	Location	Location
1 (P82)	X (ITM) 698501.924	Y (ITM) 711685.411
1	Absent	
2	Chrysosplenium oppositifolium, Aneura pinguis	
3	Absent	
4	Absent	
5	Present	
Notes	Does not conform to Annex I Pertifying Spring Habitat	

Sample No	Location	Location
2 (P378)	X (ITM) 698777.070	Y (ITM) 711123.815
1	Absent	
2	Chrysosplenium oppositifolium	
3	Absent	
4	Absent	
5	Present	
Notes	Does not conform to Annex I Pertifying Spring Habitat	

Sample No	Location	Location
3 (P337)	X (ITM) 698549.752	Y (ITM) 711561.500
1	Absent	
2	Absent	
3	Juncus effusus and Phragmites australis	
4	Absent	
5	Present	
Notes	Does not conform to Annex I Pertifying Spring Habitat	

Sample No	Location	Location
1 (P81)	X (ITM) 698727.969	Y (ITM) 711249.365
1	Absent	
2	Chrysosplenium oppositifolium	
3	Absent	
4	Absent	
5	Present	
Notes	Does not conform to Annex I Pertifying Spring Habitat	

Sample No	Location	Location
1 (P376)	X (ITM) 698777.070	Y (ITM) 711123.815
1	Absent	
2	Chrysosplenium oppositifolium	
3	Absent	
4	Absent	
5	Present	
Notes	Does not conform to Annex I Pertifying Spring Habitat	

Appendix C: Site Photos

Grassland Sites

	<p>Photo missing</p>
<p>Quadrat 1 (GW1)</p>	<p>Quadrat 1 (GW2)</p>
	
<p>Quadrat 3 (GW3)</p>	<p>Quadrat 4 (GW4)</p>



Quadrat 5 (GW5)



Quadrat 6 (GW6)

Photo missing

Quadrat 7 (GW7)



Quadrat 8 (GW8)

 <p>Q9</p>	 <p>Q10</p>
<p>Quadrat 9 (GW9)</p>	<p>Quadrat 10 (GW10)</p>
 <p>Q11</p>	<p>Photo missing</p>
<p>Quadrat 11 (GW11)</p>	<p>Quadrat 12 (GW12)</p>

Woodland Sites



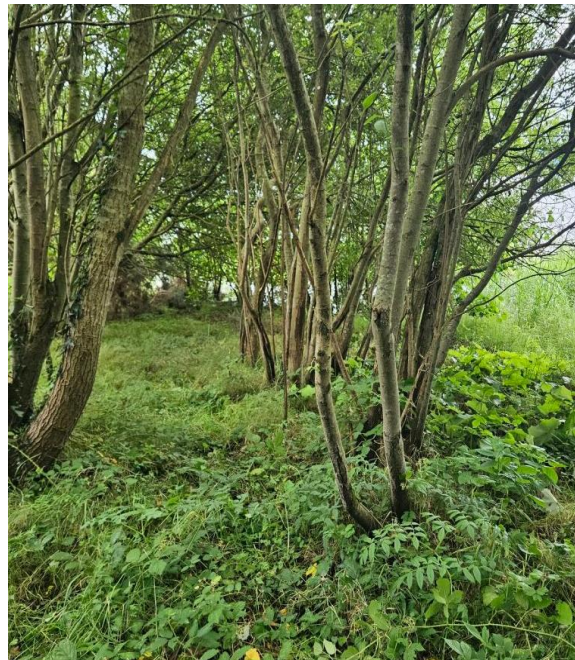
AW1



AW2



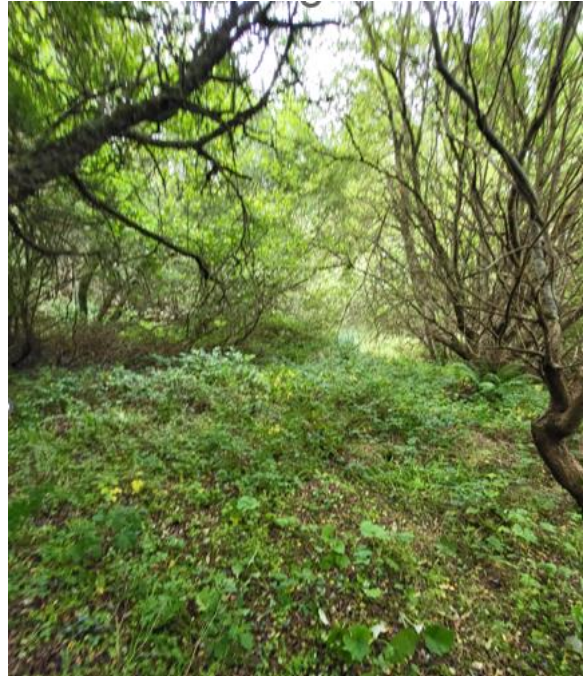
AW3



AW4



AW5



AW6

Springs and Seepages

Sample 1 (P82)



Sample 2 (P376)



Sample 3 (P377)



Sample 4 (P81)



Sample 4 (P378)

