National Parks & Wildlife Service

Tóchar Midlands Wetland Restoration Scheme

Island Fen

NFS site No. 1007007

SAC 002236

Fen Restoration Plan

September 2026

Tóchar Athchóiriú Bogach Lár na Tíre Midlands Wetland Restoration

ARUP

Rialtas na hÉireann Government of Ireland

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Fen Restoration Plan

Island Fen (Offaly) SAC (000692)

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Executive Summary

Island Fen SAC, located southwest of Clareen village, Co. Offaly, comprises predominantly 7230 Alkaline fen with smaller areas of *Cladium* fen and swamp habitats. This Fen Restoration Plan outlines measures to restore and protect the Alkaline fen habitat, supporting the achievement of the site's conservation objectives and favourable conservation condition.

The following pressures were identified at site level through the review of historical and current site data:

- Drainage
- Scrub encroachment
- Changes to water quality, e.g. nutrient enrichment
- Over or under grazing
- Invasive species e.g. scattered self-seeding conifers

Restoration Plan

The Island Fen SAC Restoration Plan proposes a targeted programme of hydrological and vegetation management to address the key pressures affecting the site and support the recovery of 7230 Alkaline fen and associated habitats.

Hydrological measures will focus on drainage impact of the Clareen Stream along the eastern boundary of the site, , to raise water levels and restore natural fen conditions. The effectiveness of this measure will be assessed through a programme of groundwater monitoring using piezometers. To address nutrient pressures, the plan promotes collaboration with local landowners and farmers to reduce nutrient runoff from surrounding agricultural land, supported by ongoing water quality monitoring. A vegetated buffer strip is also proposed to the northwest of the site, adjacent to the forestry plantation, to minimise nutrient inputs.

Vegetation restoration measures focus on the recovery and long-term maintenance of 7230 Alkaline fen through the implementation of conservation grazing, targeted scrub management, vegetation monitoring, establishment of a vegetated buffer strip to protect water quality, invasive non-native species monitoring and control, and adaptive management in response to hydrological restoration. These measures are designed to reduce the dominance of competitive species, maintain open fen conditions, improve habitat structure and resilience, and support progress towards favourable conservation condition and achievement of the site-specific conservation objectives. Successful delivery will require ongoing collaboration between landowners, NPWS and other relevant stakeholders.

Habitat and Restoration Map

The habitats recorded during the 2022 NFS and classified according to the Fossitt Habitat Classification system is presented in Figure 1-1.

The Restoration and Monitoring Map including both hydrological and ecological measures is presented in Figure 1-2.

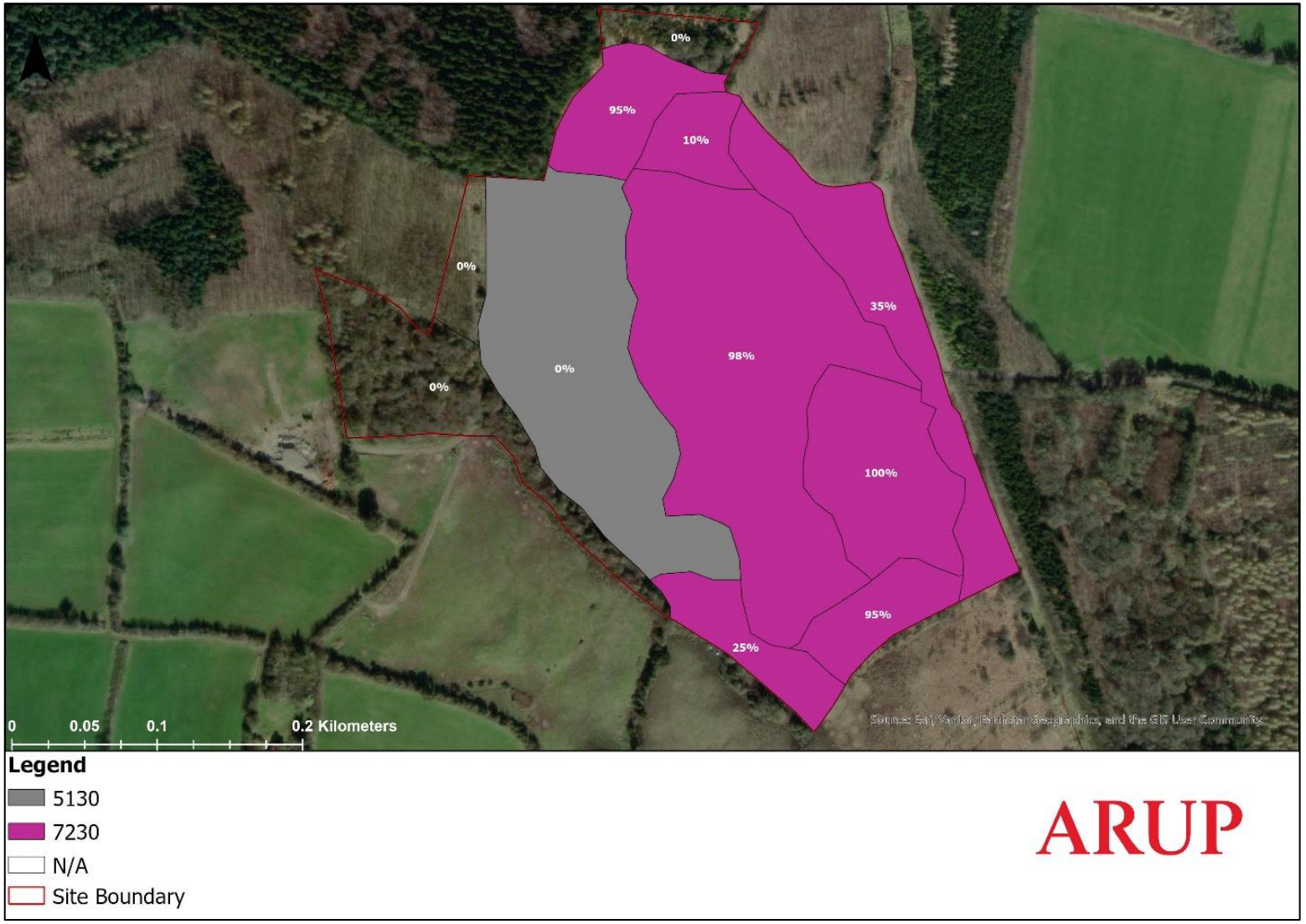


Figure 1-1: Annex I Habitats recorded during the 2022 NFS. Note the % value indicates the %cover of the Annex I and Annex I quality habitat recorded in the polygon. See Table 9-1 for the Annex I habitat code name directory.

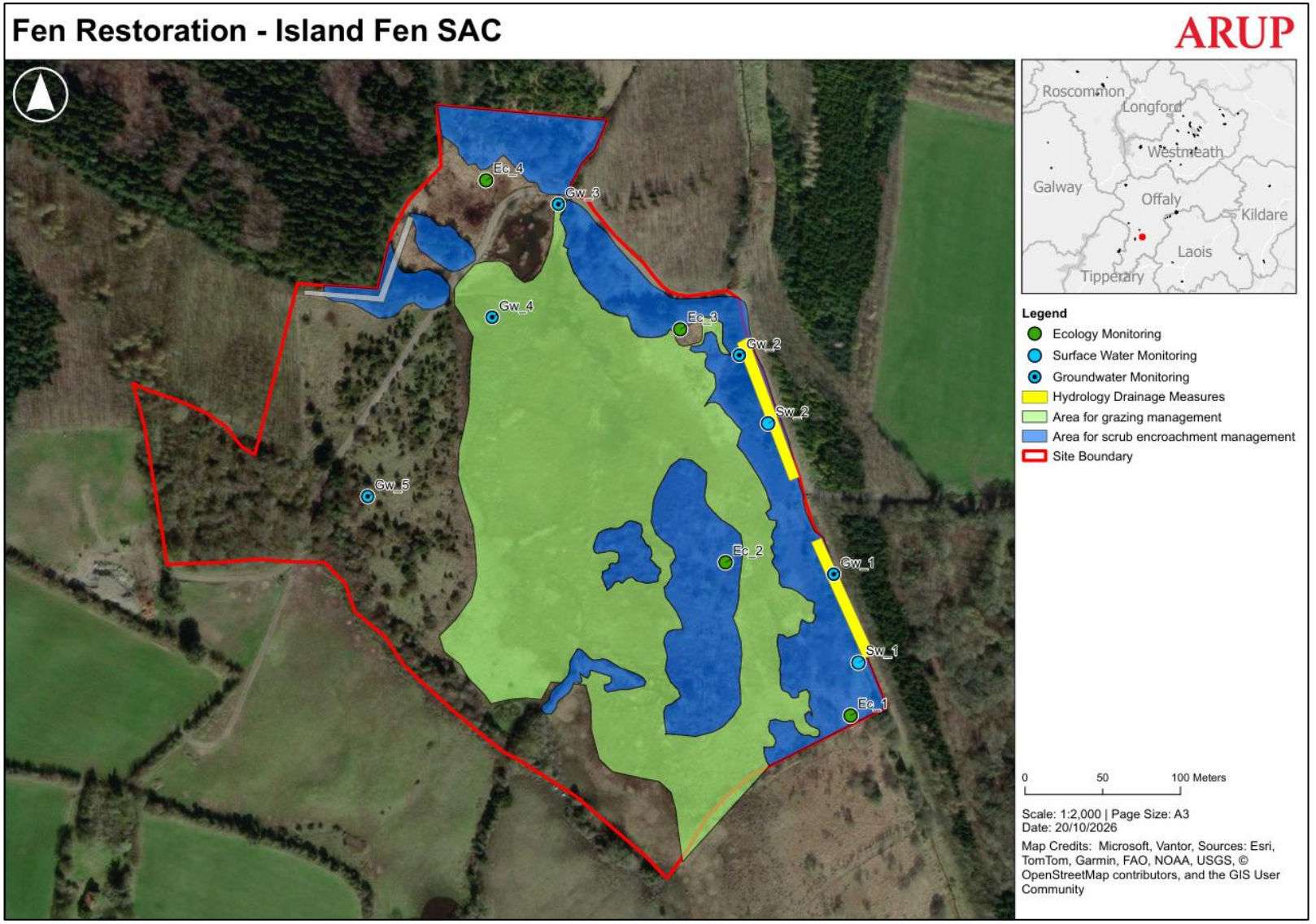


Figure 1-2: Restoration and Monitoring Map including both hydrological and ecological measures for Island fen SAC

Acknowledgements

This Fen Restoration Plan was prepared following consultation with a broad range of groups and individuals involved in Peatland restoration, local residents and stakeholders through several workshops.

Thanks to the members of the SAR Directorate, NPWS Regional Staff, Ecological Assessment Unit (EAU), Ecological Guidance and Advisory Unit (EGAU), Wildlife Enforcement and Nature Protection Directorate, Conservations Measures Unit, Conservation Planning Unit, The FENCES Project team and the Tóchar Wetlands Project Team, including Shirley Clerkin (Project Manager), Monica Byrne (Project Administrator), Hazel Daly (Community Engagement Officer), and Emily Nolan (Community Engagement Officer).

Tóchar Wetlands is a wetlands restoration project, co-funded by the Government of Ireland and the European Union through the EU Just Transition Fund Programme. It is managed by the National Parks and Wildlife Service, of the Department of Housing, Local Government and Heritage.

1 Introduction

1.1 Purpose of this Fen Restoration Plan

This Fen Restoration Plan (FRP) report has been developed by Arup on behalf of National Parks and Wildlife Service (NPWS) to set out proposals for restoration of Annex[1] quality 7230 Alkaline fen and 5130 *Juniperus communis* formations on heaths or calcareous grasslands (referred afterwards as 5130 Juniper scrub) within the site, which contributes to favourable conservation condition of the fen habitat and the achievement of Special Area of Conservation (SAC) site-specific conservation objective (SSCO) targets.

Island Fen is a SAC (site code: 002236) and is located in the foothills of the Slieve Bloom Mountains, southwest of Clareen village in Co. Offaly. The qualifying interest (QI) features of the SAC are 7230 Alkaline fen and 5130 J*uniperus communis* formations on heaths or calcareous grassland fen habitats (5130 Juniper scrub). The SAC is dominated by fen habitat although several other associated wetland habitats are also present.

The main aim of the restoration actions proposed as part of this assessment is to maintain and improve the quality of existing areas of fen to enhance hydrological conditions that will allow an expansion of the measurable area of fen thus impacting on SSCOs/ favourable condition of the fen. However, in some areas, it must be recognised that restoration to increase areas of existing fen will not be possible due to unsuitable hydrological conditions, and the objective may simply be to ensure no further deterioration. Although the focus of the restoration plan is on 7230 Alkaline fen it is anticipated that restoration actions will also benefit other wetland habitats, as outlined in Section 4.

1.2 Wider benefits of fen restoration

Fens are vital habitats due to their rich biodiversity, supporting a wide array of flora and fauna, many of which are rare or endangered. They act as natural water filters, purifying water by trapping pollutants and sediments, thus enhancing water quality downstream. Additionally, fens store significant amounts of carbon in their peat soils, contributing to climate change mitigation by reducing atmospheric carbon dioxide levels. Their ability to absorb and gradually release water helps regulate water flow and minimize flood risks. Beyond their ecological importance, fens hold cultural, historical, and recreational value, offering opportunities for education, research, and outdoor activities.

Peatland drainage and extraction transform a natural peatland which acts as a modest carbon sink into a carbon source (Waddington & McNeil, 2002; Alm *et al*. 2007; Wilson *et al*. 2015).

[1] Each habitat and species type protected under the EU Habitats Directive (Council Directive 92/43/EEC of 21 May 1992) is given a unique numeric code so that all. Member States use the same reference in legislation, reporting and monitoring. Each habitat and species code is an index in the Annex lists with codes grouped by habitat family.

The EPA- funded Carbon Restore Project (Wilson *et al*. 2012) found that rewetting of drained peatlands can lead to restoration of functional peatland, such as the return of typical plant and animal species, which in turn may lead to the restoration of peat-formation and the C-sink function.

The restoration of the fen habitat at Island Fen SAC is likely to lead to improve hydrological aspects (water quality and distribution). Well-functioning fen habitat reduces the risk of dissolved organic carbon passing into water courses and has been shown to attenuate the speed at which water moves downstream thereby reducing flood risk.

1.3 Key pressures on Fens

The overarching (National) key pressures and threats to Annex I fen habitats have been identified in the latest Status of EU Protected Habitats and Species in Ireland (Article 17 report) (NPWS 2025). The pressures/threats present in Table 1-1 are reflective of the pressures and threats identified for 7230 Alkaline fen at Island Fen SAC. The national conservation status for 7230 Alkaline fen is currently assigned as 'Bad'.

Table 1-1: National pressures to fen habitats

Habitat	Importance	Pressure
7230 Alkaline fen	High	PA22 Drainage for use as agricultural land J01 Mixed source pollution to surface and ground waters
	Medium	PA05 Abandonment of management/use of grasslands and other agricultural and agroforestry systems (e.g. cessation of grazing, mowing or traditional farming) PA08 Extensive grazing or under grazing by livestock PB24 Drainage for forestry PI02 Other invasive alien species (other than species of Union concern) PL02 Drainage (mixed or unknown drivers) to surface or ground waters
	Low	PI03 Problematic native species PB19 Forestry activities generating pollution to surface or ground waters (including marine) PB26 Other forestry activities, excluding those relating to agro-forestry

1.4 Legislative Context

There is a comprehensive system of legislation, both domestic and international, which aims to protect biodiversity at a landscape, habitat and species level in Ireland. This legislation exists within, and independently of, the planning process.

In Ireland, the most important pieces of legislation underpinning biodiversity and conservation are:

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, hereafter referred to as the Habitats Directive.
- Regulation (EU) 2024/1991 of the European Parliament and of the Council of June 2024 on nature restoration and amending Regulation (EU) 2022/869.
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, hereafter referred to as the Birds Directive.
- European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as amended, hereafter referred to as the Birds and Habitats Regulations.
- Wildlife Acts 1976 to 2017, hereafter referred to as the Wildlife Acts; and
- Flora (Protection) Order, 2015 (S.I. No. 356 of 2015).

According to the EU Habitats Directive (92/43/EEC) and the EU Birds Directive (79/409/EEC), Member States are required to establish a Natura 2000 network of sites of highest biodiversity importance for rare and threatened habitats and species across the EU. In Ireland, the Natura 2000 network of European sites includes SACs and Special Protection Areas (SPAs).

The EU Nature Restoration Regulation aims to restore damaged ecosystems and improve biodiversity with particular focus on capturing and storing carbon and reducing the impact of natural disasters. Specific targets include improving and re-establishing biodiverse habitats on a large scale and bringing back species populations by improving and enlarging their habitats. EU countries are required to submit National Restoration Plans to the European Commission showing how they will deliver on the targets and monitor their progress. Member States are required to implement restoration measures for specific habitats and species, including marine ecosystems, forests, wetlands, and pollinators.

SACs are selected for the conservation of Annex I habitats (including priority types which are in danger of disappearance) and Annex II species (other than birds). SPAs are selected for the conservation of Annex I birds and all migratory birds and their habitats. The Annex habitats and species, for which each site is selected, are the QIs of the SAC and special conservation interest (SCI). Conservation objectives for the site are defined for these qualifying interests.

Ireland is required to manage water resources in an integrated way under the Water Framework Directive (WFD, 2000/60/EC) and the European Communities (Water Policy)

Regulations 2003 (S.I. No. 722 of 2003). Member States are required to submit River Basin Management Plans to the European Commission showing how they will protect and improve the water environment. Restoring surface and groundwater bodies to the equivalent of 'good status' or better and to protect water from any further deterioration requires collaboration at a local and national level. Implementing the WFD supports the achievement of site-specific conservation objectives for fen habitats, contributing to their favourable conservation status.

1.5 Outline of this FRP document

- Section 2 of this FRP report outlines details of Island Fen SAC and the conservation objectives for 5130/7230 habitat.
- Section 3 outlines the findings from the land and water desktop and site monitoring surveys that were carried out to inform the development of these FRP.
- Section 4 outlines the findings from the ecological desktop and site monitoring surveys that were carried out to inform the development of these FRP.
- Section 5 provides a summary of the key pressures identified by this FRP report that are impacting on fen.
- Section 6 outlines the key restoration measures proposed by this FRP.
- Section 7 outlines additional considerations to inform the development of the FRP.
- Section 8 outlines key players in the FRP, summarises restoration actions proposed, habitats that will benefit and further steps required to prepare for implementation.

Restoration actions proposed by this FRP assessment were mapped in GIS format and delivered to NPWS in accordance with NPWS data standards (see Appendix D for details of GIS layers provided). This includes detailed mapping of the key pressures addressed by this assessment, detailed mapping of proposed restoration actions, ecological survey results and referenced sensitivity areas. GIS Shapefiles which accompany this report include all relevant data on referenced species.

2 Site Overview

2.1 Island Fen SAC

Island Fen SAC (Figure 2-1) comprises a groundwater-fed valley-bottom fen system supporting alkaline wetland habitats of high ecological significance. Historical mapping indicates that the site has long been associated with wetland vegetation, including a north–south flowing drainage feature. The site lies at approximately 86 mOD and is characterised by predominantly flat topography with a gentle slope from north to south.

The SAC is located within the 25B Lower Shannon catchment, with the Clareen Stream (WFD Code IE_SH_25C130600) forming the eastern boundary and ultimately draining to the Camcor River. For the purposes of the Water Framework Directive (WFD), the site is situated within the Camcor_SC_010 sub-catchment.

According to the NPWS site synopsis (2014), the 7230 Alkaline fen vegetation is concentrated within the western and northern parts of the site, transitioning to reed swamp and wet marsh communities. A small area of hazel and ash-dominated woodland is present to the northeast. The surrounding land use is primarily agricultural, with cattle grazing representing the main management activity.

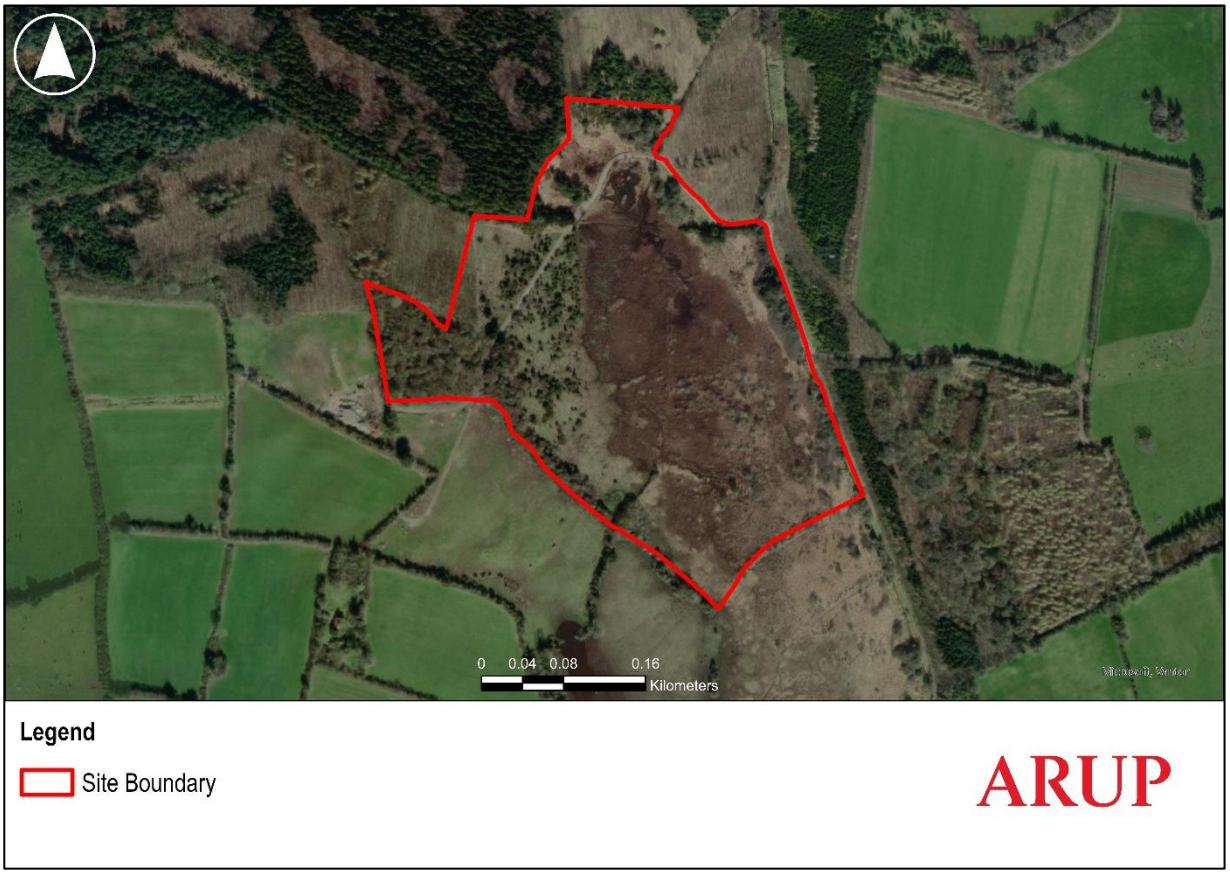


Figure 2-1: Site Location Map of Island Fen SAC

2.1.1 Fen Condition Assessment

Island Fen SAC was surveyed as part of the National Fen Survey (NFS) on the 15th of August 2022 (Brophy et al., In prep). The survey identified a number of pressures influencing the condition of the fen habitat, including drainage, extensive grazing, and a lack of active management across the site

- Drainage associated with the Clareen Stream along the eastern boundary of the site
- Extensive grazing
- Lack of active management

The NFS assessment of Annex I habitats recorded contrasting conservation condition between habitat types. The 7230 Alkaline fen was assessed as 'Unfavourable – Bad', indicating that the structure and functions of the habitat are significantly impacted. In contrast, areas of 7210 Calcareous fen were assessed as 'Favourable', reflecting more intact ecological functioning in these locations.

The pressures recorded during the NFS were all identified as having a negative influence on the condition of the alkaline fen habitat (Table 2–1). In particular, drainage associated with Clareen Stream represents a key hydrological pressure, with implications for water levels and habitat functioning. Extensive grazing and a lack of active management were also identified as contributing factors influencing vegetation structure and habitat condition. The results of a field evaluation (2026) of the above pressures to inform the restoration planning process is detailed in Section 5 of this report.

Table 2-1: Assessment of impacts of pressures on 7230 Alkaline fen at Island Fen SAC

Pressure Code	Pressure	Influence
P05	Unmanaged –Introducing annex I habitat juniper scrub.	Negative
A08	Extensive grazing by livestock	Negative
L02	Drainage – Arterial drains and agricultural drains	Negative

2.1.2 Site-specific conservation objectives

Detailed SSCOs aim to define the conditions necessary to maintain or achieve the favourable conservation condition of a habitat or species at site level. The maintenance of habitats and species within sites at favourable condition will contribute to the maintenance of favourable conservation status of those habitats and species at a national level.

A conservation objective was set for Island Fen SAC for 7230 Alkaline fen using attributes and targets based on parameters set out in the Habitats Directive. The restoration actions outlined by this restoration plan aim to contribute towards achieving these targets.

The attributes and targets for 7230 Alkaline fen, along with how the FRP will contribute to achieving set targets, are set out in Table 2-2.

Table 2-2: Attributes and Targets for 7230 Alkaline fen (NPWS, 2019)

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Yes	Yes. FRP actions are anticipated to sustain the current area of habitat designated within the SAC.
Habitat distribution	Occurrence	No decline, subject to natural processes	Yes	Yes. FRP actions will not result in a decline in distribution of fen habitat within the SAC. In fact, it will contribute to the increase of 7230 distribution.
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	Yes	Yes. FRP actions will address nutrient input from surrounding land which will assist in the restoration of more natural nutrient conditions.

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Ecosystem function: peat formation	Percentage cover of peat-forming vegetation and water table levels	Maintain active peat formation, where appropriate	Yes	Yes The restoration measures seek to have a positive impact on the vegetation structure and composition of 7230 Alkaline fen. Subsequently, all attributes should see a favourable shift towards their respective targets.
Ecosystem function: hydrology – groundwater levels	Water levels (centimetres); duration of levels; hydraulic gradients	Maintain appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	Yes	
Ecosystem function: hydrology - surface water flow	Flow direction	Maintain as close as possible to natural or semi- natural drainage conditions	Yes	
Ecosystem function: water quality	Water chemistry measures	Maintain appropriate water quality, to support the natural structure and functioning of the habitats	Yes	

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Yes	
Vegetation composition: brown mosses	Percentage cover at a representative number of 2m x 2m monitoring	Maintain adequate cover of typical brown moss species	Yes	
Vegetation composition: typical vascular plants	Percentage cover at a representative number of 2m x 2m monitoring stops	Maintain adequate cover of typical vascular plant species	Yes	
Vegetation composition: native negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of native negative indicator species at insignificant levels	Yes	
Vegetation composition: nonnative species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species at insignificant levels	Yes	

Attribute	Measure	Target	Addressed by FRP?	Will restoration actions contribution to achieving target?
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs at insignificant levels	Yes	
Physical structure: disturbed bare ground	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of disturbed bare ground not more than 10%	Indirectly	

3 Land and Water

3.1 Desktop Study

3.1.1 Meteorological Conditions

Understanding long-term meteorological patterns is key for informing effective fen restoration planning, particularly with respect to hydrological dynamics. To support this, historical precipitation data over the past 30 years from the closest weather station at Mullingar (Met Éireann - The Irish Meteorological Service), was compiled to assess seasonal variability in rainfall at the site and surrounding areas.

Two datasets presented: (1) average yearly precipitation (mm) to display long-term rainfall patterns over a 30-year period (Figure 3-1) and (2) average monthly precipitation to show seasonal distribution patterns over a 30-year period (Figure 3-2). This information is important to evaluate the feasibility and sustainability of restoration actions aimed at restoring or maintaining suitable hydrological conditions.

The yearly maximum rainfall is highly variable compared to average and minimum rainfall (Figure 3-1). The average monthly rainfall is highest in the winter months (October to January) and lowest in late spring (April and May) (Figure 3-2). Minimum rainfall follows a similar pattern, while the maximum monthly rainfall shows a notable increase in winter.

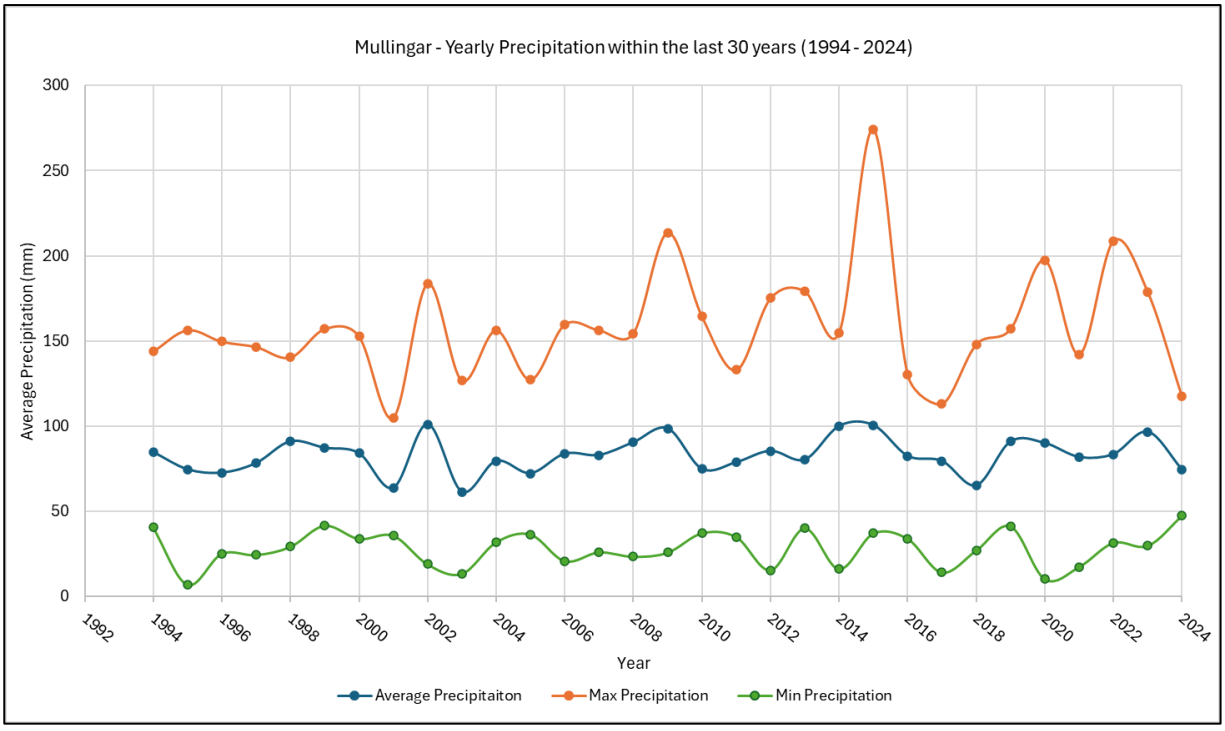


Figure 3-1 Mullingar weather station- average, maximum, and minimum yearly precipitation from 1994-2024

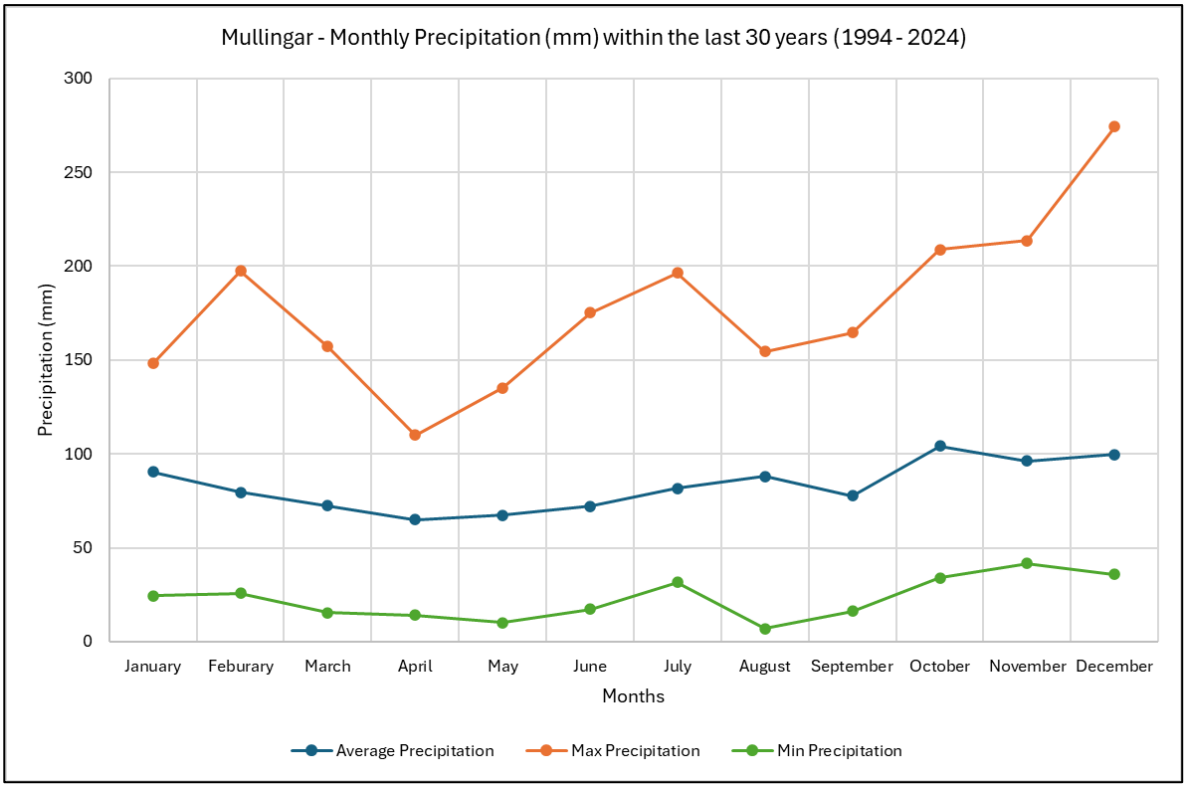


Figure 3-2: Mullingar weather station - average, maximum, and minimum monthly precipitation between 1994 and 2024

3.1.2 Hydrogeological Setting

The site is underlain by the Waulsortian Limestones, which is characterised by massive, unbedded lime-mudstone, as shown in Figure 3-3 (Bedrock Geology 100K layer (GSI).

The area is underlain by a Locally Important Aquifer (Ll), which is moderately productive only in local zones. A Locally Important Aquifer which is generally moderately productive (Lm) is located to the north of the site (Figure 3-4).

Quaternary sediments within the site comprise Fen Peat (FenPt), which underlies majority of the site with a small area of Till (derived from limestone and alluvium) present to the northwest, as shown in Figure 3-5.

Recharge rates follow a similar pattern, reflecting the influence of subsoil type on the water infiltration. Where the site is covered by peat, recharge rates are significantly lower, typically between 1 and 50 mm per year. In areas dominated by till and alluvium deposits, recharge rates raise from approximately 101 to 150 mm per year (Figure 3-6).

Groundwater vulnerability is moderate within the site. To the east, the vulnerability is high and increases for extreme and rock at or near surface (Figure 3-7).

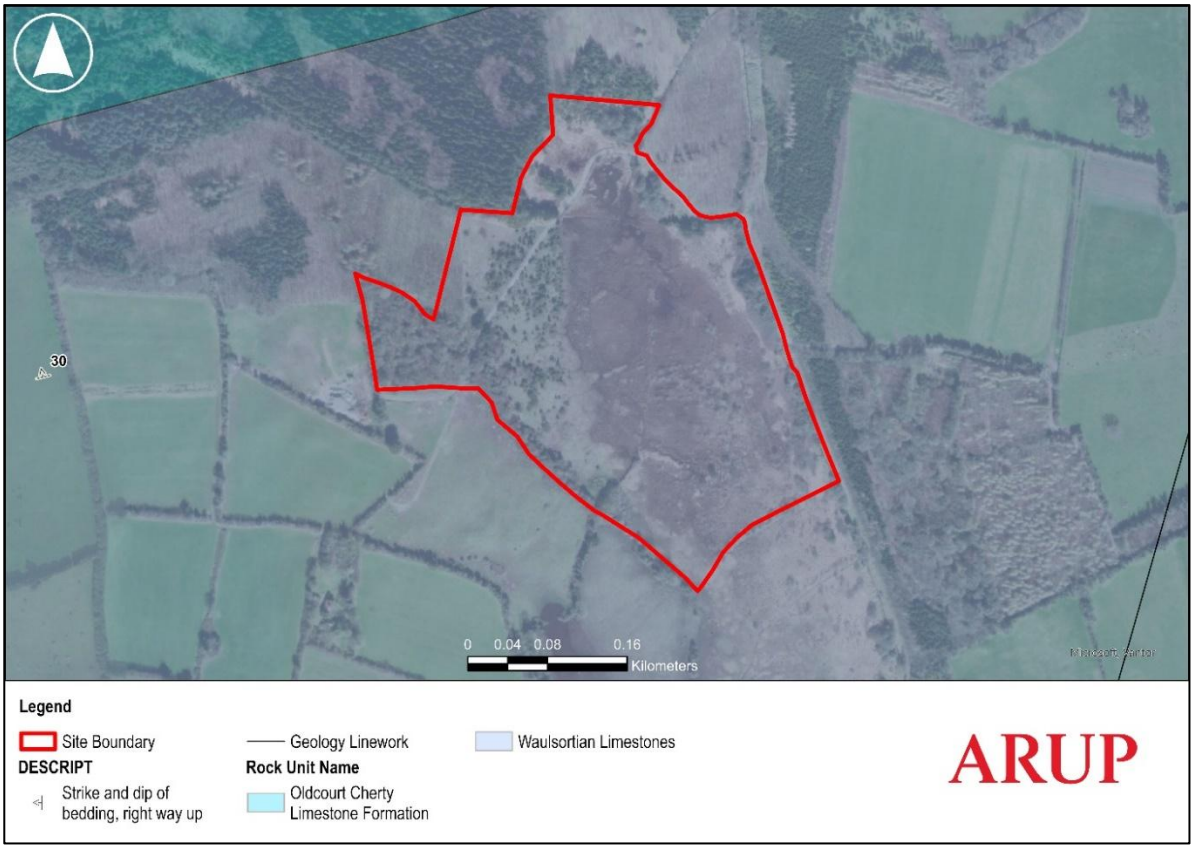


Figure 3-3: Bedrock geology of Island Fen SAC



Figure 3-4: Aquifer classification and karst underlying Island Fen SAC

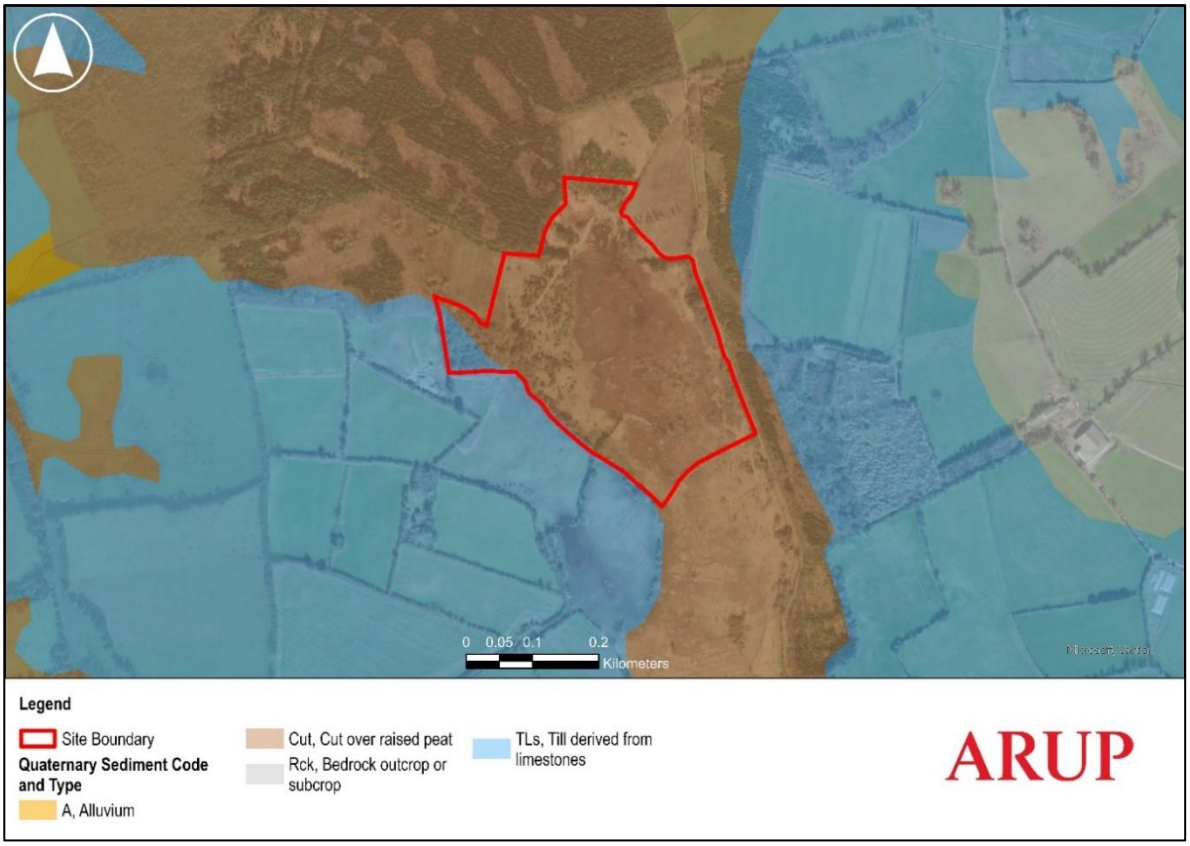


Figure 3-5: Sub-soil type underlying Island Fen SAC (Source: GSI Quaternary map)

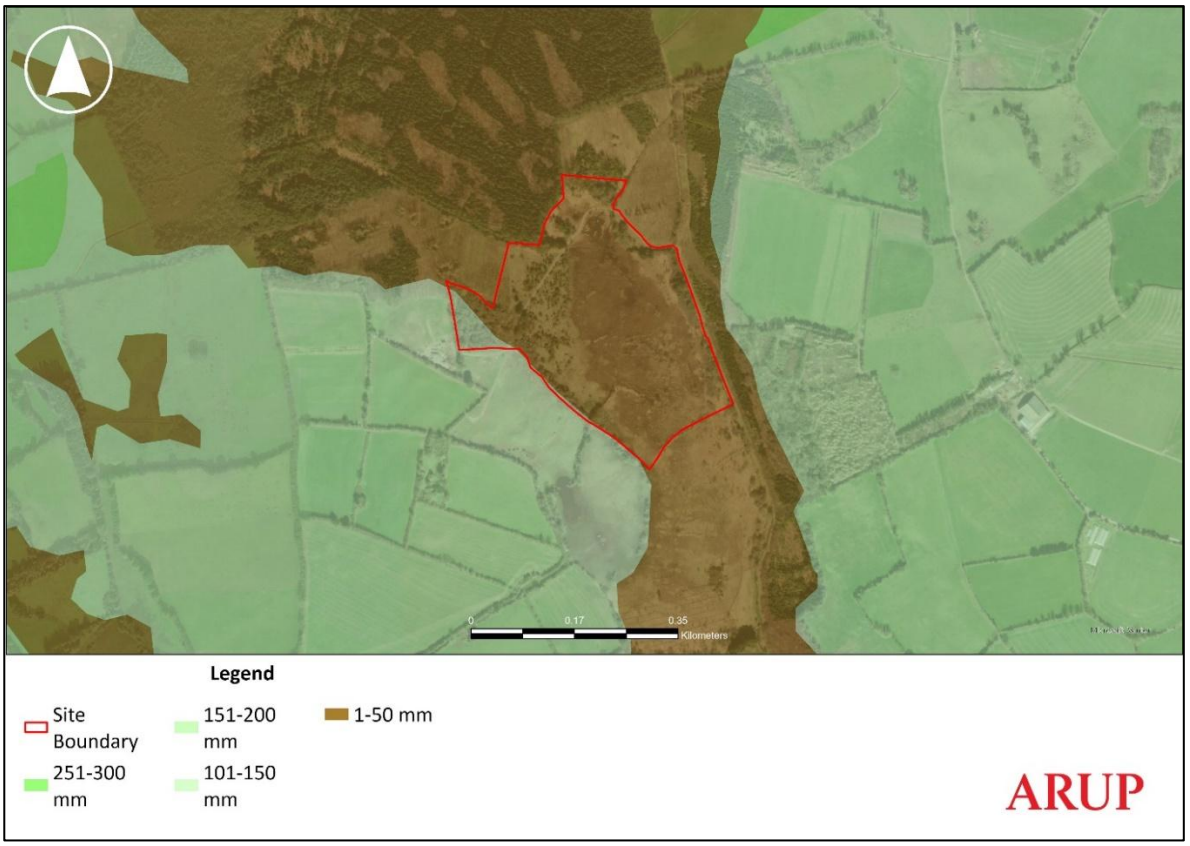


Figure 3-6: Groundwater recharge map for Island Fen SAC (Source: GSI)

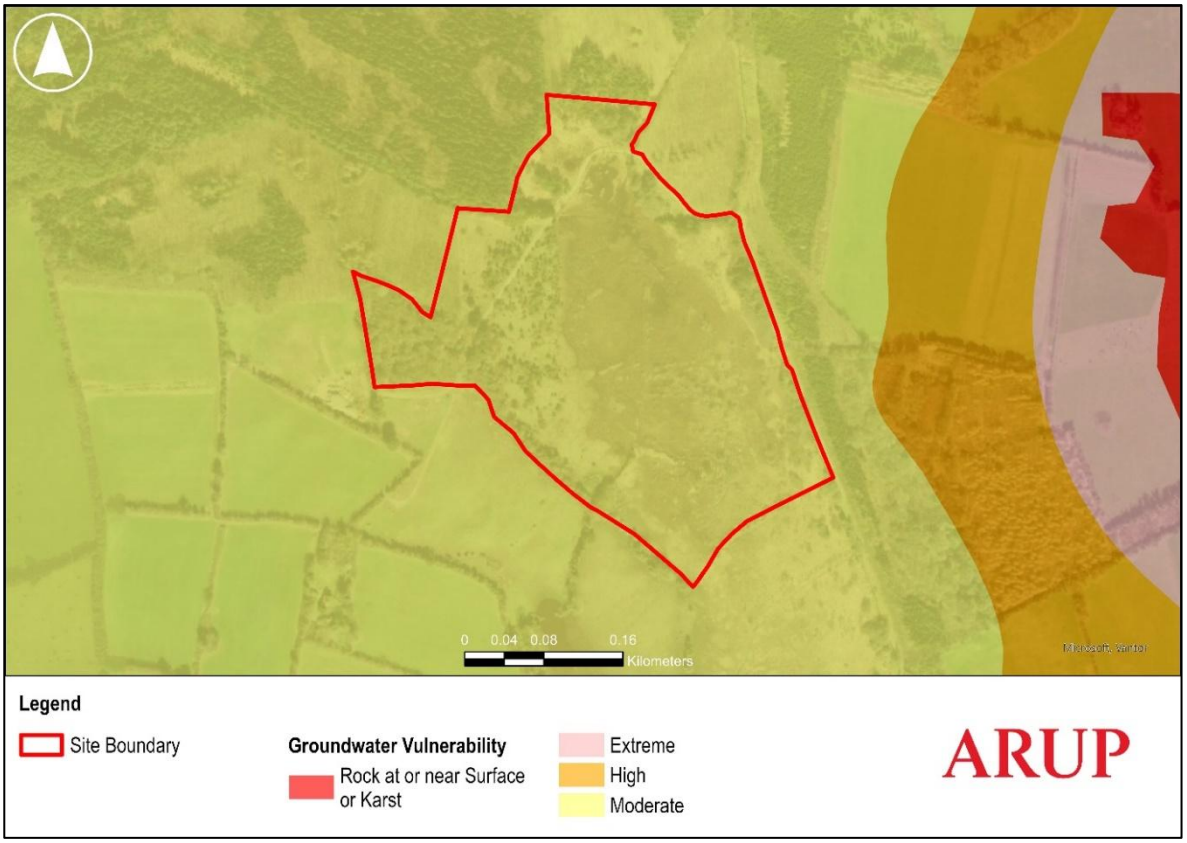


Figure 3-7: Groundwater vulnerability map for Island Fen SAC (Source: GSI)

3.1.3 Topographic and Surface Water Drainage

The topography of the site is mainly flat at approximately 86 mOD. There is an area of high elevation outside of the site boundary, to the east of the site, at approximately 127 mOD.

The site is located within the 25 Lower Shannon_ WFD Catchment and the Camcor_010 WFD sub catchment (Figure 3-8). The *Clareen Stream/Fuarawn_020 (IE_SH_25C130600)* drains the site to the north-west towards the River Shannon. The WFD River waterbody is classed at 'Moderate' WFD Status and 'at risk' of not achieving its WFD objectives.

An assessment of both historical hydrological records (mapping from 1829 to 1913) (Figure 3-9) indicate there were no notable features, such as wells, springs and drains present within the site during this period.

The National Fen survey 2022 (Brophy et al., In prep) identified two small drains located in the northwestern area of the site as shown in Figure 3-10.

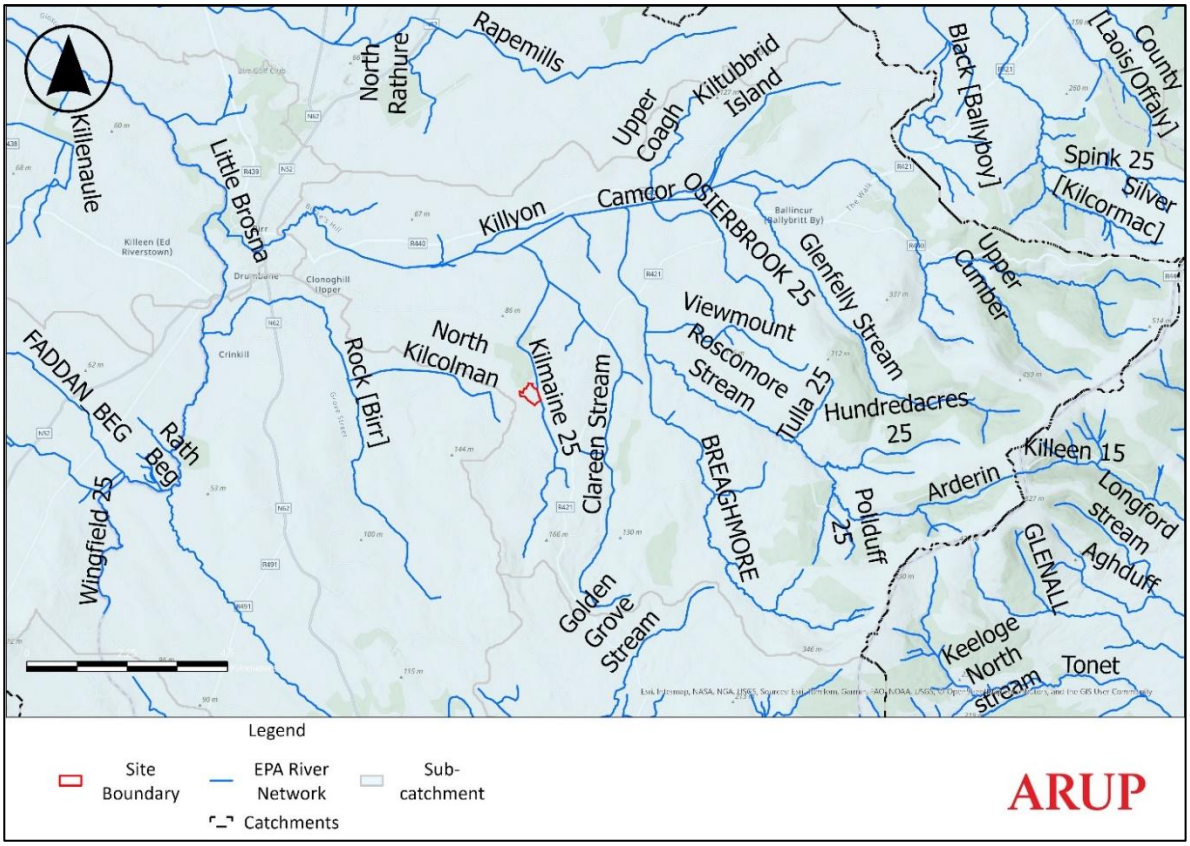


Figure 3-8 WFD Catchment and River sub-basin (EPA, 2025)

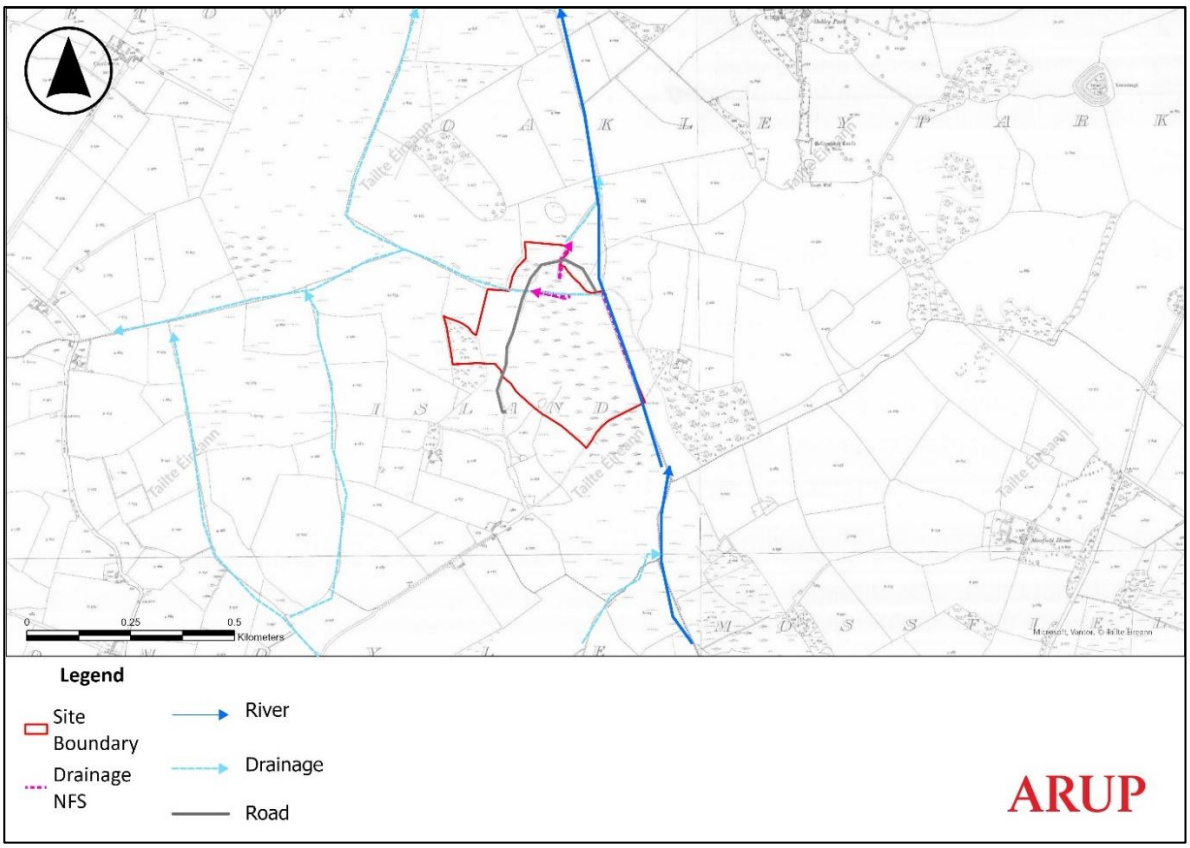


Figure 3-9: Mapped drainage network at Island Fen SAC – Historical map 25inch B&W



Figure 3-10: Mapped drainage network at Island Fen SAC

The mapped Wetness Index[2] classifies the site as temporarily wet (Figure 3-11), indicating alternating periods of saturation and dryness over the period of 2012 and 2018. This pattern suggests a mosaic of variable soil moisture conditions, supporting intermittent wetland characteristics across the site (Figure 3-11).

An analysis of total productivity from 2017 to the present shows that Island Fen SAC shows low productivity in the central area, indicating intact bogs with nutrient poor conditions, water saturated soils and moss-dominated vegetation. Along the boundary the high productivity indicates drained or degraded peat, which could be a result of agricultural activities from the surrounding farmlands. This is shown in Figure 3-12.

A Digital Terrain Model (DTM) derived from LiDAR data and a site photogrammetry model generated with a camera for Island Fen SAC are presented in Figure 3-13 and Figure 3-14. These images indicate that the Clareen Stream, located along the eastern site boundary, is the most prominent hydrological feature within the site. The DTM LiDAR images show the drain in the north west is approximately 2 m wide and 1 m deep.

[2] Dataset available at 10m resolution indicating the occurrence of water and wet surfaces over the period from 2012 to 2018.

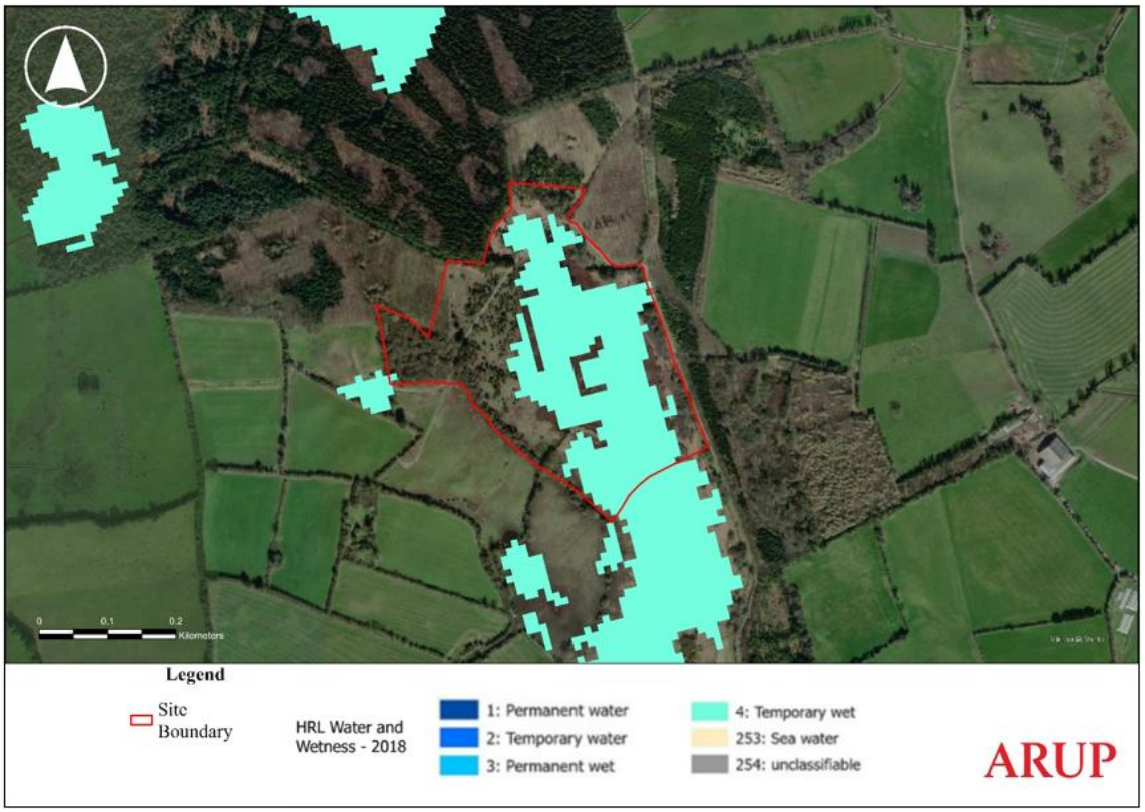


Figure 3-11: HRL Water and Wetness – 2018 of Island Fen SAC (Copernicus, 2025)

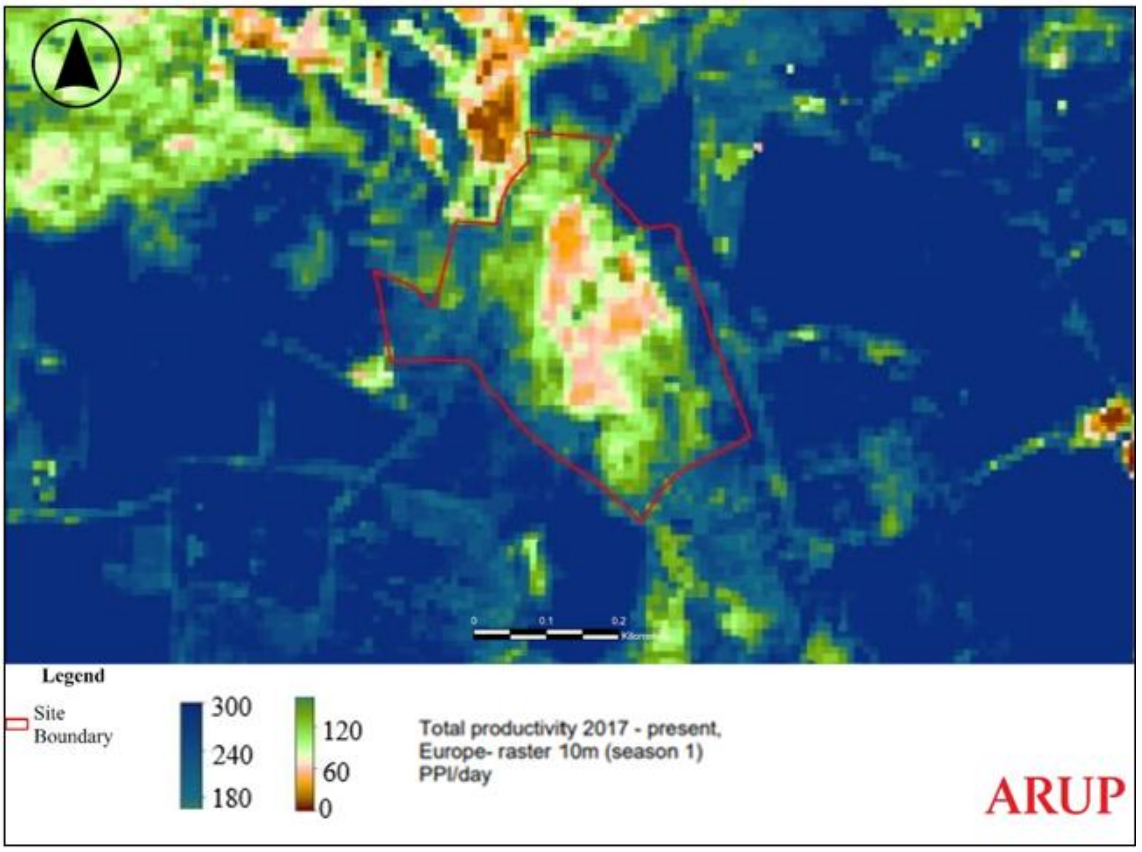


Figure 3-12: Total Productivity 2017 -present, Europe – raster 10m (season 1) of Island Fen SAC (Copernicus, 2025)

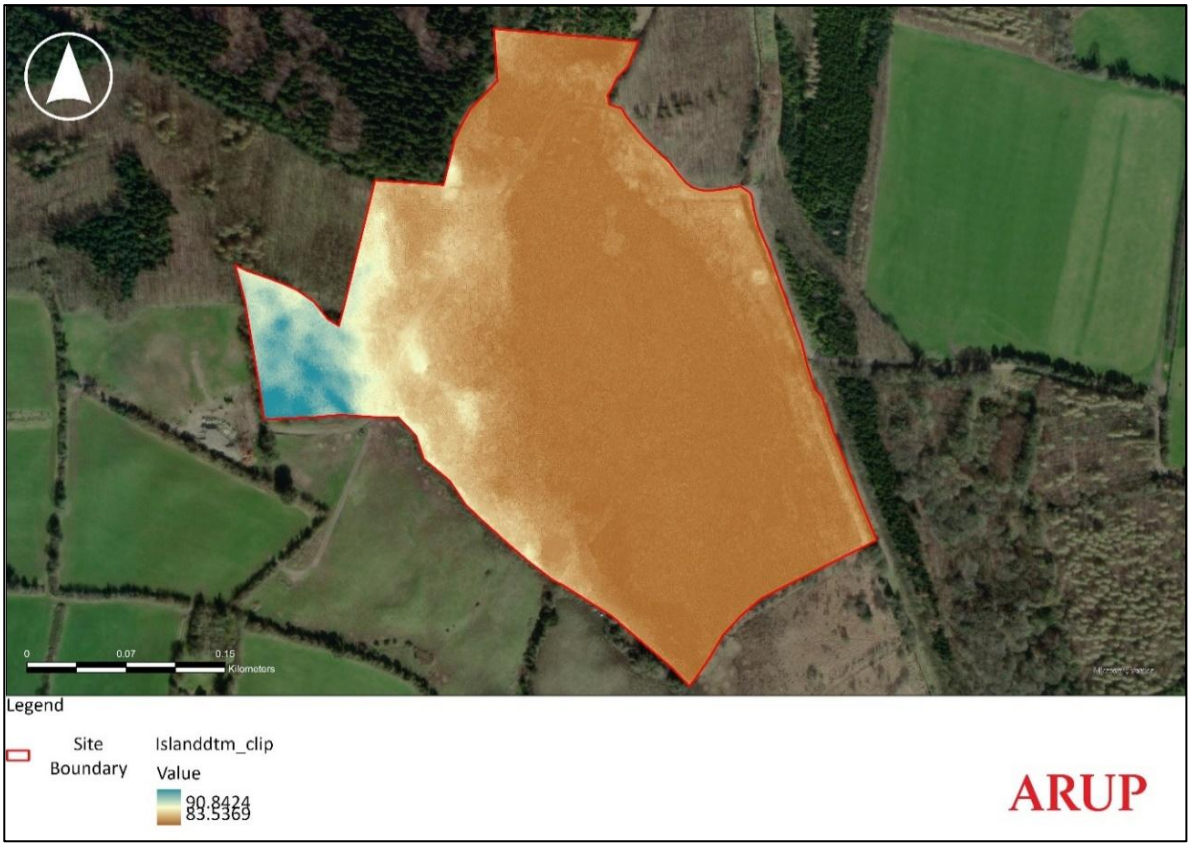


Figure 3-13: DTM Topographic (LiDAR) map of Island Fen SAC



Figure 3-14: Site Photogrammetry map of Island Fen SAC

3.1.4 3.1.4 Land use Pressures and Water Quality

Pollution Impact Potential (PIP) maps (EPA,2025) show the risk areas on the landscape for losses of nitrate and phosphorus water bodies. The PIP maps estimate the annual nutrient losses from the agricultural land using spatial data on farm management, soils and hydrogeology. PIP maps for Nitrogen (near surface and sub surface) are presented in Figure 3-15 and Figure 3-16 and for Phosphorus in Figure 3-17 and Figure 3-18.

Areas characterised by freely draining soils and significant groundwater pathways are recognised as high-risk zones for nitrate losses. Within the context of Island Fen SAC and its surroundings, the overall risk of nitrate loss near surface is moderate with an area to the east characterized as high. The groundwater vulnerability within the site is moderate with a high vulnerability being recorded in area to the east, outside the site boundary. However, sub surface nitrate is characterized as very low, with low to moderate surrounding the site. Targeting Agricultural Measures map indicate that Island Fen SAC is designated as a Navy & Orange Flag area, which indicates that the site is at risk for phosphorus/sediment and nitrate losses.

High risk areas for phosphorous loss typically have poorly draining soils and dominant overland flow pathways. Such conditions facilitate the movement of phosphorus from the land surface into nearby waterbodies. PIP Phosphorus mapping indicates that phosphorus delivery flow pathways range from medium to high throughout the site. The highest risk (rank 1 & 2) area of phosphorus runoff is within the southern area.

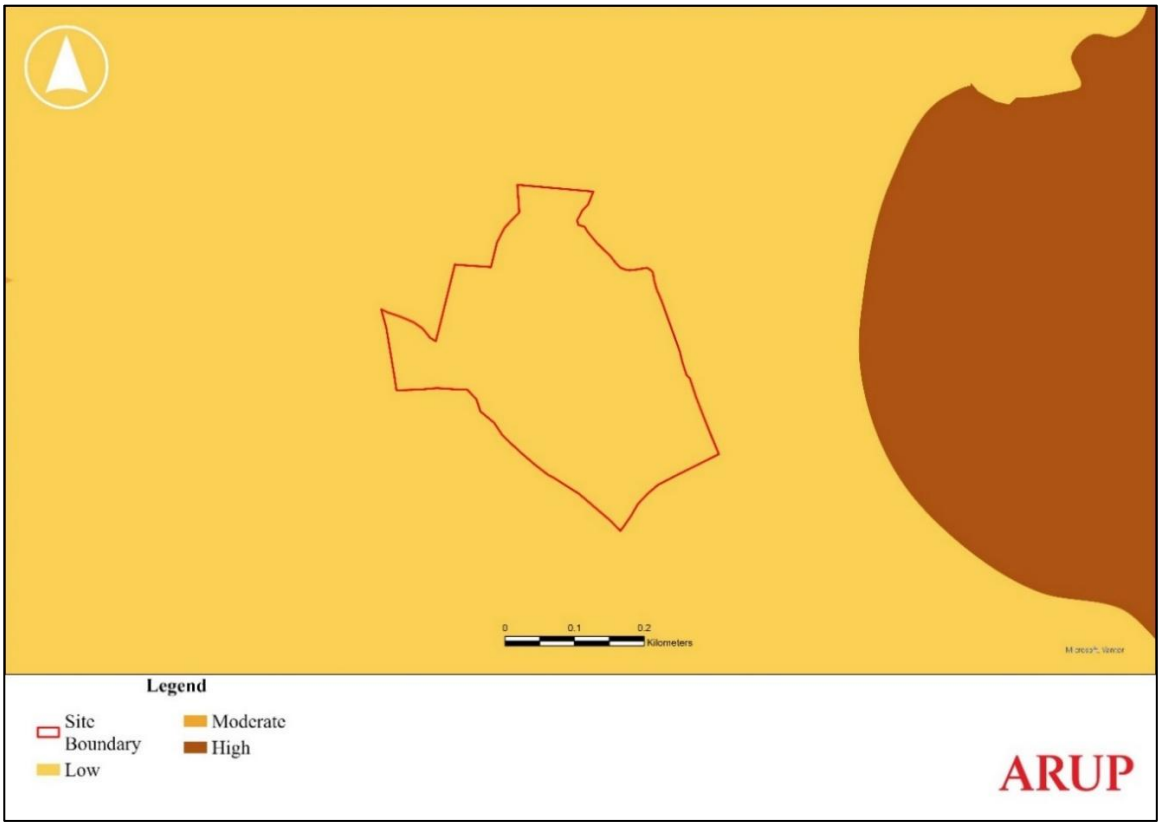


Figure 3-15: PIP - near surface Nitrate (PIP- N) at Island Fen SAC (EPA, 2025)

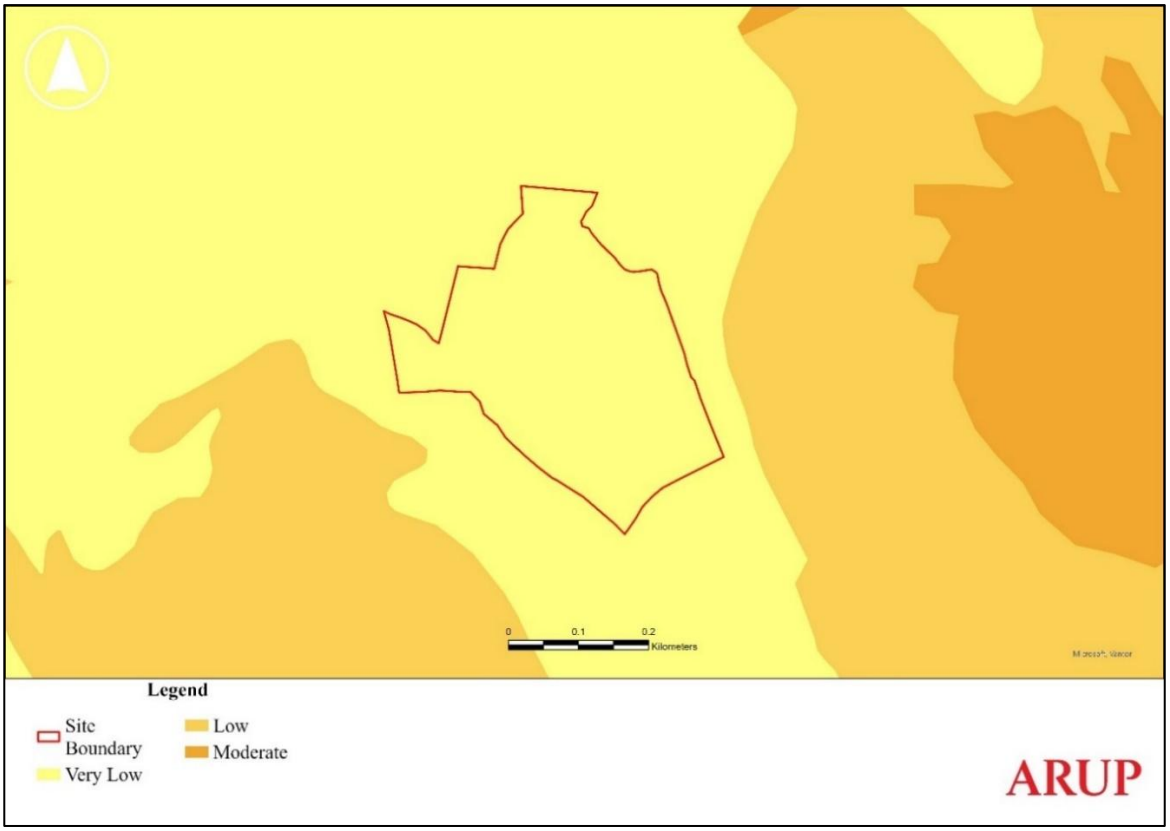


Figure 3-16: PIP - sub-surface Nitrate (PIP- N) at Island Fen SAC (EPA, 2025)

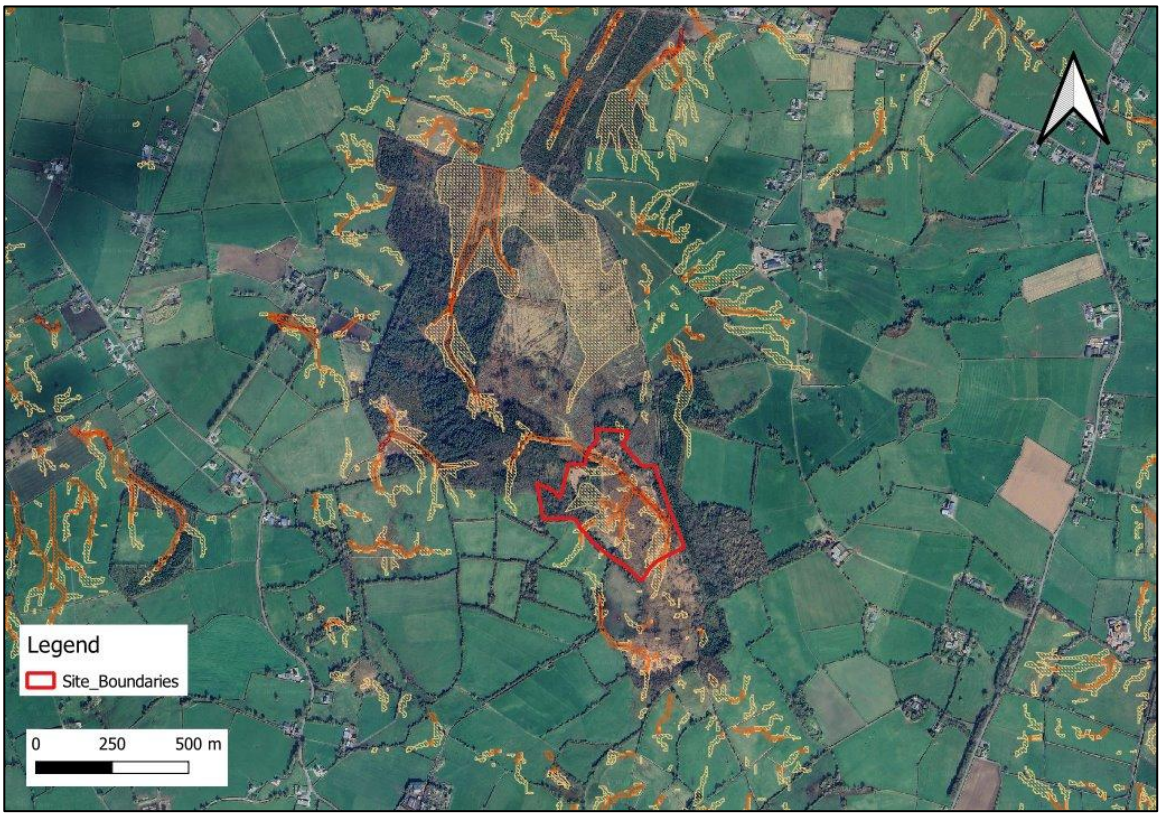


Figure 3-17: PIP- P Flow delivery paths and points for Phosphorus at Island Fen SAC (EPA, 2021)

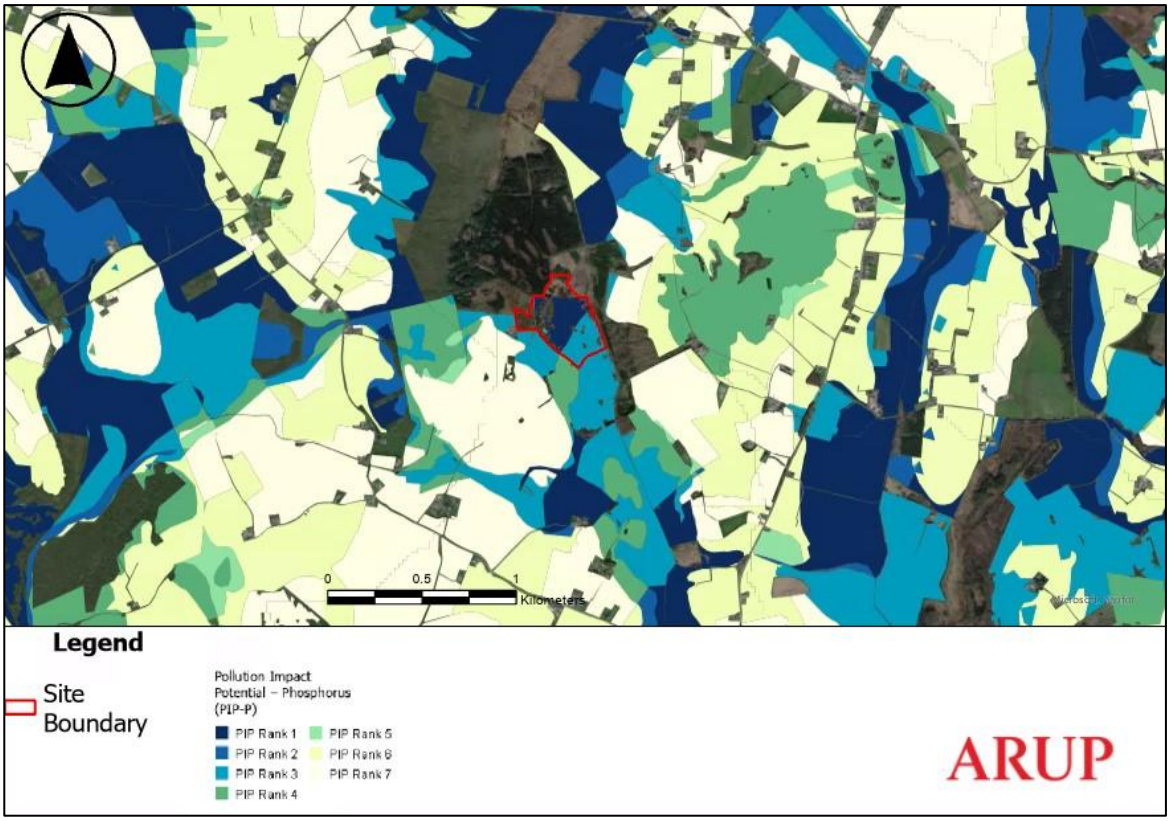


Figure 3-18: PIP -Phosphate (Phosphorus) (PIP- P) at Island Fen SAC (EPA, 2025)

3.2 Field Survey

Electrical Conductivity (EC), pH, and peat depth data were recorded as part of the National Fen Survey (Brophy et al., In prep). EC was recorded at 730 µS/cm and pH at 7.29 in one location. Peat depth was also recorded at one location with a depth of 320 cm. However, the spatial location of these measurements was not provided.

Site monitoring was undertaken in March and June 2026, focusing on developing the understanding of the water regime, pressures and implementation of restoration measures within the site. The monitoring included peat depth probing, water quality monitoring (pH, EC, temperature, dissolved oxygen (DO), nitrate, and phosphate) and observations of water flow.

Water quality data were collected from several areas within the site and samples were obtained from the drains located in the northern area as well as from the Clareen Stream located along the eastern site boundary (Clareen stream).

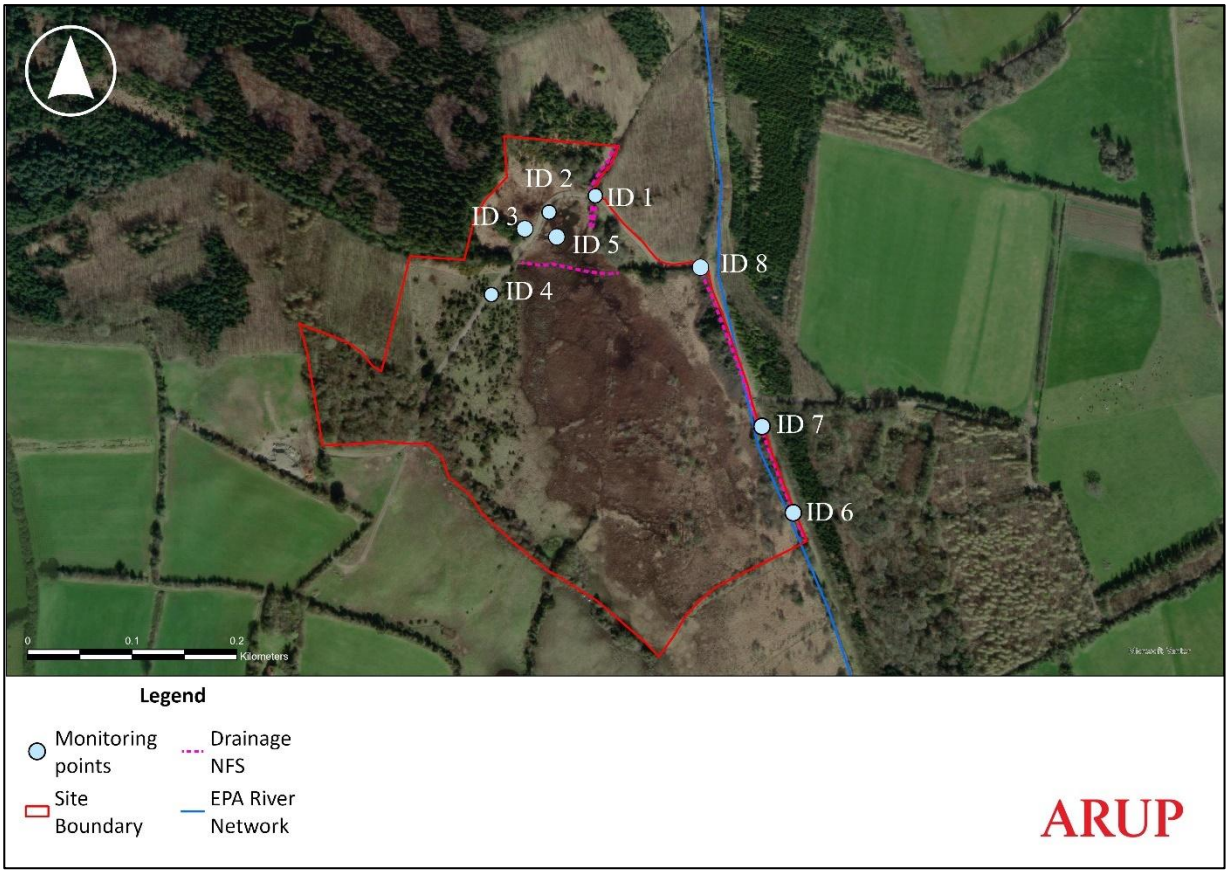


Figure 3-19: Monitoring points at Island Fen SAC

3.2.1 Peat Depth Probing and Ground Investigations

Peat depth probing was conducted throughout the site to assess substrate characteristics (Figure 3-20). Findings from the National Fen Surveys (Brophy et al., In prep), documented a peat depth of 320 centimetres (3.2 m) based on a single measurement across the site, however no spatial location was reported for this measurement.

During the site visit in June 2026, peat depth was measured throughout the site. Peat depth is shallow surrounding the stream along the eastern perimeter at 0.1-0.75m. Peat depth is deeper towards the centre of the site, at 2.56m. Towards the northern and northwestern area, near the road, peat is shallow ranging from 0.15-0.35m.

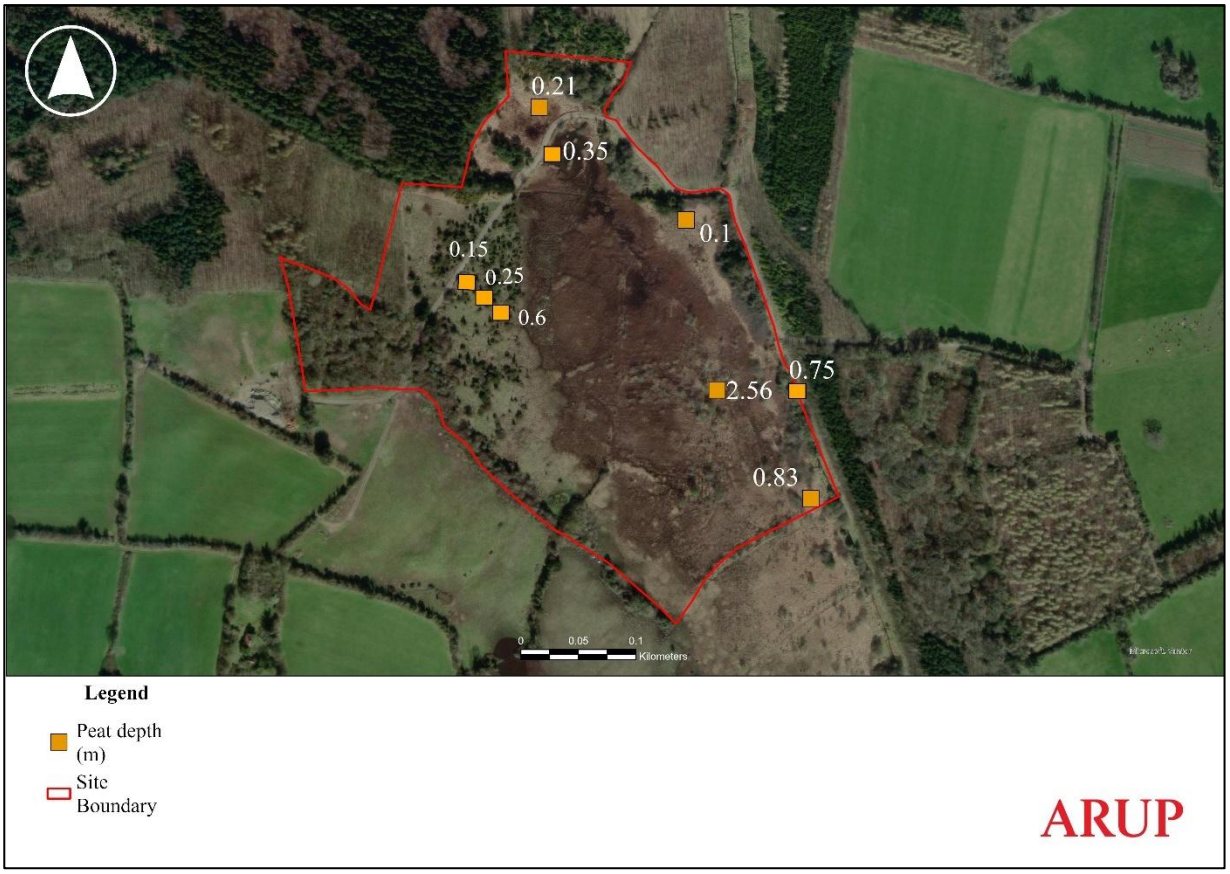


Figure 3-20: Peat depth (m) at Island Fen SAC

3.2.2 Surface Water Drainage

The first site visit took four water samples along the north and northwestern area of the site. The first sample (ID 1) was taken along a drain in the northern area that was observed flowing to the north. Three sample were collected from ditch along a road from the north to northwest. The second and third sample (ID 2 & ID 3) were taken in an open body of water, and the fourth sample was taken (ID 4 & 5) along the same road. No flow was observed.

The second site visit focused on the Clareen stream. At the first monitoring point (ID 6), the channel was approximately 2 m wide and 1.25 m deep, with a recorded water depth of 0.75 m. Flow conditions were fast, moving from south to north. The channel was heavily vegetated, and the water was clear.

Further downstream, at point ID 7, the channel remained fast flowing towards the north, with densely vegetated banks. The overall channel depth remained at approximately 2 m; however, the base of the channel was shallower (c. 1.0 m), and the water depth had decreased to 0.5 m.

At a third location (ID 8), further north where the channel changes direction to northwest, the is measured approximately 2 m in width and 1 m in depth. The water depth remained consistent at 0.5 m.

3.2.3 Water Quality

Water quality monitoring indicates spatial slightly variability and identifies potential sources of nutrient enrichment in the northwest of the site.

Phosphate concentrations (PO_4) vary across the site, with some measurements exceeding the 'good' status environmental quality standard for rivers of 0.107 mg/l PO_4 (0.035 mg/l PO_4-P) and others falling below this threshold Figure 3-23. A sample taken (ID 1) along the drain in the northern area had elevated phosphate of 0.98 mg/L, which exceeds the standards. Two samples were taken (ID 2 & 3) in an open water body located in the northern area of the site. Phosphate shows measurements of 0.18 mg/L and 1.42 mg/L, both exceeding the standards. Samples were taken (ID 4 & 5) along the road which showed a concentration of 1.22 mg/L and 0.79 mg/L.

Measurements were taken along the Clareen stream with the first point (ID 6) showing a concentration of 1.79 mg/L, exceeding the threshold, and the second point (ID 7) a concentration of 0.02 mg/L, which is below the threshold.

High phosphate in the northern area of the site may be related to the forestry located to the north of the site.

Nitrate (NO_3-) concentrations vary considerably across the site, with some values above and others below the regulatory groundwater threshold of 37.5 mg/L NO_3. Although there is no regulatory surface water threshold for nitrate, nitrate concentrations of greater than 8 mg/L NO_3 may impact the ecological health of rivers (EPA, 2025b) (Figure 3-24). The drain in the north (ID 1) showed a concentration of 12.3 mg/L NO_3-N, which doesn't exceed the threshold, but could impact the ecological health of the drain. Points taken in the north (ID 3 & 5) which showed concentrations of 7 mg/l. The other samples (ID 2 & 4) showed measurements ranging from 0.3 –3.7 mg/l which are below the threshold.

Samples taken along the Clareen stream; the first point (ID 6) showed a concentration of 3.4 mg/L, while the second point (ID 7) showed a concentration of 30.2 mg/L, which exceeds the threshold.

Electric conductivity (EC) (µS/cm) and pH were measured during field visits (Figure 3-25 & Figure 3-26). pH values ranged from 6.88 to 7.52 µS/cm in the northern, indicating neutral to slightly alkaline conditions consistent with a groundwater-fed (base-rich) fen system. EC values ranged from 552 to 731 µS/cm, with the highest measurement taken in the drain located in the northern area. These EC concentrations indicate groundwater conditions.

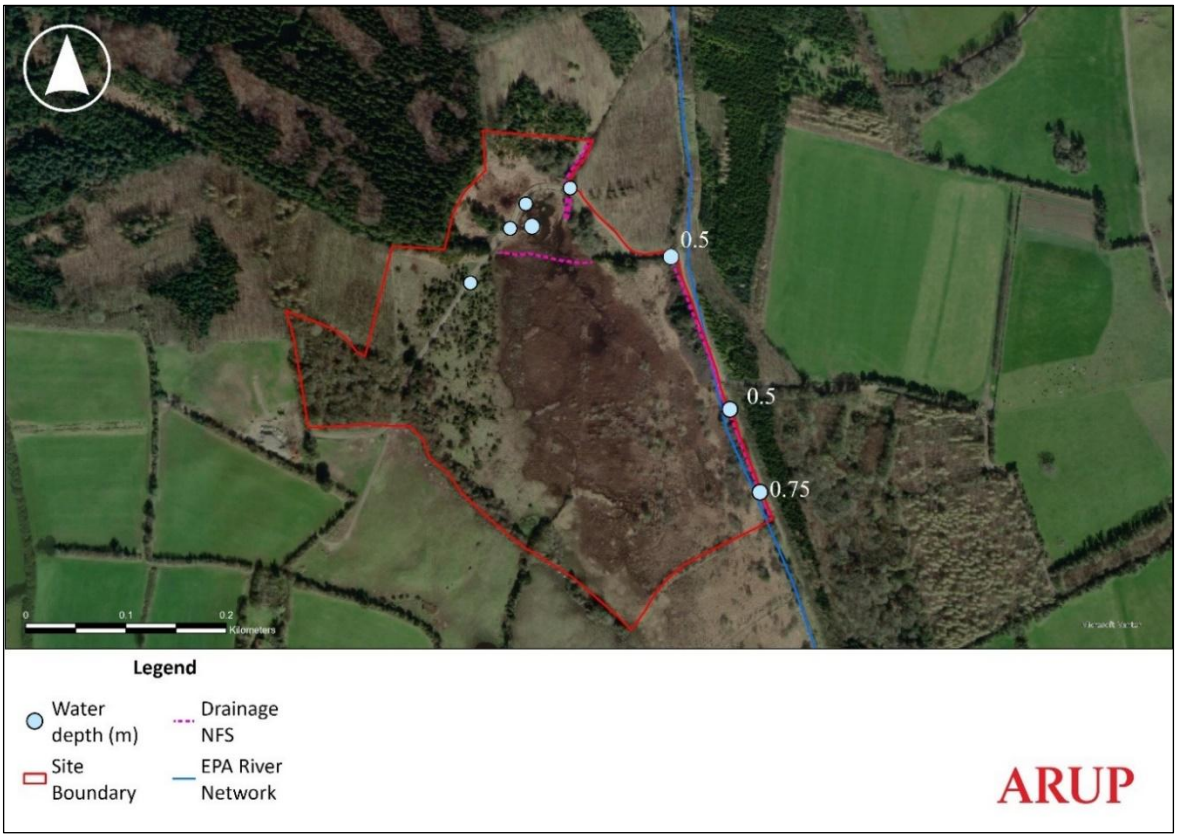


Figure 3-21:Water depth along the Clareen stream at Island Fen SAC

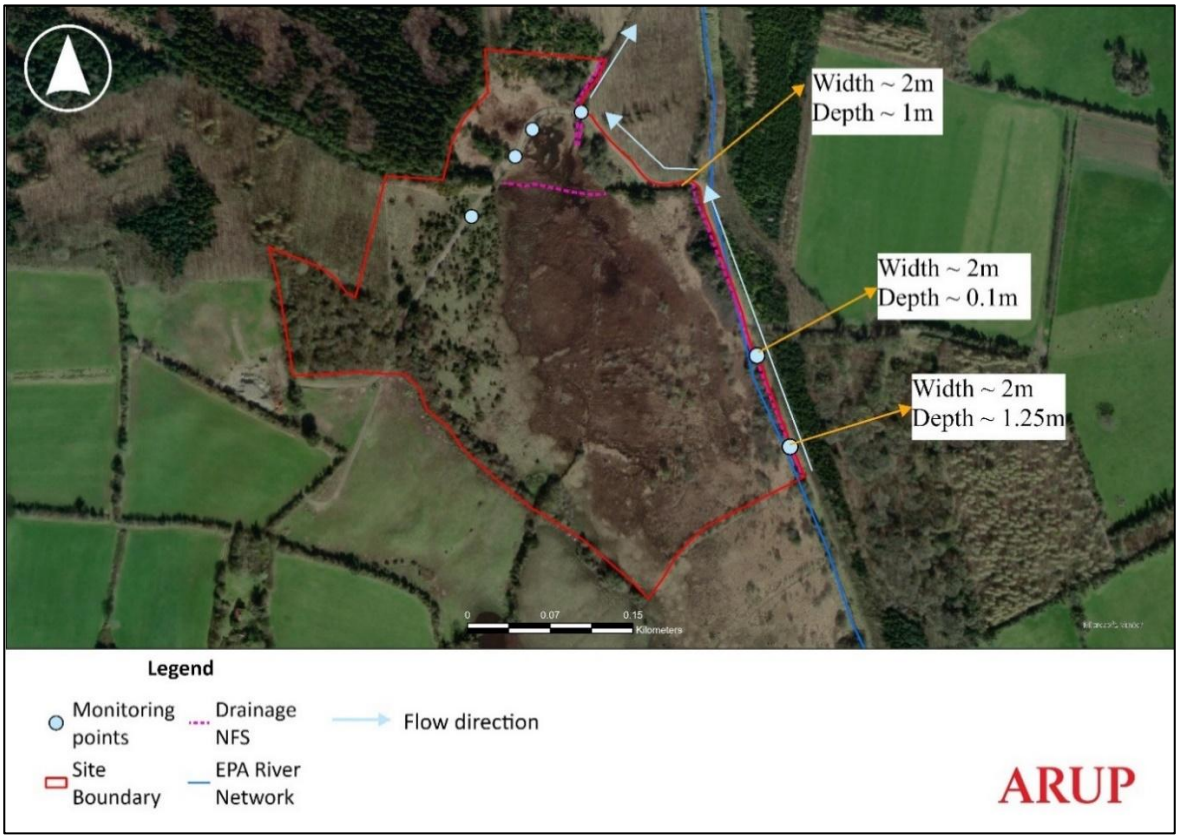


Figure 3-22: Drain measurements of Island Fen SAC

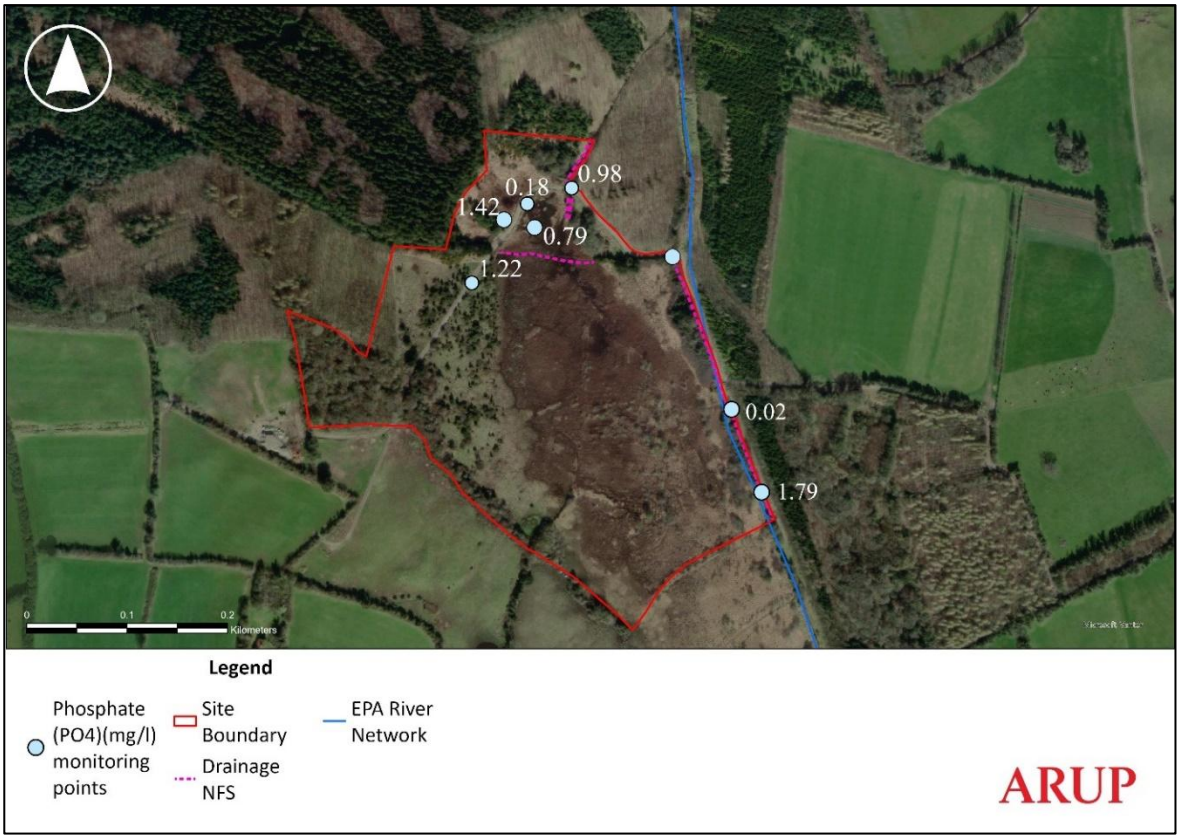


Figure 3-23: Phosphate (PO4) at survey points in Island Fen SAC

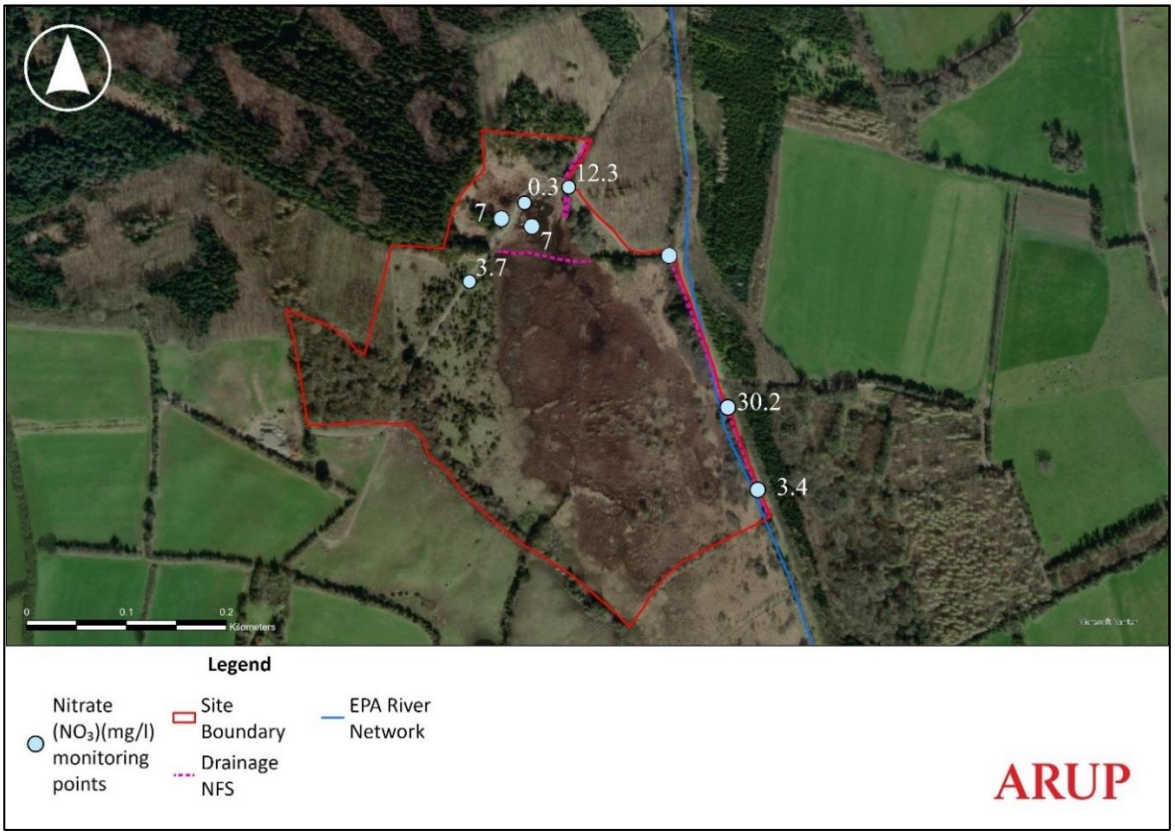


Figure 3-24: Nitrate (NO_3-N) at survey points in Island Fen SAC

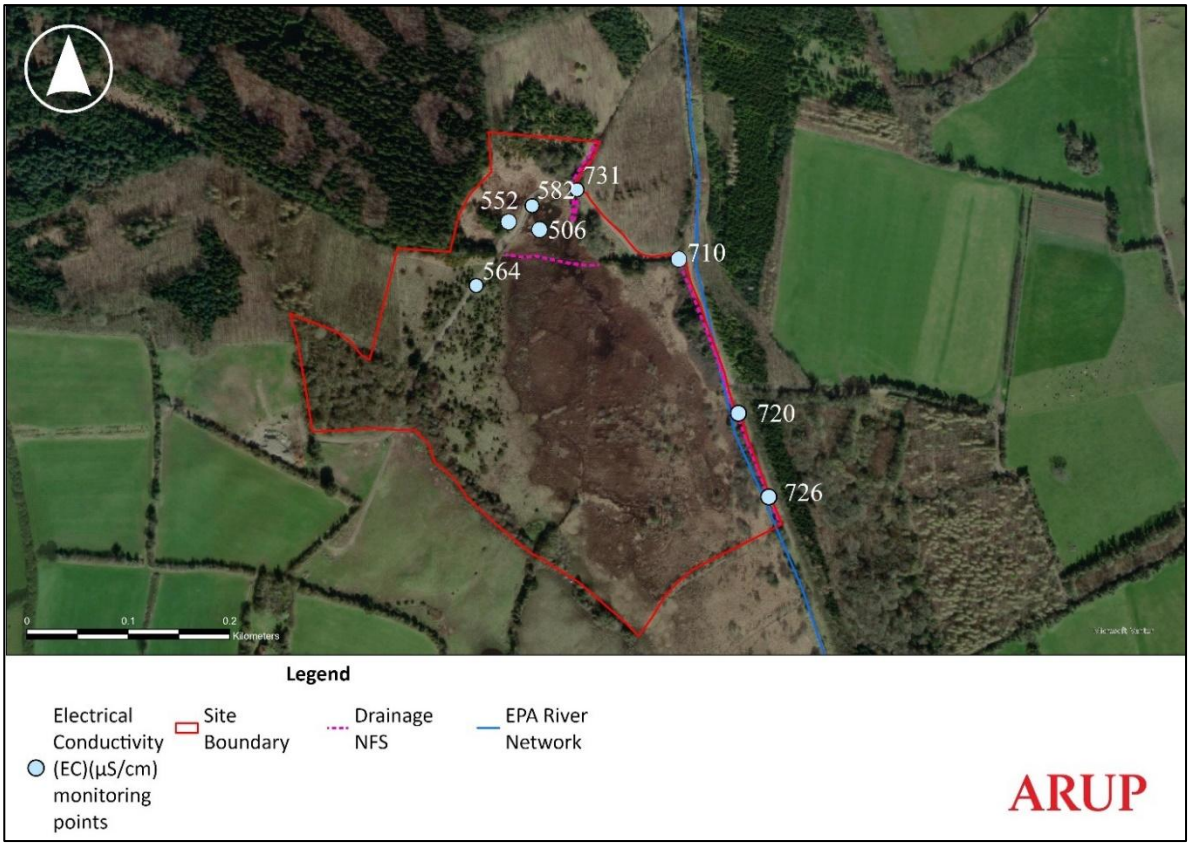


Figure 3-25: EC at survey points at Island Fen SAC

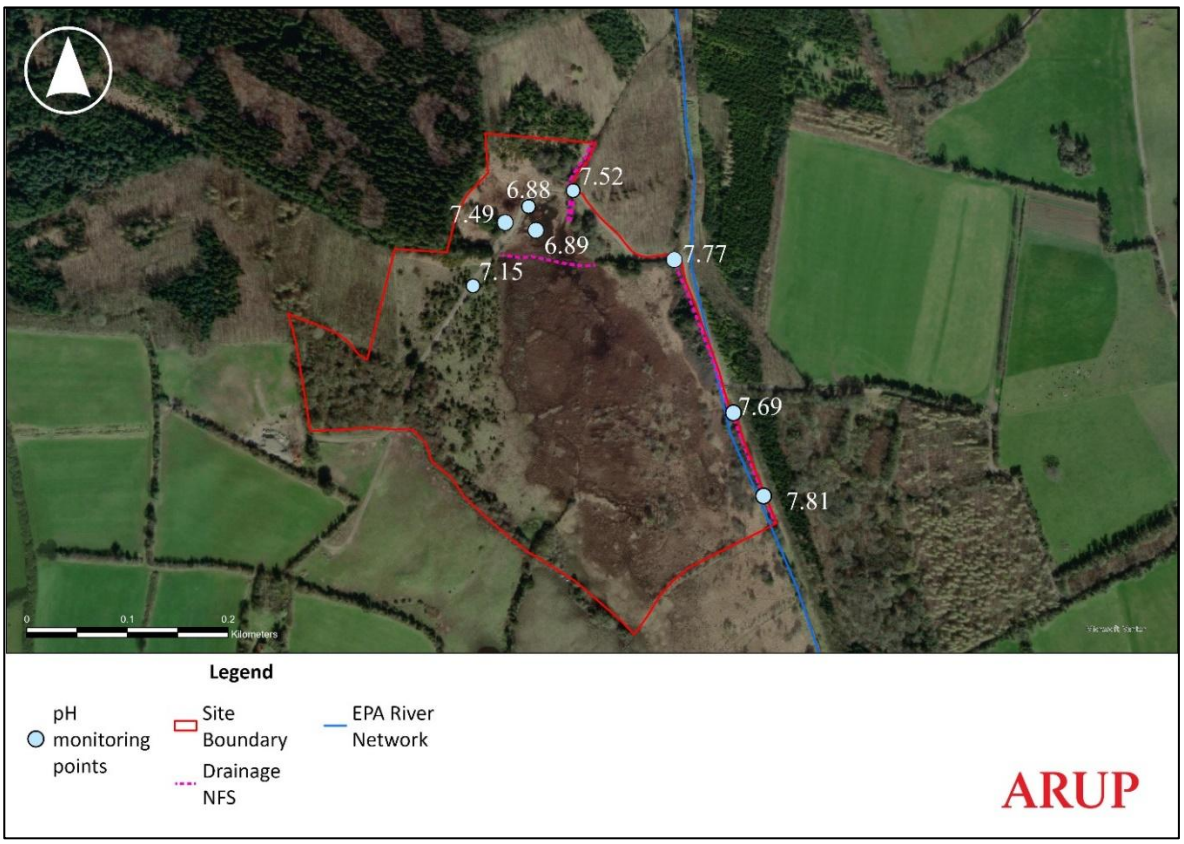


Figure 3-26: pH at survey points at Island Fen SAC

3.3 Conceptual Site Model

Island Fen is classified as a groundwater-fed-bottom WETMEC 9, characterized by a valley-bottom fen system that has developed within a basin and is predominantly maintained by groundwater discharge from adjacent higher ground, with water flowing through the fen to a surface water outfall. The site is characterized between WETMEC 9b (part-drained groundwater bottom) and WETMEC 9a (wet groundwater bottom).

The classification is supported by the following information:

- Island Fen SAC site is at an elevation of approximately 86 mOD, with a gentle slope from north to south. An area of high elevation, at approximately 127 mOD, is located to the east of the site. Peat deposits are deeper towards the centre of the site, reaching up to 2.56 m, and thinner towards the site boundary.
- The site is underlain by Waulsortian Limestones, which is formed by massive, unbedded limestone and mudstone. GSI subsoil mapping indicates the majority of the site is underlain by *Cut-over raised peat*; however, this is more likely to be Fen peat. Other subsoils include Till derived from limestones, with localised Alluvium soil and gravels derived from limestones surrounding the site.
- The site is underlain by a Locally Important Aquifer (LI), which is moderately productive only in local zones.
- Surface water flow is generally directed northwards, ultimately discharging to the Camcor River. Historical mapping indicates that the Clareen stream located along the eastern site boundary, flows northwards. The mapping also shows a drain connected to the river that extends northwest before splitting, with one branch flowing north and another west. Two farm drains situated to the west of the site discharge into the north-flowing western drain.
- The southern section of the site supports the best-developed fen habitats, including Annex I Alkaline fen and localised patches of Cladium fen vegetation.
- The electrical conductivity measurements taken within the monitoring points range from 552 to 731 µS/cm, indicating groundwater contribution. pH is slightly acidic to slightly alkaline (6.88-7.52), indicating influence from calcium-rich groundwater, which supports the development of these fen habitats.
- Elevated nitrate concentrations were identified in the northern drain and the Clareen Stream, with levels of 30.2 mg/L NO_3-N and 12.3 mg/L NO_3-N recorded, respectively. Elevated phosphate concentrations (0.79 to 1.42 mg/L PO_4-P) were predominantly observed within drains located in the northern and northwestern areas of the site, which are adjacent to the forestry zone to the north. The highest phosphate concentration recorded was in the Clareen Stream, at 1.79 mg/L.

- The presence of high-quality Annex I vegetation, characterised by a diverse assemblage of typical fen species, including brown mosses, charophytes, and a range of positive indicator vascular plants, represents the expected ecological expression of a functioning WETMEC 9a, with a few areas being affected by drainage and being characterized as WETMEC 9b.

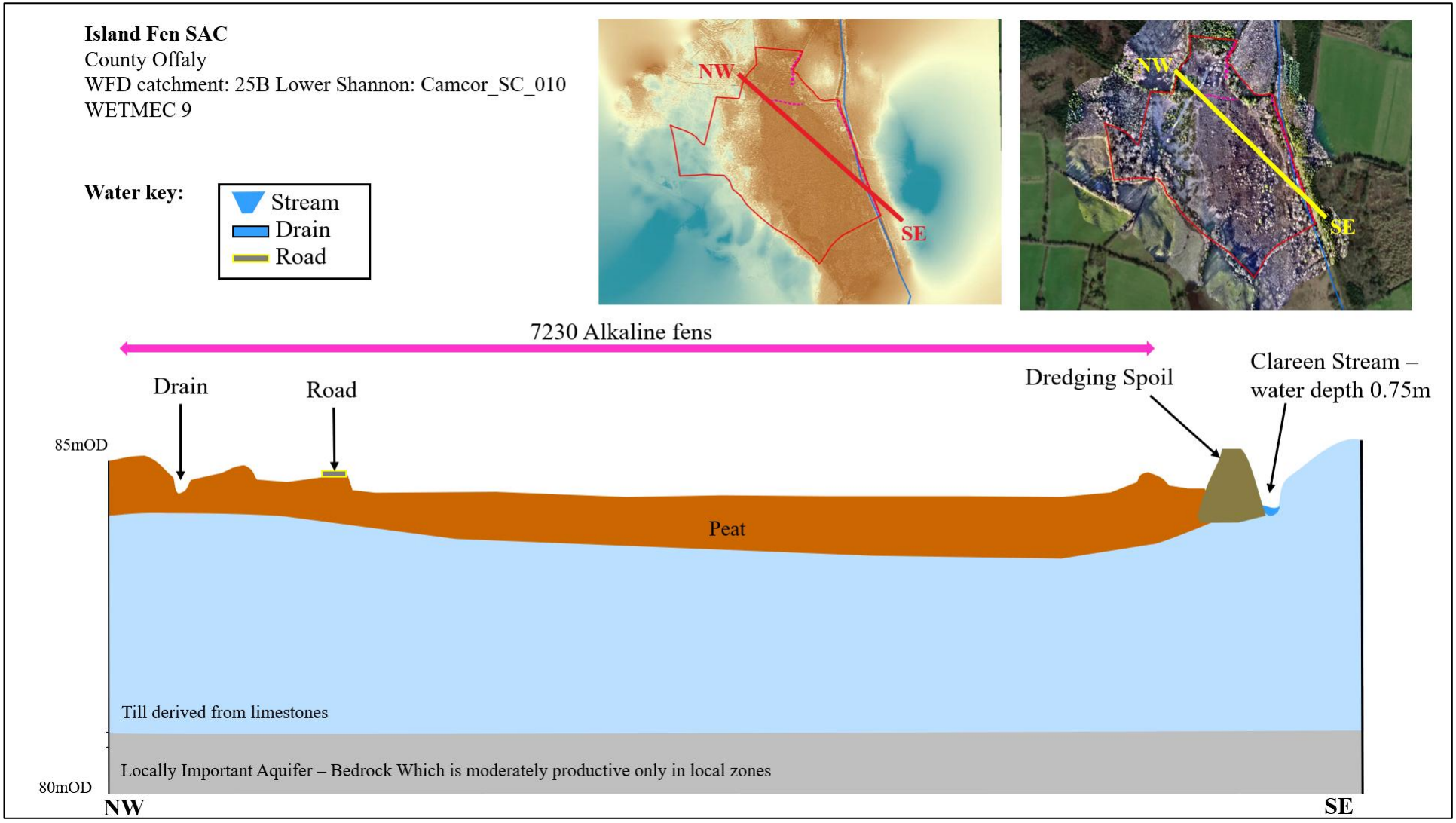


Figure 3-27: Conceptual Site Model for at Island Fen SAC

4 Ecology

4.1 Desk Study

A desk-based review of available ecological information for Island Fen SAC was undertaken to establish the baseline ecological conditions of the site. The following sources were consulted:

- National Fen Survey (Brophy et al., in prep);
- National Biodiversity Data Centre (NBDC) mapping;
- Botanical Society of Britain & Ireland (BSBI) Plant Atlas 2020;
- NPWS Site Synopsis for Island Fen SAC.

The NFS provides the primary source of ecological information for the site, including habitat mapping, vegetation composition and condition assessment. The survey methodology incorporated vegetation relevés, mapping of habitat extent, and recording of key indicators of ecological condition, including hydrological characteristics and disturbance pressures.

The desk study information was used to inform the understanding of habitat distribution, structure and condition within the SAC.

4.2 Habitats

The NFS identified Island Fen SAC as being dominated by alkaline fen habitat, occurring within a wetland system that includes transitional zones to swamp communities.

The alkaline fen is characterised by wet to very wet conditions, supporting vegetation typical of base-rich fen systems. The habitat displays a mosaic structure, with variations in species composition and dominance reflecting local hydrological conditions.

Vegetation within the fen includes a combination of vascular plant and bryophyte communities, with species associated with alkaline and swamp transitions recorded. Dominant species include *Phragmites australis* and *Menyanthes trifoliata*, with *Schoenus nigricans* occurring within tussock-forming communities. Aquatic and transitional elements are also present, reflecting the wetness of the system.

4.2.1 Annex Habitats

The following Annex I habitats were identified and mapped during the NFS:

- **7230 Alkaline fen** – Approximately 6.12 ha, forming the dominant habitat within the central, southern and south-eastern parts of the site.
- **5130 *Juniperus communis* formations** – Occurring along the western boundary, where juniper scrub forms a locally important habitat component.

It should be noted that NFS habitat mapping is based on the dominant habitat within each polygon. As such, mapped polygons may represent mosaics of habitats, and the extent of Annex

I habitat within each polygon may vary. Interpretation of habitat extent should therefore consider the potential presence of mixed habitat composition within mapped areas.

4.2.2 Non-Annex/Fossitt habitats

In addition to Annex I habitats, a range of non-Annex I habitats were recorded and classified according to the Fossitt (2000) habitat classification system. These habitats form part of the wider wetland mosaic and are summarised in Table 4-1.

Table 4-1: Fossitt habitats recorded within Island Fen SAC

Habitat Type	Location	Notes
WN2 – Oak- ash-hazel woodland	West	Located on the western boundary of the site.
PF1- Rich fen and flush	Central section of the site, South and Southeast	The polygons of PF1 directly correlate with the 7230 Alkaline fen habitats.
WS1 – Scrub	Two sections within the eastern boundary and the west	One polygon is located along the eastern boundary with the polygon to the west directly within the 5130 Juniper scrub habitat.
GS4 – Wet grassland	South and southwestern boundary of site	Located in the southwestern section of the site with some located in the same area as the 5130 Juniper scrub.
FS1 - Reed and Large Sedge Swamps	North	One small area located to the north of the site, bordered by PF1 and WS1.

4.2.3 Species

The following subsections outline the presence of species recorded at or within the zone of influence of Island Fen SAC. This includes protected species listed under relevant legislation and conservation frameworks such as the EU Habitats and Birds Directives (Annex I, II, IV, and V), the Irish Red Lists, and the Wildlife Acts (including species protected under the Flora Protection Order. Records are limited to those from the past ten years, reflecting the most plausible timeframe for continued presence and ecological relevance to the site - excepting where invasive species were historically recorded and there has been no indication since of their elimination.

4.2.3.1 Species Within the Site

The species within Table 4-2 were identified using the NBDC interactive maps service, reviewing the NFS documentation and from the ecological walkover conducted in 2026.

Table 4-1 Species records within Island Fen SAC

Common name	Latin name	Description	Most recent record
Intermediate Hook-moss	*Scorpidium cossonii*	Occurs in calcareous wetland habitats where base-rich water is present, particularly within alkaline fens and flush systems.	2011
Yellow Starry Feathermoss	*Campylium stellatum* s.l	A characteristic species of base-rich flushes and mires; also associated with other calcareous wetland habitats.	2011
Speckled Wood	*Pararge aegeria*	A widespread butterfly species associated with shaded woodland and hedgerow habitats; active between April and September.	2019
Beautiful Demoiselle	*Calopteryx virgo*	A large metallic damselfly typically associated with clean, fast-flowing rivers and streams, particularly over sandy or gravel substrates.	2019
Marsh Fritillary	*Euphydryas aurinia*	A protected species under the EU Habitats Directive. Adults are on the wing from mid-May to mid-July. Larvae depend on Devil's-bit Scabious (*Succisa pratensis*) in damp grassland, heath, fen margins and marsh habitats.	2017
Curlew	*Numenius arquata*	A winter visitor to wetland habitats across Ireland, breeding locally in bogs, wet grassland and floodplains. Populations have declined significantly due to habitat loss and land-use change.	2025
Common frog	*Rana temporaria*		2020

4.2.3.2 Species within the Zone of Influence

Table 4-3 outlines the functionally linked species recorded within 2km distribution zone of influence around Island Fen SAC within the last ten years from the NBDC.

Table 4-3: Species records within the Zone of Influence of Island Fen SAC

Legislative protection	Common name	Latin name
EU Habitats Directive	Brown Long-eared Bat	*Plecotus auritus*
EU Habitats Directive	Common Pipistrelle	*Pipistrellus pipistrellus sensu stricto*

Legislative protection	Common name	Latin name
EU Habitats Directive	Leisler's Bat	*Nyctalus leisleri*
EU Habitats Directive	Soprano Pipistrelle	*Pipistrellus pygmaeus*
Not legally protected	Grass-of-Parnassus	*Parnassia palustris*
Not legally protected	Lady's Bedstraw	*Galium verum*
Not legally protected	Weld	*Reseda luteola*
Not legally protected	Winter Heliotrope	*Petasites fragrans*
Not legally protected	Common Blue	*Polyommatus icarus*
Not legally protected	Holly Blue	*Celastrina argiolus*
Not legally protected	Speckled Wood	*Pararge aegeria*
Not legally protected	Beautiful Demoiselle	*Calopteryx virgo*

4.3 Field Survey

Following a comprehensive review of available desktop data, a targeted ecological survey was undertaken in April and June 2026. The field surveys concentrated on key areas highlighted during the desk-based assessment, specifically those with potential for restoration activities. These locations were investigated in detail to verify and further assess ecological conditions and parameters, ensuring that any recommended restoration measures would be both appropriate and effective in the identified zones**.**

Two survey forms were created to collect data relevant to:

- Monitoring data; and
- Pressures and threats

4.3.1 Monitoring Points

The targeted walkover survey was a focused assessment designed to gather site-specific ecological data at pre-identified locations within the site. The walkover was designed to assess ecological condition at four pre-identified monitoring points (Monitoring Points 1–4), selected based on hydrological features, habitat potential and restoration feasibility. These locations were determined through expert discussion and review of baseline data and will serve as fixed monitoring stations for post-restoration monitoring. A map of survey points is provided in Appendix B.

These monitoring points serve a dual purpose:

- baseline characterisation of current site conditions; and
- long-term monitoring stations to assess ecological change following restoration.

The surveys focused on two key components:

- Target notes: qualitative observations at each monitoring point, capturing vegetation structure, habitat condition, hydrological context and legacy management; and
- Pressures and threats identification: systematic recording of anthropogenic and natural pressures affecting each location.

7230 Alkaline fen was confirmed at Monitoring Points 2, 3 and 4, while Monitoring Point 1 supported PF1 Rich fen and flush habitat only.

4.3.2 Pressures & Threats

This section outlines the historical and current pressures and threats affecting fen habitats at Island Fen SAC with particular emphasis on 7230 Alkaline fen and associated fen habitat recorded during the NFS and 2026 ecological walkover.

4.3.2.1 7230 Alkaline fen

Historical Pressures

The NFS determined that the structure and functions of the Annex I 7230 Alkaline fen habitat at were 'Unfavourable – Bad', with negative pressures relating to drainage, lack of management and grazing. The NFS records the Clareen Stream on the eastern edge of the site and also identifies unmanaged vegetation and extensive grazing as negative influences on site condition.

- **Drainage** was identified as a key hydrological pressure, associated with the Clareen Stream along the eastern boundary and additional drainage features noted in the northern part of the site. These features are likely to have altered local water levels and contributed to reduced hydrological suitability for alkaline fen.
- **Lack of management** was recorded by the NFS as a negative pressure affecting the site.
- **Extensive grazing** was also recorded by the NFS as a negative pressure affecting the alkaline fen habitat.

Current Observations

Recent walkover surveys indicate that the historical pressures identified through the NFS remain relevant to the site, with evidence of ongoing vegetation change and hydrological pressure in parts of the monitored fen habitat. Current observations recorded during the 2026 walkover indicate that drainage, limited management, localised scrub encroachment and potential invasive non-native species pressure continue to influence habitat condition.

- **Drainage**-related pressure remains relevant to the site. The Clareen Stream on the eastern boundary and drainage context recorded through the NFS were considered during the 2026 assessment, and drainage continues to be identified as a pressure affecting fen condition.

- **Lack of management/ insufficient grazing control** is reflected in the occurrence of competitive and rank species at monitoring points, including *Molinia caerulea, Phragmites australis*, bramble and blackthorn within or adjacent to monitored fen vegetation.
- **Scrub encroachment** was recorded as a continuing pressure, particularly along site margins and in drier fen areas where bramble, blackthorn and grey willow were noted.
- **Invasive non-native species** were not identified as a dominant current pressure within the monitored fen itself; however, the potential for encroachment from nearby plantation sources was noted as a future risk.

4.3.2.2 7210 Calcareous fen

Historical Pressures

The NFS recorded 7210 Calcareous fen at Island Fen SAC as 'Favourable', indicating that no significant adverse pressure was identified for this habitat during the NFS condition assessment. It is worth noting, however, that the 7210 Calcareous fen recorded, comprised of only 1% of a mapped polygon at the site.

Current Observations

No dedicated monitoring point was established specifically within mapped 7210 habitat during the 2026 ecological walkover. Therefore, the 2026 monitoring dataset does not provide direct monitoring-point evidence on current pressures affecting this habitat. However, two distinct patches of *Cladium mariscus* were noted in the north-central part of the site during the field survey, indicating the continued presence of calcareous fen elements within the wider wetland mosaic.

4.3.3 Additional Observations

Additional observations recorded during the 2026 ecological walkover indicate that pressures acting on the site are not limited to internal habitat condition alone but may also be influenced by adjacent land use. A 10–15-year-old *Fraxinus excelsior* Ash plantation is located to the north-west of the site and was noted as having the potential to affect water quality within the fen system, particularly in the event of future harvesting. Other surrounding plantation areas were similarly noted as having the potential to influence the fen through runoff or associated land management activities.

The field survey also recorded two distinct patches of *Cladium mariscus* in the north-central part of the site, measuring approximately 8 m × 8 m and 10 m × 15 m respectively. These observations indicate localised persistence of calcareous fen interest within the wider fen mosaic.

Taken together, the NFS baseline and 2026 walkover observations indicate that fen condition at the site is influenced by a combination of localised hydrological pressure, reduced or uneven management, scrub development and potential off-site water quality risks. These interacting pressures are likely to be contributing to the current unfavourable condition of the 7230 Alkaline fen habitat and have informed the restoration priorities identified in later sections of this report.

Table 4-4: Site Conservation Priority Matrix for Island Fen SAC

Level	Feature Type	Feature Name	Extent/ Population	Pressure/Threat affecting it	Restoration Measure On-Site	Restoration Measure Off- Site
1	SAC Habitat Annex I Habitat	7230 Alkaline fen	6.12 ha	Drainage Lack of management; insufficient grazing; Scrub encroachment; Potential nutrient inputs from surrounding land	Targeted hydrological management (subject to further assessment); scrub control; Implementation of conservation grazing where appropriate; Vegetation monitoring Hydrological monitoring	Establishment of vegetated buffer strips along site boundaries (particularly adjacent to forestry and agricultural land) to intercept nutrient runoff and sediment; Engagement with landowners to reduce nutrient inputs
		5130 Juniper scrub	Not quantified (western boundary)	Not surveyed	No restoration measures recommended for 5130 Juniper scrub however, overall restoration measures may have a co-benefit upon the habitat.	None proposed
2	European Priority Species	N/A (no qualifying species recorded within available dataset)	N/A	N/A	N/A	N/A

3	Nationally important species	See Table 4-1 (e.g. Marsh Fritillary, Curlew)	Records only (not population estimates)	Habitat degradation linked to drainage, vegetation structure change and potential nutrient enrichment	Habitat restoration through hydrology and grazing measures to improve habitat suitability	Catchment-level nutrient management through buffer strips and landowner engagement
4	Habitats and species of local interest	PF1 Rich fen and flush; associated wetland mosaic	Not mapped in detail	Drainage; Insufficient grazing; Scrub encroachment; Potential nutrient inputs	Vegetation management (scrub control); Conservation grazing; Vegetation monitoring	Buffer strips to intercept runoff; engagement with adjacent landowners

4.4 Impact Assessment Notes

Following hydrological monitoring, should restoration actions be recommended, these aim to improve the ecological condition of the fen and wetland habitats, particularly the Annex I habitats 7230 Alkaline fen. These actions are designed to support favourable condition of these habitats and enhance habitat resilience. However, potential impacts, both direct and indirect, must be carefully considered to ensure no detrimental impacts to habitats.

Potential impacts:

- **Habitat loss** – low risk – restoration actions e.g. drain blocking and scrub removal are designed to enhance and expand habitats rather than remove them.
- **Habitat degradation** – moderate risk – potential degradation could occur if restoration measures are poorly implemented or monitored. This could occur through poor management of herbicides as part of scrub management, poor biosecurity and spread of invasive species or drain blocking alters hydrology in unintended ways if not based on robust baseline data. Should restoration measures be actioned, monitoring protocols will be embedded into the site plan to monitor change following implementation of the restoration measures.
- **Species disturbance** – low risk – potential for species disturbance if works are undertaken during breeding bird season. Should works be required, these will be undertaken outside the breeding bird season (March to August inclusive). Should works be required during the breeding season, confirmation from an Ecological Clerk of Works that no nesting birds are present in the working area will be undertaken ahead of any works proceeding.
- **Introduction and/or spread of invasive non-native species** – moderate risk - restoration activities (e.g., soil disturbance, water movement) could facilitate dispersal of invasive species. Monitoring and biosecurity protocols will be embedded into the site plan to avoid such risks.

4.5 Good Practice Recommendations

Several good practice measures are recommended based on the requirement for compliance with legislation but also the occurrence of sensitive receptors and possible pathways for negative effects during preparation for or implementation of restoration actions. These are summarised in Table 4-1 below and should be taken as generally applicable in the planning of FRP.

Consultation with relevant NPWS staff should be undertaken prior to implementation to obtain more recent or up to date information on the locations of sensitive receptors, and buffers revised accordingly. Any further requirements outlined by NPWS at pre implementation stage should also be adhered to.

Table 4-5 Good Practice Recommendations

Receptor	Measure
Ground nesting birds	No vegetation clearance or activity which might contravene Section 40 of the wildlife act (consolidated) should be undertaken.
Invasive Alien Species	All vehicles should undergo stream cleaning before site entry. Identified buffers on IAS should be avoided during site preparation and restoration implementation. Consideration should be given to confirmatory survey to identify the latest *Rhododendron* infestation extent along with ecological oversight regarding works proximal to larger infestations.
Protection of European Sites	Any required mitigation measures to avoid potentially adverse effects on European Sites should be incorporated into an Environmental Management Plan or Checklist of Environmental Commitments. Implementation should be overseen by a suitably qualified ecologist.
Protection of Sensitive Habitats	High sensitivity habitats should be protected from long term damage by the use of low-pressure vehicles. Extensive repeated tracking over fen habitat or any other identified priority habitat should be avoided. The storage locations of any materials should avoid high & medium sensitivity habitats.

5 Key Pressures – Field Validation and Evaluation

The FRP considers pressures on Island Fen SAC through an initial desktop assessment of existing information on the site (including previous NPWS commissioned surveys), assessment of land, water and topographic data and aerial imagery, followed by field surveys to characterise and confirm key pressures mapped through desktop assessment. Consultation with NPWS Regional Staff was also undertaken, including a visit with the Conservation Ranger for the area to inform identification of pressures.

The NFS undertook a site evaluation and ranking which determined the conservation value of the site. This evaluation considered 15 criteria as outlined which included naturalness, non-recreatability, potential value, typicality, educational value, size, diversity, fen value, rarity of species, rarity of habitats, viability, recorded history, management needs, intrinsic appeal and expert opinion. These criteria then informed the overall conservation status assessment was applied based.

The conservation status assessment results for Island Fen SAC is summarised in Table 5-1.

Table 5-1: Conservation Status Assessment as per NFS 2022 (Brophy et al, In prep)

OVERALL CONSERVATION STATUS ASSESSMENT				
Annex I habitat	**Area**	**Structure & functions**	**Future prospects**	**Overall Conservation Status**
7230	Not assessed	Unfavourable - Bad	Not assessed	Not assessed
7210	Not assessed	Favourable	Not assessed	Not assessed

5.1 Field surveys of key pressures

Following completion of desktop mapping of key pressure, field surveys were carried out by personnel to verify the findings of the desktop assessment and characterise conditions of the pressures to inform selection of appropriate restoration actions required. The site surveys are discussed in Sections 3.2 and 4.2. These surveys aimed to capture information on the land and water environment such as drainage features, peat depth and water quality and the ecology.

As part of the ecology monitoring surveys, pressures and threats associated with the monitoring point were recorded. A summary is provided within Section 5.2.

5.2 Key Pressures

The NFS and subsequent walkover observations identify three primary pressures at Island Fen SAC that are relevant to the condition and restoration of Annex I quality fen habitats: historical drainage, scrub encroachment and abandonment of traditional grazing regimes resulting in undergrazing and the development of rank vegetation. Where relevant, potential pressures

relating to nutrient inputs are noted based on adjacent land use; however, the NFS draft site report records no evidence observed for signs of nutrient enrichment at the time of survey.

An overview of the key pressures identified on site, following desktop review and in-situ walkovers is summarised below.

All identified pressures and threats, both historical and currently observed, have been comprehensively considered within the FRP to inform appropriate remediation measures. The proposed suite of restoration actions, incorporating both hydrological and vegetation-based interventions, is designed to maintain and enhance the condition of Annex I habitats within Island Fen SAC, while providing co-benefits to associated non-Annex habitats and protected species.

The prioritisation of pressures was informed by a review of NFS data and detailed observations recorded at monitoring locations during field surveys. The implementation of these measures, supported by ongoing vegetation and hydrological monitoring, will contribute to the maintenance of habitat structure and function, enable the timely management of emerging threats, and support the long-term ecological integrity of the site.

5.2.1 Flora and Fauna Pressures

The key flora and fauna pressures affecting the ecological receptors of Island Fen SAC were identified through a review of historical information, including the NFS, and data collected during the 2026 ecological walkover. These pressures are ranked below based on their relative intensity, spatial extent and ecological impact on Annex I 7230 Alkaline fen and associated wetland habitats.

- **Abandonment of traditional pastoral systems / undergrazing** The reduction or absence of effective grazing represents one of the primary pressures acting on the site. Data collected during the 2026 ecological walkover indicate that grazing is insufficient to maintain appropriate vegetation structure, with this condition observed across multiple monitoring points. Mechanistically, reduced grazing pressure limits biomass removal and vegetation disturbance, allowing competitive species to dominate. This has resulted in the development of dense and tussocky swards, characterised by species such as *Molinia caerulea* and *Phragmites australis*. The outcome is a reduction in structural diversity, suppression of typical fen vegetation (including small vascular plants and bryophytes), and a decline in overall habitat quality within 7230 Alkaline fen. This pressure interacts strongly with scrub encroachment and hydrological pressures, amplifying their ecological impact.
- **Drainage and hydrological modification** Drainage was identified as a historical pressure through the NFS. The dredging and deepening of the Clareen Stream along the eastern boundary and additional drainage features has altered local hydrological regimes. Mechanistically, drainage lowers the water table and reduces soil saturation, which is critical for maintaining alkaline fen conditions. This shift in hydrology

promotes the establishment and dominance of competitive species, facilitates scrub encroachment, and reduces the suitability of the habitat for characteristic fen communities. The impact is reflected in changes to vegetation composition, reduced peat-forming processes, and increased vulnerability to secondary pressures such as nutrient enrichment and succession.

- **Rank vegetation development** The proliferation of rank, competitive vegetation is a widespread pressure across the site and is closely linked to undergrazing and hydrological modification. At monitoring points, the dominance of species such as *Molinia caerulea* and *Phragmites australis* indicates a shift towards species-poor and structurally simplified vegetation communities. Mechanistically, the accumulation of dense biomass and litter reduces light penetration to the bryophyte layer and inhibits germination and establishment of characteristic fen species. This leads to a decline in species richness, reduced habitat heterogeneity, and degradation of ecological condition within 7230 Alkaline fen.

- **Scrub encroachment (problematic native species)** Scrub encroachment was identified through both historical NFS data and current field observations as a pressure affecting fen habitats at the site. Species such as grey willow (*Salix cinerea*), blackthorn (*Prunus spinosa*) and bramble (*Rubus fruticosus*) are establishing within or adjacent to fen areas. Mechanistically, scrub increases shading, enhances evapotranspiration, and contributes to further drying of the habitat, reinforcing the impacts of drainage. This leads to a progressive transition from open fen to more terrestrial or scrub-dominated communities. The pressure is closely linked to undergrazing and hydrological change, and its continued progression will result in fragmentation and loss of open fen habitat if unmanaged.

- **Nutrient enrichment (localised and off-site influence)** Nutrient enrichment is considered a potential and spatially variable pressure at Island Fen SAC, with evidence indicating pathways for nutrient and sediment inputs from surrounding land uses. In particular, plantation forestry located to the north-west of the site presents a potential source of sedimentation and siltation, particularly during periods of heavy rainfall or future forest management activities (e.g. harvesting). Surface runoff from forestry is likely to be conveyed via the existing drainage network along the north-western boundary, providing a pathway for fine sediments and associated nutrients to enter the fen system. This may result in localised siltation and nutrient enrichment, leading to changes in substrate conditions, reduced suitability for bryophytes and other fen specialists, and promotion of more competitive vegetation. This pressure may act cumulatively with drainage and undergrazing to degrade vegetation condition and restrict the recovery of characteristic fen communities.

- **Invasive non-native species (localised / low influence)** Invasive non-native species are currently considered a minor and localised pressure. Limited occurrences were

recorded, and no widespread impact on habitat condition was observed. However, the proximity of plantation forestry and surrounding land uses presents a potential risk for future encroachment. If unmanaged, this may influence vegetation composition and habitat structure over time.

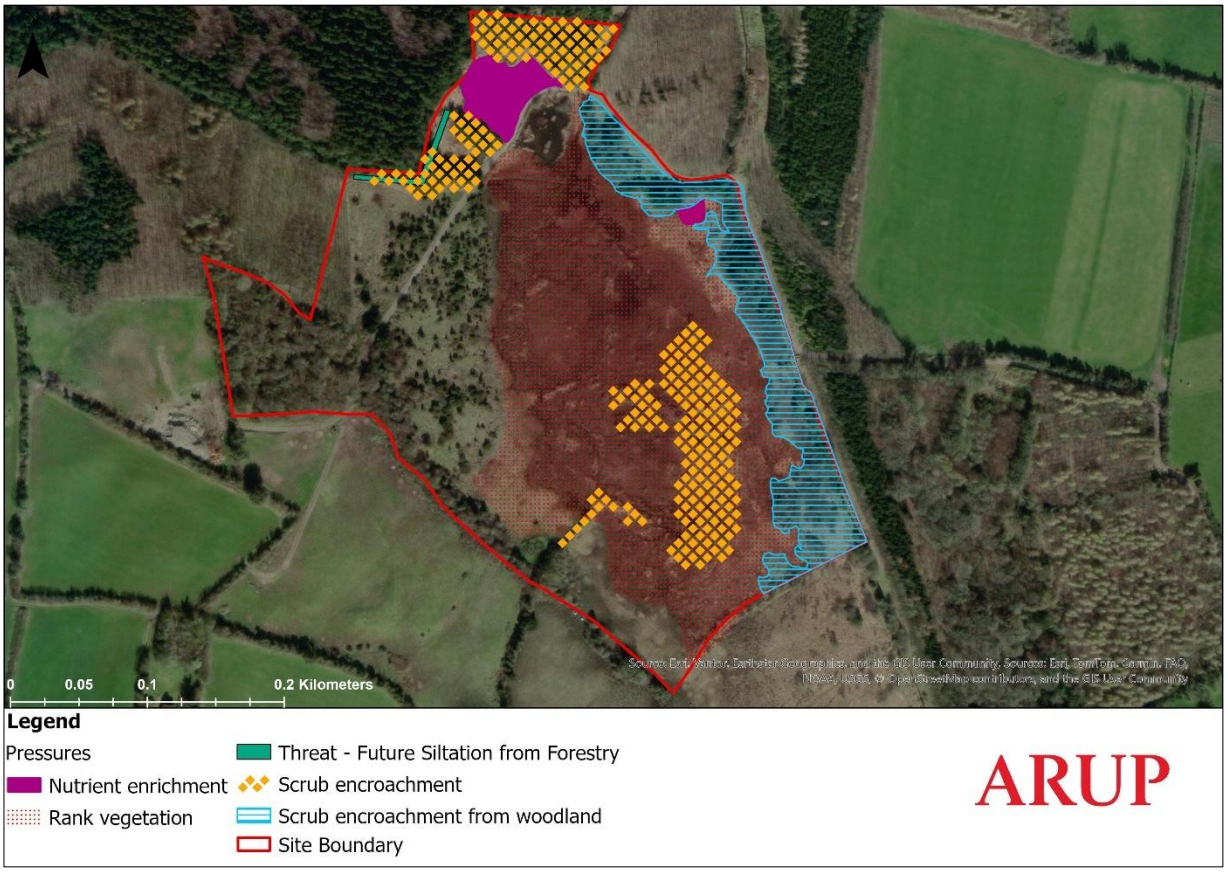


Figure 5-1: Flora & Fauna Pressures mapped within Island Fen SAC

5.2.2 Hydrology Pressures

Drainage has been identified as a key pressure for Island Fen SAC. One drain located in the northern area shows localised impacts and was highlighted as a pressure requiring targeted management. Clareen stream located along the eastern site boundary presents impacts on fen habitats within this area and requires targeted management.

5.2.3 Nutrient Pressures

Diffuse pollution from agricultural activities presents nutrient pressure on the fen habitat. Land use in the surrounding areas, specifically in the north, is contributing to nutrient enrichment and eutrophication.

6 Restoration Measures

6.1 Introduction

The restoration actions proposed by the Fen Restoration Plan will help to maintain or improve the quality of existing areas of fens and improve the conditions that will allow an expansion of the area of fen. In some areas it must be recognised that restoration to fen habitat will not be possible, and the objective may simply be to improve the habitat condition.

Selection of the most appropriate restoration action depends on a range of factors including peat depth, hydrological conditions (flow rates, existing and expected flow paths after restoration), substrate type, existing ecological conditions, potential ecological constraints and practicality of access for machinery.

Each of the factors was considered based on a combination of desktop analysis combined with site-specific field surveys to select the most appropriate restoration technique to address each pressure considered by the FRP. The restoration measures proposed are outlined in Section 4.3 and Section 6.3, with detailed mapping of proposed measures illustrated in the maps provided in Appendix B.

6.2 Hydrology Measures

6.2.1 On-site Fen Hydrology Measures

Vegetation indicators in the vicinity of the Clareen Stream reflect localised reduced water input and drainage impacts. To improve water balance within the eastern part of the site, raise the water table, and consequently reduce scrub encroachment while promoting favourable conditions for the development of the 7230 Alkaline fen habitats, drainage measures are required on the Clareen Stream.

The LiDAR indicates the Clareen stream is approximately 2 m wide and 1 m deep. Site surveys recorded water depths of approximately 0.75 m in the northern section and 0.5 m in the southern section of the drain.

The Clareen Stream is defined as a River Water Body under the Water Framework Directive (*CLAREEN*. STREAM/FUARAWN_020 No.IE_SH_25C130600) and is part of a Drainage District managed by Offaly County Council. Consultation is required with Offaly County Council on the maintenance and function of the channel. Therefore, engagement with County Council will be required and possible stream level monitoring prior any implementation of drainage measures.

A hydrological monitoring network is proposed to assess site conditions, which will include the installation of piezometers and standpipes at five selected locations and two surface water monitoring points in the northern and southern of the as Clareen Stream.

The viability of in-stream measures will need to be considered in the context of other constraints such as fish migration and flooding impacts.

Monitoring progress

Regular groundwater and surface water level monitoring will be undertaken through a network of piezometers and standpipes at key locations within the site (as described above) to inform the need for interventions, including peat reprofiling and flow-blocking measures, and to assess changes in water levels resulting from both outlet control reinstatement and any implemented restoration measures.

The locations for measures and monitoring are presented in Figure 6-1.

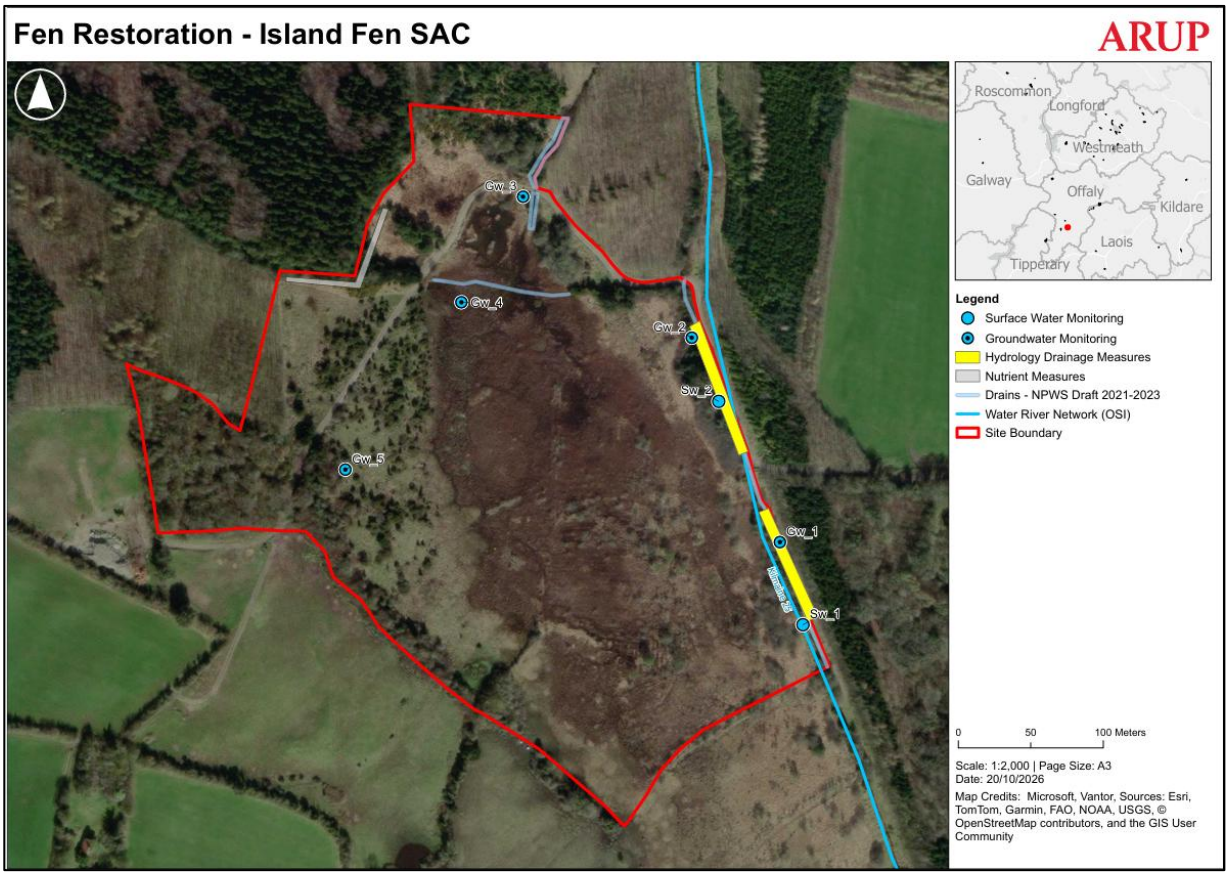


Figure 6-1: Proposed hydrological restoration measures and monitoring for Island Fen SAC

6.3 Nutrient Measures

6.3.1 On-site Nutrient Measures

Elevated phosphate concentrations were recorded in the northern part of the site, adjacent to forestry lands. PIP mapping and field water quality data indicate that the northern site boundary may benefit from the establishment of a vegetated buffer strip.

Historical mapping indicates the presence of a drain in this area, flowing towards the forestry. This drain may provide a pathway for nutrient-rich drainage water, potentially contributing to the elevated phosphate concentrations observed in this area. The vegetated buffer strip will intercept excess nutrients and sediment that could be originated from activities relating to felling, harvesting, planting of the forestry to the northwest of the site boundary. A vegetation

buffer strip will be proposed within the SAC site but subject to AA Screening prior to implementation.

The protected juniper scrub habitat is located within the northwestern part of the site. Therefore, the design and placement of the proposed vegetation strip should avoid this protected feature and ensure that it's not impacted.

6.3.2 Off-site Nutrient Measures

Targeted nutrient mitigation measures should be implemented throughout the catchment to address both phosphorus and nitrogen loss pathways.

Measures identified under the Farming for Water EIP, and innovative approaches promoted through NPWS Farm Plans can be categorised according to whether they target nutrient sources, transport pathways, or sensitive receptors. Potentially suitable measures for Island Fen SAC include:

Source control measures:

- M2 Farmer Training Course for farmers in the fen catchment.
- M3 Nutrient Management Plan. Such a plan will enable farmers in the catchment to achieve optimum slurry application and nutrient update and avoid overapplication of nutrients.

Pathway interception measures:

- M17 Tree planting. Trees help absorb nutrients such as phosphorus and will prevent sediments from reaching the fen.

6.4 Water Quality Monitoring

Proposed water quality monitoring includes measuring nutrients (nitrate and phosphate), electrical conductivity, pH and temperature. Water samples will be taken from the piezometers installed in five selected locations.

A surface water sample will be taken from the Clareen Stream to monitor nutrient input.

The locations are presented in Appendix C.

6.5 Vegetation Measures

6.5.1 On-site Vegetation Measures

Proposed measures to address vegetation succession, rank vegetation development, and scrub encroachment include the following on-site measures, which are described in order of priority in Table 6-1 and shown in Figure 6-2.

Hydrological restoration measures (Section 6.2) are expected to indirectly support vegetation recovery by increasing soil saturation and restoring more natural hydrological conditions across

the site. Improved water levels will reduce conditions favourable to the development of rank vegetation and scrub encroachment, thereby promoting the recovery of characteristic alkaline fen communities.

Vegetation response to any hydrological intervention will be monitored through the established monitoring points, and vegetation management measures (including grazing and targeted scrub control) will be adapted accordingly to support the achievement of SSCOs.

Table 6-1 On-site vegetation measures proposed for Island Fen SAC

Priority	Measure	Description	Responsibility
1	Conservation grazing	Following engagement with relevant landowners, the implementation of a conservation grazing regime is recommended to address the key pressures of undergrazing and abandonment of traditional pastoral systems. This is the principal vegetation restoration measure for the site. Grazing will aim to reduce the dominance of competitive species such as *Molinia caerulea* and *Phragmites australis*, restore appropriate vegetation structure, and maintain open fen conditions within 7230 Alkaline fen. Stocking type, timing and intensity will be adaptive and informed by ongoing monitoring to avoid localised overgrazing or damage to sensitive wet areas.	NPWS (post-Tóchar)
2	Scrub encroachment management	Scrub removal will be undertaken on a targeted, evidence-led basis to control the spread of woody vegetation beyond mapped scrub areas where it is contributing to degradation of fen habitat. Species such as grey willow (*Salix cinerea*), blackthorn (*Prunus spinosa*) and bramble (*Rubus fruticosus*) will be managed where encroachment is affecting open fen. Scrub control will be implemented in conjunction with grazing, as removal alone will not prevent re-encroachment under current site conditions.	Tóchar implementation phase where feasible; otherwise, post-Tóchar
3	Vegetation monitoring	Monitoring points established during the 2026 ecological walkover will be used as fixed stations to assess vegetation structure, species composition and habitat condition. Monitoring will inform adaptive management of grazing and scrub control, including the timing, intensity and spatial focus of interventions.	Tóchar & NPWS (post-Tóchar)

Priority	Measure	Description	Responsibility
		This will allow ongoing evaluation of restoration success and ensure alignment with SSCO targets.	
4	Vegetation buffer strip (northwest boundary)	Establishment of a vegetated buffer strip adjacent to the drain along the north-western boundary of the site, downstream of adjacent plantation forestry. The primary purpose of this measure is to intercept sediment and nutrient inputs arising from forestry operations, thereby preventing siltation and nutrient enrichment of the alkaline fen habitat. This measure is preventative in nature and should be implemented in advance of any forestry harvesting operations, ideally a minimum of two years prior to felling.	NPWS
5	Invasive non-native species monitoring and control	Invasive non-native species will be monitored during annual vegetation surveys. Where such species are recorded and considered to pose a risk to habitat condition, targeted removal will be undertaken at an appropriate stage to prevent establishment and spread. Early intervention will be prioritised given the currently low level of invasion recorded at the site.	NPWS (post-Tóchar)
6	Vegetation response to hydrological restoration	Hydrological restoration measures (including potential drain blocking or attenuation) will indirectly support vegetation recovery by increasing soil saturation and reducing conditions favourable to scrub and rank vegetation. Vegetation response will be monitored, and vegetation management measures will be adapted accordingly to support recovery of characteristic fen communities.	NPWS (post-Tóchar)

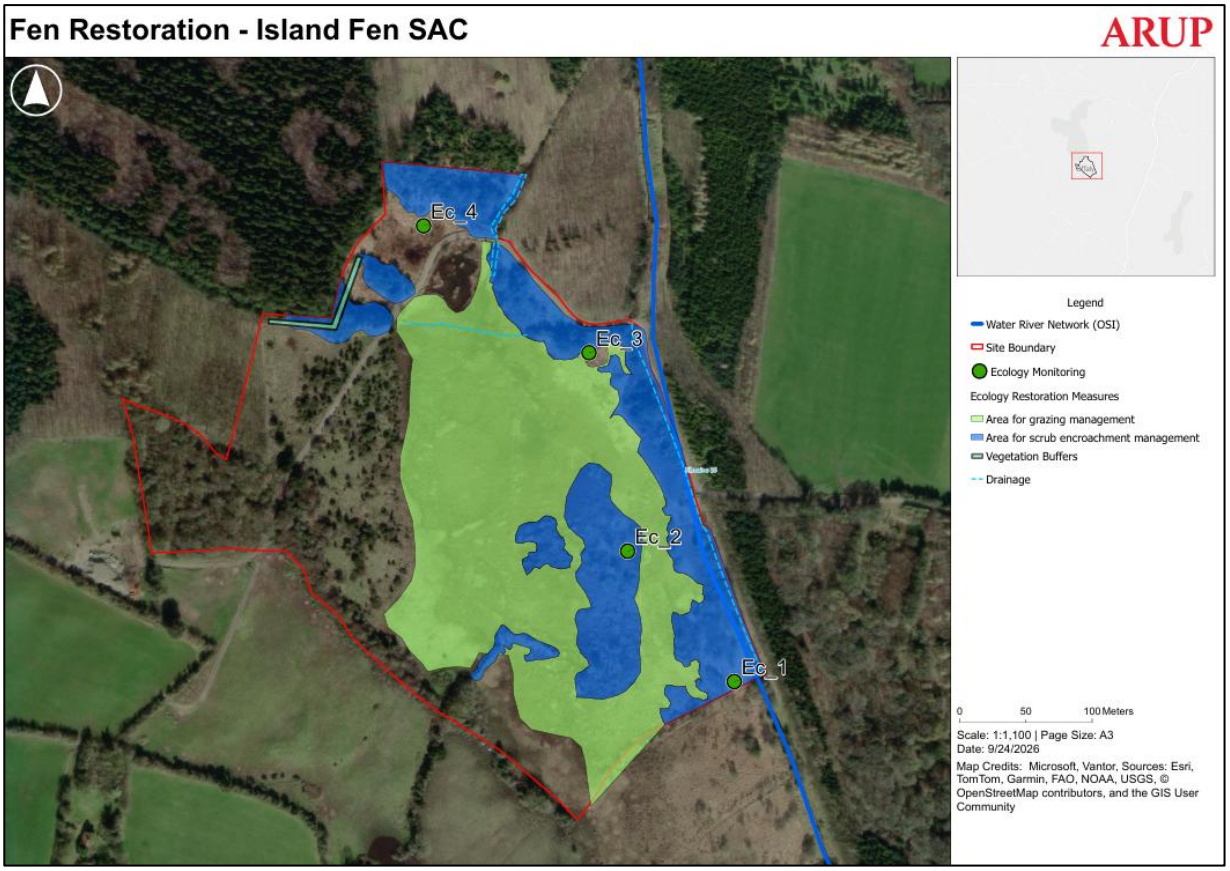


Figure 6-2: Proposed ecological restoration measures for Island Fen SAC

6.5.2 Off-site Vegetation Measures

Proposed off-site vegetation measures include landowner engagement as shown in Table 6-2 below.

Table 6-2 Off Site Vegetation measures proposed for Island Fen SAC

Priority	Measure	Description	Responsibility
1	Landowner engagement	Engaging with landowners surrounding the site regarding farming practices within and adjacent to an SAC with particular consideration for fens.	NPWS

7 Additional Considerations

7.1 Drainage Management Plan

Arterial Drainage Schemes were carried out under the Arterial Drainage Act, 1945 to improve land for agriculture and to mitigate flooding. Rivers, lakes weirs and bridges were modified to enhance conveyance, embankments were built to control the movement of flood water and various other work was carried out under Part II of the Arterial Drainage Act, 1945. The purpose of the schemes was to improve land for agriculture, to ensure that the three-year flood was retained in bank this was achieved by lowering water levels during the growing season to reduce waterlogging on the land beside watercourses known as callows. Flood protection in the benefiting lands was increased as a result of the Arterial Drainage Schemes.

The Island Fen SAC site and its associated drainage network are not located within an OPW Arterial Drainage Scheme (ADS) or Drainage District (DD)[3] however, it is part of a Drainage District managed by Offaly County Council. Consultation is required with Offaly County Council on the maintenance and function of the channel and the impact of the proposed restoration measures on the objectives of the drainage district.

The preliminary drainage management plan for Island Fen SAC is presented in Appendix C.

7.2 Peat Stability Assessment

Restoration activities have the potential to introduce additional risk of peat stability issues. The combination of additional loading (e.g. when excavators are used) and a higher water table has the potential to increase risk. At present, no specific guidance is available in Ireland detailing how peat stability risks should be managed in restoration projects.

7.2.1 GSI Landslide Susceptibility Mapping

Restoration activities have the potential to introduce additional risk of peat stability issues. The combination of additional loading (e.g. when excavators are used) and a higher water table has the potential to increase risk. At present, no specific guidance is available in Ireland detailing how peat stability risks should be managed in restoration projects.

Undertaking detailed geotechnical assessments is beyond the scope of the FRP. However, preliminary peat stability analysis was undertaken to inform the level of assessment required prior to the implementation of restoration actions. This includes a review of the landslide susceptibility map and historic landslide events produced by the Geological Survey of Ireland (GSI). The GSI landslide susceptibility map provides a preliminary indication of the susceptibility of a landslide based on several contributing factors, including where previous landslides have

[3] https://www.floodinfo.ie/map/drainage_map/

occurred and what caused them (slope, soil type and the impact of the flow of water in an area).

The proposed approach to peat stability is a tiered approach that aims to filter out low risk sites that can proceed with limited ground investigation, followed by more complex sites that require a more detailed quantitative assessment. Where risks cannot be excluded following these steps it may be necessary to progress to more detailed geotechnical studies.

GSI landslide susceptibility map for Island Fen SAC is presented in Figure 7-1, which shows that the site area presents a low landslide susceptibility. A small area located just outside the southeast corner presents a moderately to low landslide susceptibility.

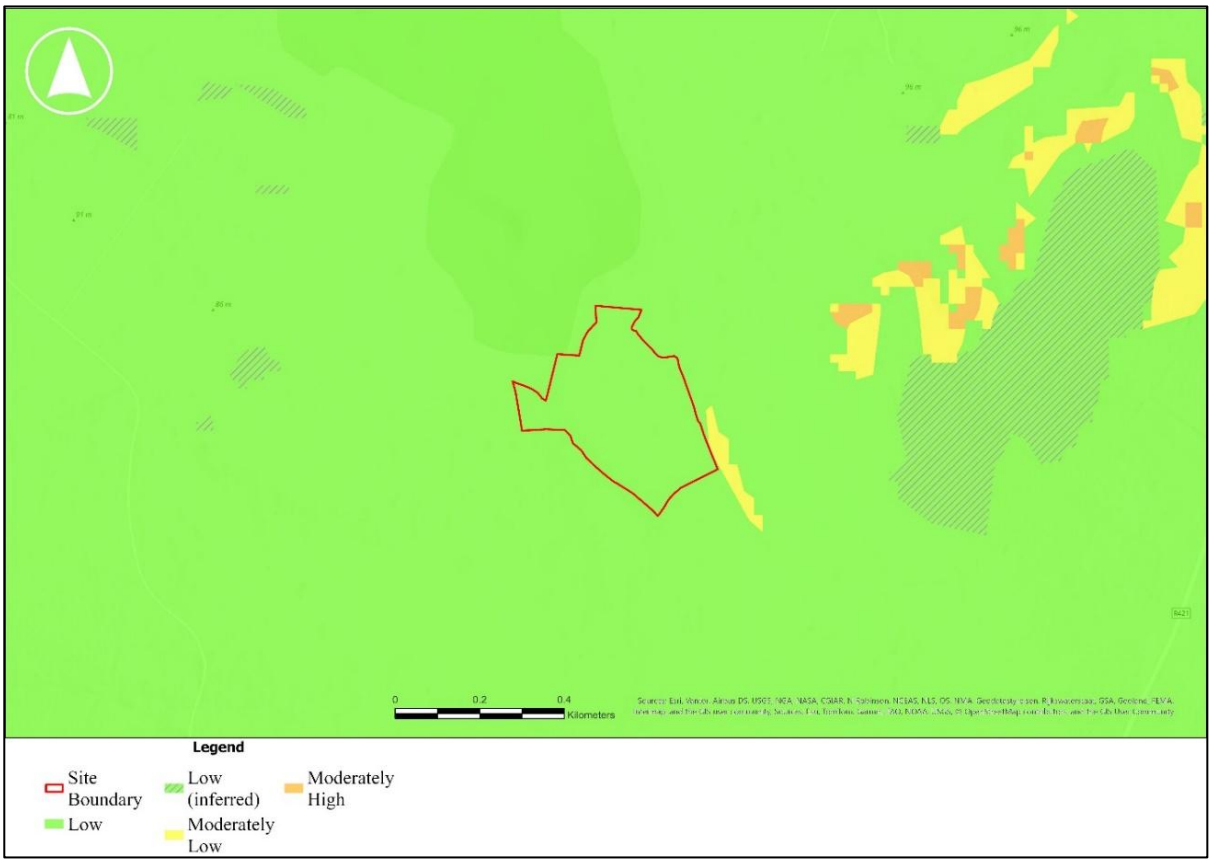


Figure 7-1: GSI Landslide Susceptibility mapping for Island Fen SAC

7.3 *Archaeology*

A desktop constraint assessment was conducted using the National Monuments Service (NMS) Historic Environment Viewer to evaluate the site boundary and immediate surrounding buffer zones against the statutory Record of Monuments and Places (RMP) and the Sites and Monuments Record (SMR). No recorded archaeological sites were identified within the site boundary during this assessment. An enclosure is located approximately 83 m north of the site, while additional archaeological features situated further north include a bawn, castle, fortified house, well, and ringfort. These sites are presented below in Figure 7-2.
A desktop constraint assessment was conducted using the National Monuments Service

(NMS) Historic Environment Viewer to evaluate the site boundary and immediate surrounding buffer zones against the statutory Record of Monuments and Places (RMP) and the Sites and Monuments Record (SMR). The assessment confirmed that there are no recorded archaeological monuments, protected heritage features, or statutory "zones of notification" overlapping with or situated within a relevant proximity to the proposed restoration footprint. Consequently, statutory requirements under the National Monuments Acts are determined to be not applicable to this project as follows:

- Section 12 Notification: Not required, as no works will take place at, or in the immediate vicinity of, an RMP-listed site.
- Section 14 Consent / Licensing: Not required, as the project does not impact any designated National Monument or site subject to a Preservation Order.

Proactive Risk Mitigation (Chance Finds Protocol)

While no recorded features exist, the waterlogged and anaerobic conditions of fen environments possess a high potential for preserving previously unrecorded organic archaeological materials (e.g., wooden trackways, ancient implements, or environmental deposits). To ensure complete compliance with the spirit of the National Monuments Acts, a standard "Chance Finds" Protocol will be maintained throughout the duration of the restoration works. In the highly unlikely event that any sub-surface archaeological features or artefacts are exposed during ground disturbance or rewetting activities, works in the immediate area will cease immediately, and the National Monuments Service and the National Museum of Ireland will be notified within the statutory 72-hour window.

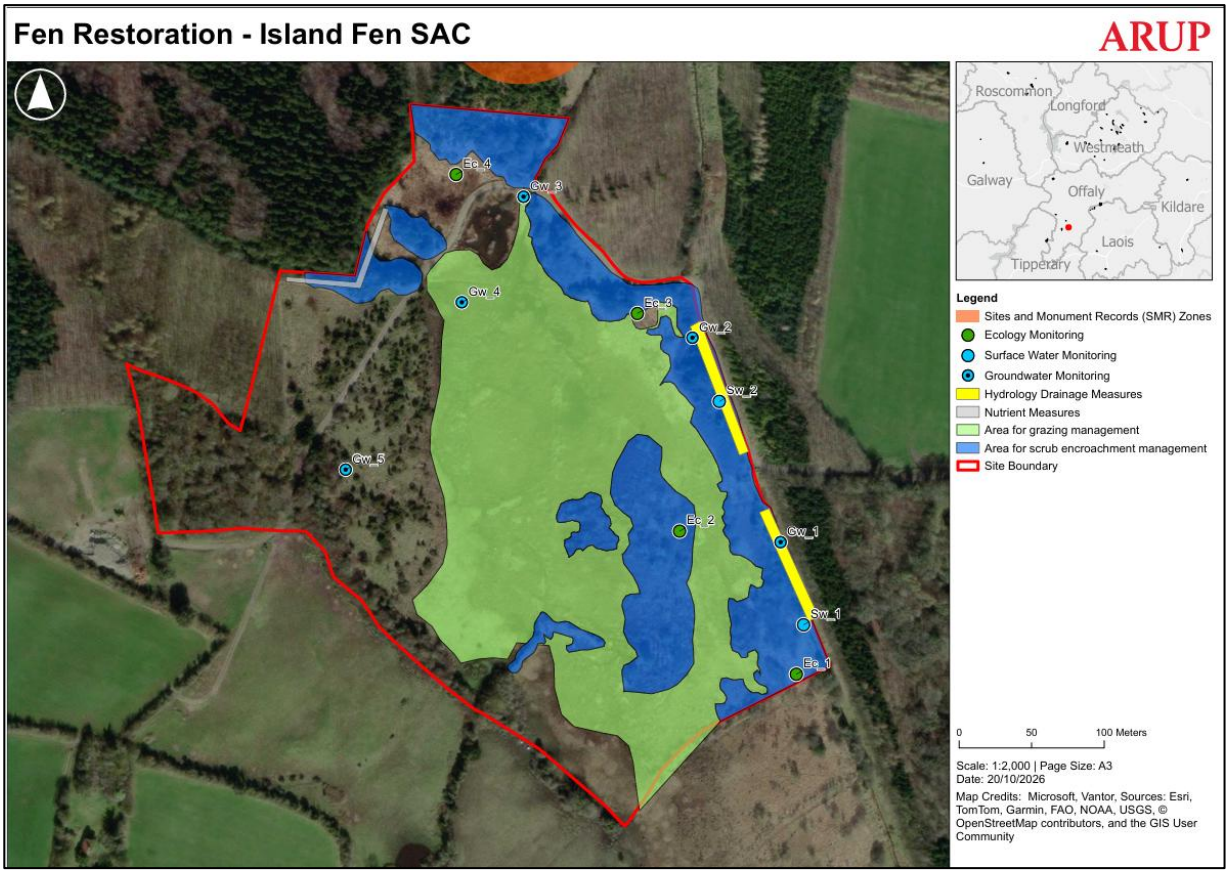


Figure 7-2: Archaeological Sites for Island Fen SAC (NMS, 2025)

8 Summary of Fen Restoration Plan Actions

Prior to proceeding with the implementation of the restoration measures outlined in the FRP, consultation with landowners and key stakeholders with an interest in the site is essential (Table 8-1). While this FRP identifies the key pressures and actions to be implemented, consultation with landowners and stakeholders may identify the need to amend or alter restoration actions. There may also be opportunities to provide additional benefits to the wider community. Consultation with local NPWS staff will be crucial to informing implementation planning.

Table 8-1: Role players in fen restoration plan

Measures	Stakeholder	Description
On-site	Landowners	Island Fen SAC is under private ownership. Future engagement is priority for the implementation of the proposed restoration measures, including longer term measures relating to conservation grazing.
Off-site	Coillte	Engagement in regard to future management and harvesting of forestry
	Landowners & farmers	Engagement for uptake of catchment measures.
Capacity building	NPWS	NPWS engaging in community education and events

This section provides the summary of the FRP Actions for Island Fen SAC (Table 8-2).

Table 8-2: Implementation plan for Island Fen SAC Restoration

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
1	**Required preliminary actions**							
1.1	**Screening for Appropriate Assessment report.**							
	This report must outline all restoration measures that shall be undertaken as part of the project at Island Fen SAC. The Screening for AA must conclude whether a likely significant effect is anticipated to arise from the implementation of the project.	Sitewide	Screening report	Pre-restoration	NPWS			NPWS
1.2	**Drainage management plan**							
	Consultation with Offaly Co. Co on the drainage management plan is required to ensure compliance with legislation and local authority objectives.	Sitewide	Drainage management plan	Pre-restoration	NPWS	Offaly Co. Co	Arup	Within Tóchar project scope
1.3	**Archaeological assessment**							
	Consultation with NMS on the archaeology is required to ensure compliance with legislation and local authority objectives.	Sitewide	Archaeological assessment report	Pre-restoration	NPWS	Offaly Co. Co	Arup	Within Tóchar project scope
2	**Enabling Works**							
2.1	**Pre-restoration Works Surveys**							

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
	Pre-site walkover with Ecologist/Ecological Clerk of Works (ECoW) to ensure proposed measures are appropriate and whether alterations are required.	Sitewide	ECoW report	Pre-restoration			Arup	Within Tóchar project scope
2.2	**Implementation of Mitigation Measures**							
	Ecological Impact Assessment Considerations – identification of necessary mitigation measures. Such measures may include, but are not limited to, the utilisation of hand machinery to avoid impact on sensitive habitats	Sitewide	ECoW report	Pre-restoration			Arup	Within Tóchar project scope
2.3	**Breeding Bird Considerations**							
	Prior to restoration works, where any restoration measures are identified to have the potential to interfere with breeding birds e.g. scrub removal, these works shall occur outside the breeding bird season (1 March – 31 August inclusive).	Sitewide	ECoW report	Pre-restoration			Arup	Within Tóchar project scope
2.4	**Good Practice Recommendations and CEMP**							
	Good Practice Recommendations – Includes, but not limited to, avoidance of sensitive ecological receptors, pollution prevention procedures, biosecurity measures etc. The preparation and provision of a Construction Environmental Management Plan (CEMP).	Sitewide	ECoW report	Pre-restoration			Arup / Contractor	Within Tóchar project scope
3	**On-Site Restoration measures**							
3.1	**Hydrology measures**							

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
	Drainage measures along the Clareen Stream Detailed optioneering and design using Lidar data and stream level measurements are required to determine the most appropriate drainage measure for the Clareen Stream. Engagement with Offaly County Council as the Clareen Stream is part of a Drainage District and a WFD RWB.	Eastern site boundary	Water management balance	Restoration in 2027	NPWS to facilitate	Offaly Co. Co	Arup/ Contractor	Within Tóchar project scope
3.2	**Nutrient measures**							
	Vegetation buffer Implementing a buffer zone in the northern and northwestern area which will reduce the input of phosphorus within Island Fen SAC.	Northern and Northwest		Restoration in 2027	NPWS to facilitate		Arup/ Contractor	Within Tóchar project scope
	Source control within site boundary Engage landowners to reduce nutrient application within site boundary through farmer training and nutrient management plan specific to fen.	Nutrients (Nitrate and phosphate), EC, pH		Long-term	NPWS to facilitate site access	Arup / Contractor	Within Tóchar project scope	Nutrients (Nitrate and phosphate), EC, pH
	Pathway interception within site boundary Initial priority will be that the northern drains have a riparian buffer along the farm side. In the long-term ensure all drains have a riparian buffer along the farm side.	Sitewide		Long-term	NPWS to facilitate site access		Arup / Contractor	Within Tóchar project scope
3.3	**Vegetation measures**							

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
	Proposed measures to address vegetation condition, rank vegetation, scrub encroachment and undergrazing include: 1. Implementation of conservation grazing across fen habitats, with stocking type, timing and intensity agreed with landowners; 2. Ongoing vegetation monitoring at established monitoring points to assess species composition, vegetation structure and response to management; 3. Targeted scrub management, including removal where monitoring indicates encroachment is contributing to habitat degradation; 4. Monitoring and control of invasive non-native species where recorded during surveys; 5. Adaptive management of vegetation based on monitoring results, including refinement of grazing intensity and spatial targeting of scrub control.	Sitewide	Site records habitat surveys monitoring point assessments	Restoration phase (2026–2027), with long-term adaptive management	NPWS to facilitate access and implementation		Tóchar / Contractor	Within Tóchar project scope (implementation phase); future NPWS or agri-environment schemes for long-term grazing
4 Off-Site Restoration measures								
4.1	**Nutrient measures**							
	Elevated nutrient concentrations were identified in the north of the site. Further investigation is required to identify the source of the nutrients and determine appropriate mitigation measures.	Surrounding landowners north of the site	Uptake of measures by landowners	Long-term	NPWS, LAWPRO, Farming for Water EIP		Landowners	Catchment measures to be funded through Farming for Water EIP/ other similar

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
5	**Monitoring progress**							
5.1	**Hydrology monitoring**							
	Installation of Piezometers Piezometers will be used to monitor groundwater levels and support the interpretation of groundwater flow pathways. The data collected will help determine fen conditions across the site. **Surface water** Surface water levels to be analysed Clareen stream to determine the appropriate drainage measures for the stream.	Allocated locations within the site	Surface and groundwater levels	Long-term	NPWS to facilitate site access			Within Tóchar project scope
5.2	**Nutrient monitoring**							
	Implement a water quality monitoring programme to monitor EC, Ph, Temperature, Nitrate and Phosphorus regularly. Trace source of elevated nutrients upstream via riverbank walks with monitoring to identify sources.	Allocated locations with the site	Nitrate, Phosphorus, EC, Temperature and pH	Long term	NPWS to facilitate site access			NPWS
5.3	**Vegetation monitoring**							

	Activity	Location	Monitoring/ implementation indicator	Timeframe	Key role player			Possible funding source
					National	Regional/ Local	Other	
	Vegetation monitoring will be undertaken using detailed relevés to document habitat composition, cover, and structural characteristics within representative plots. The surveys will also record any pressures or threats, including scrub encroachment, invasive species, or changes to hydrological conditions. These surveys will guide any restoration actions if changes are detected.	Sitewide	Site records/habitat surveys	Long term	NPWS to facilitate site access	Offaly Co.Co		NPWS
6	**Capacity building and training**							
	Public meeting: To engage stakeholders on developments and results from the restoration measures.			Long-term	NPWS			NPWS
	Farmer training: Training such as that provided by the Farming for Water EIP will provide farmers with knowledge of alternative and habitat sensitive measures			Long-term	NPWS/ Farming for Water EIP / LAWPRO / Teagasc			Farming for Water EIP / other similar

8.1 Habitats Benefiting from Implementation of Restoration Actions

8.1.1 7230 Alkaline fen

The implementation of restoration actions will lead to improved ecological condition of 7230 Alkaline fen primarily through recovery of vegetation structure, hydrological function and water quality. Increased soil saturation associated with hydrological restoration will restore the groundwater-dependent conditions required by fen communities, reducing suitability for competitive grasses and woody species. This, combined with appropriate grazing, will result in the breakdown of dense, rank vegetation and promote a more open, structurally diverse sward. Improved light penetration and reduced litter accumulation will facilitate the recovery of characteristic fen flora, including bryophyte communities. In addition, interception of nutrient and sediment inputs will help maintain low nutrient conditions, limiting competitive dominance and supporting species-rich vegetation. Collectively, these changes will improve habitat structure and function, contributing to a transition towards favourable conservation condition.

8.1.2 5130 Juniper scrub

The proposed restoration actions will support the long-term persistence and structural integrity of 5130 *Juniperus communis* formations by maintaining appropriate ecological conditions in the surrounding habitat matrix. Improved grazing management will reduce the dominance of coarse grasses and limit encroachment by competitive scrub species, maintaining open conditions around juniper stands. This will enhance light availability and reduce competition for resources, supporting natural regeneration and the persistence of existing individuals. In addition, improved hydrological stability across the site will help maintain suitable transitional conditions between fen and scrub habitats, preserving the ecological gradients upon which juniper stands depend. Overall, these changes will help maintain the characteristic structure and composition of juniper scrub within the wider site mosaic.

8.1.3 Associated Fossitt habitats (WN2 / PF1 / GS4/ FS1 / WS1 wetland mosaic)

Associated wetland habitats will benefit indirectly through improvements in hydrology, vegetation structure and nutrient status across the site. Restoration of higher and more stable water tables will enhance soil moisture conditions, supporting ecological processes within wet woodland, rich fen/flush and wet grassland habitats. Reductions in nutrient and sediment inputs will limit eutrophication, helping to maintain more diverse plant communities and preventing dominance by competitive species. In parallel, management of rank vegetation and scrub will maintain structural diversity and prevent succession towards more homogeneous or degraded habitat states. These combined effects will support improved habitat quality and ecological functioning across the wetland mosaic, reinforcing connectivity and resilience at a site-wide scale.

8.2 Species Benefiting from Implementation of Restoration Actions

The proposed restoration actions will enhance habitat suitability for species associated with open, wetland environments by improving vegetation structure, hydrological conditions and overall habitat quality. For Marsh Fritillary, the reduction of rank vegetation and suppression of scrub will create a more open and structurally diverse sward, improving conditions for the establishment and persistence of larval host plants and facilitating suitable microclimatic conditions for breeding. For Curlew, improved hydrological conditions and the maintenance of shorter, more open vegetation will enhance foraging opportunities by increasing accessibility to invertebrate prey within soft, wet soils while maintaining open sightlines within the landscape. Overall, the restoration of vegetation structure and wetland processes will increase habitat suitability for these species by supporting the ecological conditions necessary for feeding, breeding and long-term persistence.

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Appendix A – Non Technical Summary

NPWS Tóchar Midlands Wetland Restoration Scheme Fen Restoration Plan Non-Technical Summary			
Site Name	Island Fen SAC	**NFS site no.**	107007
County	Offaly	**Designations**	*SAC*
Fen habitats present (area)	7230 Alkaline fens (6.12ha)	**Species of note**	*Epipatis palustris, Juniper communis*

Site Description

Island Fen SAC is located in a small valley in the foothills of the Slieve Bloom Mountains, southwest of Clareen village in Co. Offaly, and is a designated at a European (SAC). Island fen SAC supports a large area (6.12ha) of Annex I quality 7230 Alkaline Fen within the site with a small parcel (1%) of 7210 Cladium fen. 5130 *Juniperus communis* formations on heaths or calcareous grassland is located in the western area with 7230 Alkaline fen covering the rest of the site. The site also contains a large area of PF1 rich fen flush in the center of the site extending to the southern section, with GS4 west grassland in the western section of the site and other habitats, including, WN2 oak ash hazel woodland, WS1 scrub and FS1 reed and large sedge swamps. Common species located in Island Fen SAC include *Phragmites, Chara spp., Menyanthes* and frequent *Schoenus* tussocks.

Figure 1 presents the habitats mapped within the site.

Conceptual Site Model (CSM)

The topography of Island Fen SAC is relatively flat, ranging from 86 to 90 mOD. The site sits in a basin with higher surrounding areas to the east, at approximately 127 mOD. Under the WETMEC framework defined by Wheeler, Shaw & Tanner (2009), Island Fen SAC is classified as a groundwater-fed-valley-bottom fen, where hydrological inputs are dominated by groundwater emerging from adjacent elevated terrain and moving through the site that represents a discharge zone.

The Clareen stream on the eastern boundary of the site provides surface water inflow into the site and flows from south to north. The stream continues to flow to the north until it changes to northwest and ultimately joins the Camcor river. Drains in the northern area of the site, which flows from north to west, connecting to the Clareen stream. The CSM is presented in Figure 2.

Key Pressures

Hydrology Pressures	Drainage in the eastern area is disrupting hydrological connectivity, lowering water levels, and degrading alkaline fen habitats while promoting scrub encroachment. Additional pressures include fluctuating and reduced water levels, evidenced by extensive dry, degraded areas adjacent to the Clareen Stream.
Nutrient Pressures	High nutrient levels in Island Fen SAC occur mainly in the northern section, the source of the nutrients has not been confirmed. High levels were also observed in the Clareen stream.
Ecology Pressures	Scrub encroachment along the Clareen stream contribute to drying conditions and altered hydrology. These pressures reduce peat saturation, suppress wetland species, and promote succession towards scrub and woodland, diminishing the extent and quality of wetland habitats.

Objective of Restoration Plan

The objective of the Island Fen SAC Restoration Plan is to maintain and enhance the quality of existing fen habitats while creating the conditions necessary to support the expansion of fen areas where feasible. It is recognized that, in some locations, the restoration of fen habitat may not be achievable or desirable due to site-specific constraints. In these areas, the focus will be on improving the overall condition and ecological value of the existing habitat.

Restoration Measures

Hydrology Measures	**On-Site Measures**: Surface water and groundwater monitoring to determine appropriate drainage measures for the Clareen stream.

NPWS Tóchar Midlands Wetland Restoration Scheme Fen Restoration Plan Non-Technical Summary	
	Off-Site Measures: Avoid the creation of new agricultural drains and deepening of existing drains where hydrological connectivity to Island Fen SAC.
Nutrient Measures	**On site Measures:** Surface water and groundwater monitoring and the implementation of a buffer vegetation strip within the northwest area. **Off-Site Measures**: Source identification and control through nutrient management planning, pathway interception to reduce nutrient transport.
Ecology Measures	**On-Site Measures**: Ecological monitoring and management of *Juniperus communis* in the western area.
Monitoring Progress	
Hydrology Monitoring	Groundwater and surface water monitoring within the fen.
Nutrient Monitoring	Ongoing monitoring of habitats and drainage channels for water quality parameters within the fen.
Ecology Monitoring	Ecology monitoring of habitats and habitat condition assessments to track restoration progress.
More information	
Fen Restoration Plan Report Tóchar website: https://www.tocharwetlands.ie/fen-restoration/	

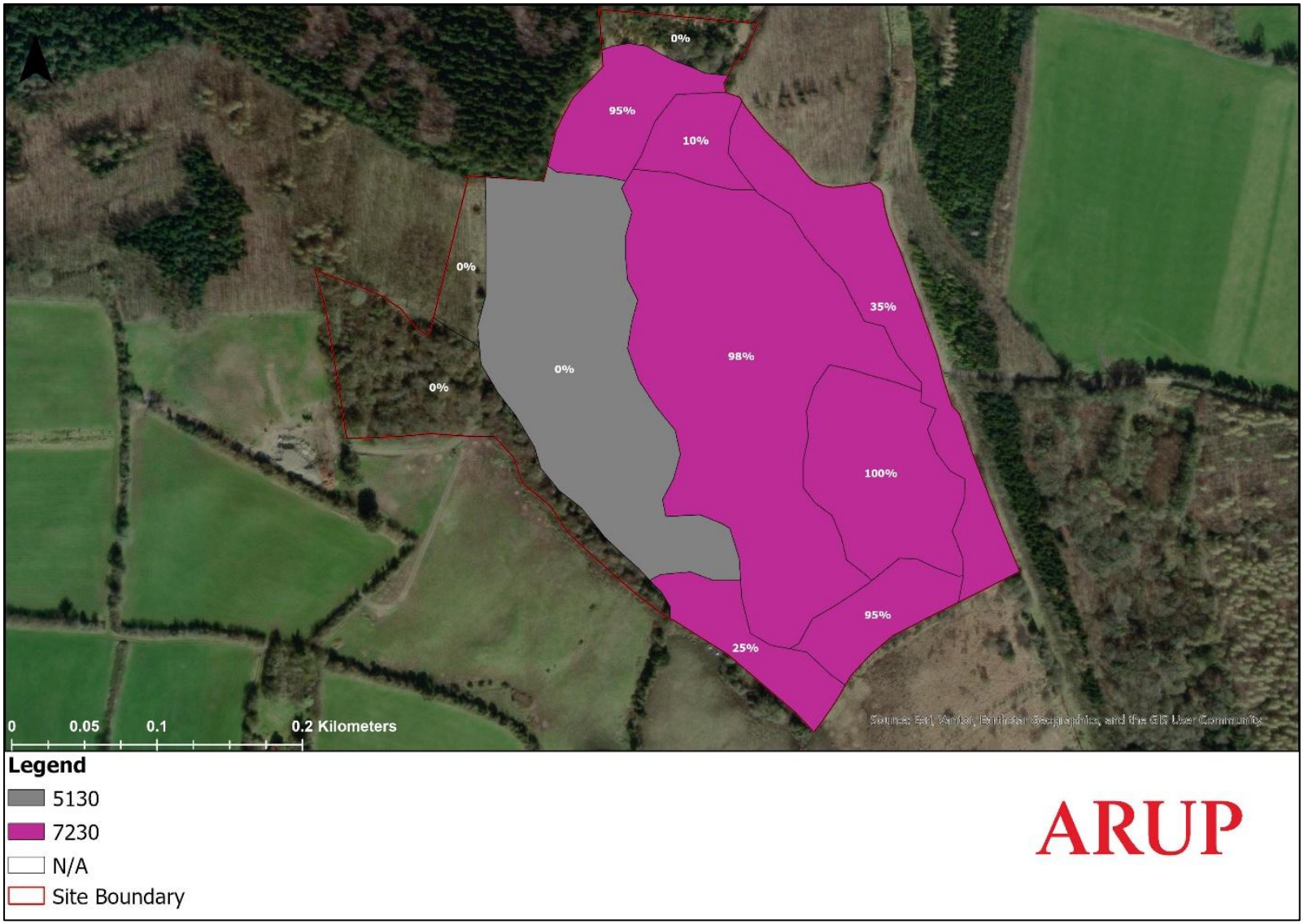


Figure 1: Site Habitat Map

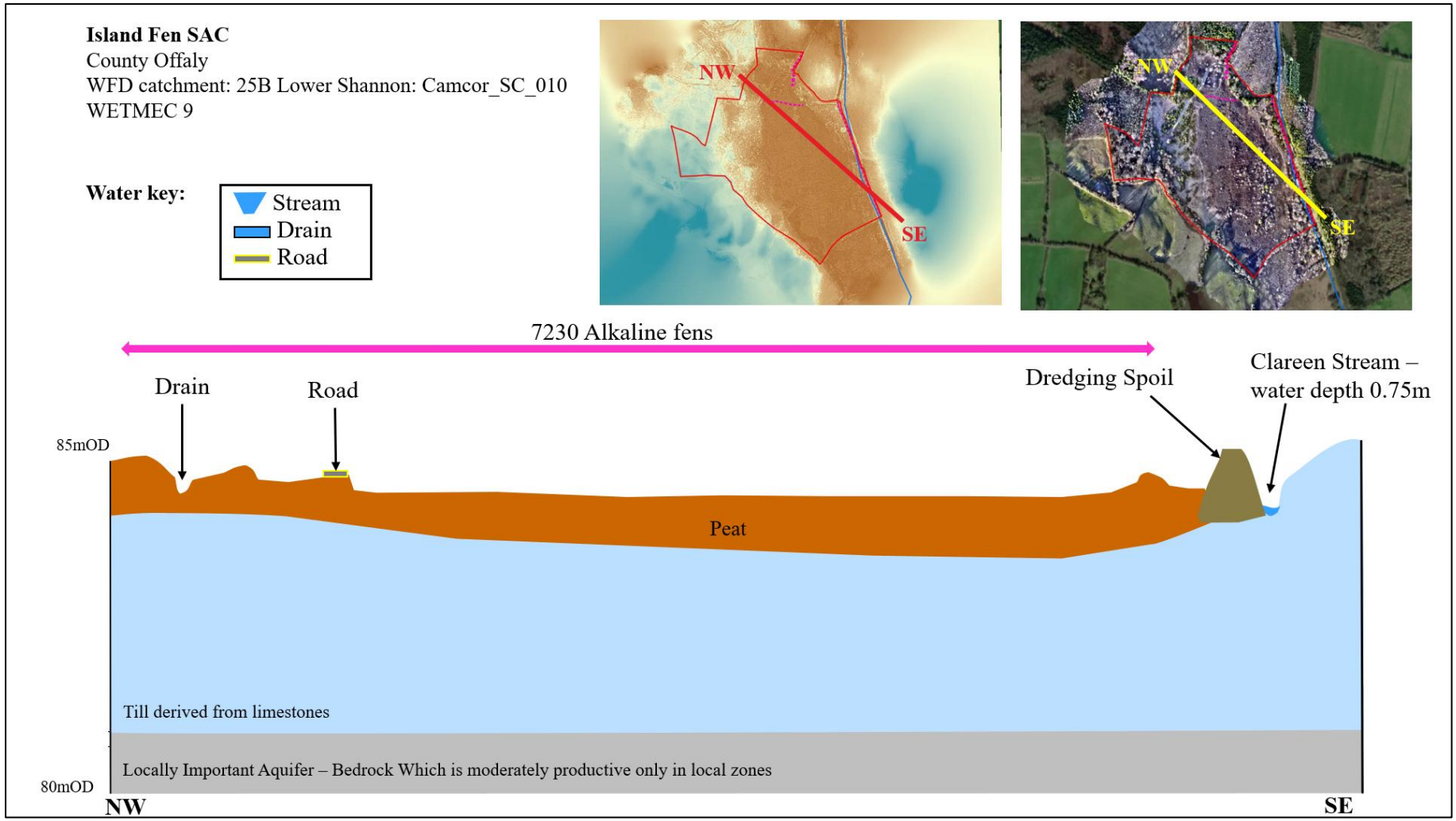


Figure 2: Conceptual Site Model

Appendix B – Ecological Survey Maps

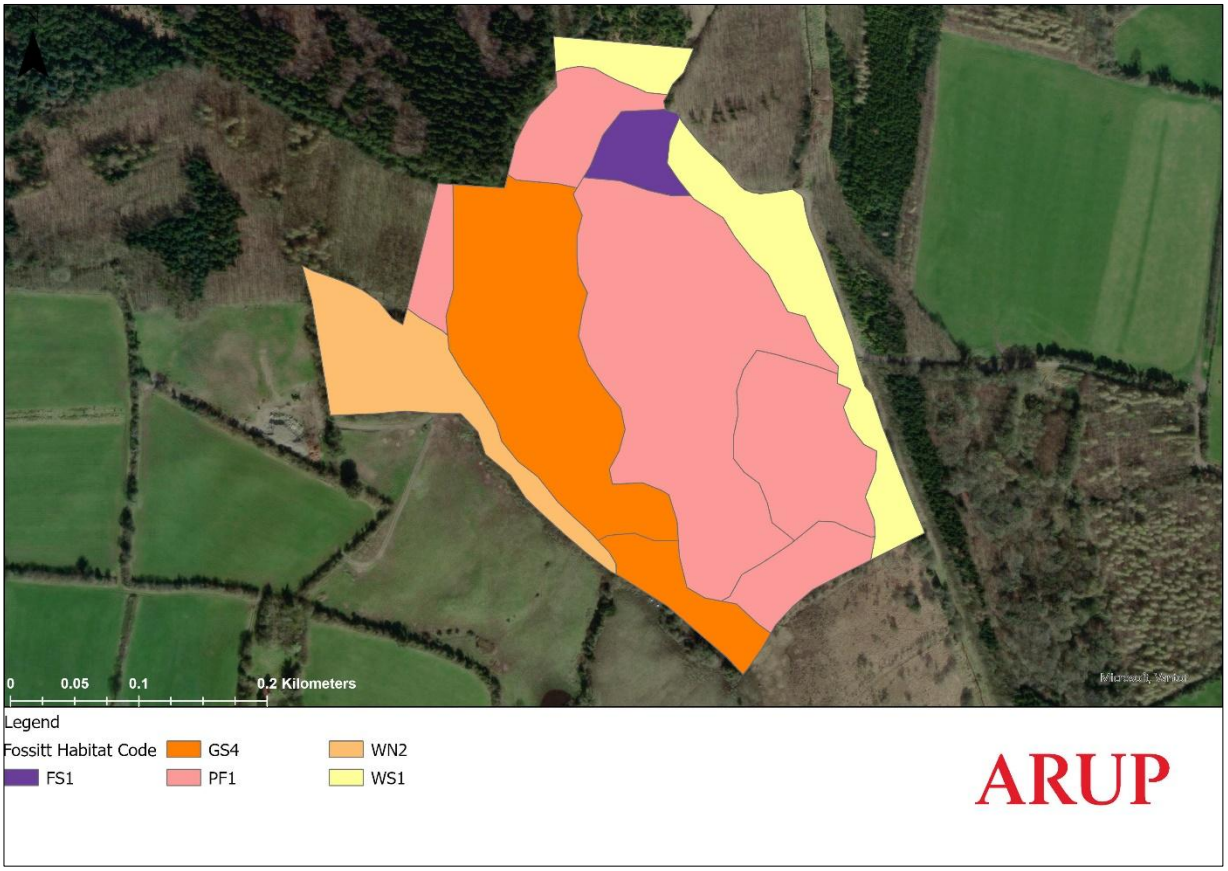


Figure 9-1: Habitats recorded during the 2022 NFS and classified according to the Fossitt Habitat Classification system. See Table 9-1 for full list of habitat names and corresponding codes.

Table 9-1: Annex I habitats and Fossitt habitat code directory.

Annex I habitat code	Annex I habitat name	Fossitt Habitat Code	Fossitt Habitat Name
3110	Oligotrophic Isoetid lake habitat	FL1	Dystrophic lakes
3130	Slender Naiad-type lakes	FL2	Acid oligotrophic lakes
3140	Hard-water lakes	FL3	Limestone/marl lakes
3150	Rich pondweed lake habitat	FL4	Mesotrophic lakes
3160	Acid oligotrophic lakes	FL5	Eutrophic lakes
3180	Turloughs	FL6	Turloughs
3260	Vegetation of flowing waters	FL7	Reservoirs
3270	Chenopodion rubri	FL8	Other artificial lakes and ponds
4010	Wet heaths	FW1	Eroding/upland rivers
4030	Dry heaths	FW2	Depositing/lowland rivers
4060	Alpine and subalpine heath	FW3	Canals
5130	Juniper scrub	FW4	Drainage ditches
6130	Calaminarian grasslands	FP1	Calcareous springs
6210	Orchid-rich calcareous grassland	FP2	Non-calcareous springs
6230	Species-rich Nardus grassland	FS1	Reed and large sedge swamps
6410	Molinia meadows	FS2	Tall-herb swamps
6430	Hydrophilous tall-herb swamp	GA1	Improved agricultural grassland
6510	Hay meadows	GA2	Amenity grassland (improved)
7110	Raised bog (active)	GS1	Dry calcareous and neutral grassland
7120	Degraded raised bogs	GS2	Dry meadows and grassy verges
7130	Blanket bog (active)	GS3	Dry-humid acid grassland
7140	Transition mires	GS4	Wet grassland
7150	Rhynchosporion depressions	GM1	Marsh
7210	Cladium fens	HH1	Dry siliceous heath
7220	Petrifying springs	HH2	Dry calcareous heath
7230	Alkaline fens	HH3	Wet heath
8110	Siliceous scree	HH4	Montane heath

Annex I habitat code	Annex I habitat name	Fossitt Habitat Code	Fossitt Habitat Name
8120	Calcareous scree	HD1	Dense bracken
8210	Calcareous rocky slopes	PB1	Raised bog
8220	Siliceous rocky slopes	PB2	Upland blanket bog
8240	Limestone pavement	PB3	Lowland blanket bog
8310	Caves	PB4	Cutover bog
8330	Sea caves	PB5	Eroding blanket bog
91A0	Old oak woodland	PF1	Rich fen and flush
91D0	Bog woodland	PF2	Poor fen and flush
91E0	Alluvial woodland	PF3	Transition mire and quaking bog
91J0	Yew woodland	WN1	Oak-birch-holly woodland
		WN2	Oak-ash-hazel woodland
		WN3	Yew woodland
		WN4	Wet pedunculate oak-ash woodland
		WN5	Riparian woodland
		WN6	Wet willow-alder-ash woodland
		WN7	Bog woodland
		WD1	(Mixed) broadleaved woodland
		WD2	Mixed broadleaved/conifer woodland
		WD3	(Mixed) conifer woodland
		WD4	Conifer plantation
		WD5	Scattered trees and parkland
		WS1	Scrub
		WS2	Immature woodland
		WS3	Ornamental/non-native shrub
		WS4	Short rotation coppice
		WS5	Recently-felled woodland
		WL1	Hedgerows
		WL2	Treelines
		ER1	Exposed siliceous rock
		ER2	Exposed calcareous rock
		ER3	Siliceous scree and loose rock
		ER4	Calcareous scree and loose rock

Annex I habitat code	Annex I habitat name	Fossitt Habitat Code	Fossitt Habitat Name
		EU1	Non-marine caves
		EU2	Artificial underground habitats
		ED1	Exposed sand, gravel or till
		ED2	Spoil and bare ground
		ED3	Recolonising bare ground
		ED4	Active quarries and mines
		ED5	Refuse and other waste
		BC1	Arable crops
		BC2	Horticultural land
		BC3	Tilled land
		BC4	Flower beds and borders
		BL1	Stone walls and other stonework
		BL2	Earth banks
		BL3	Buildings and artificial surfaces

Appendix C – Restoration Measures and Monitoring

Table 9-2: Long-term monitoring points for fen restoration at Island Fen SAC

Point	Measure	Objective	Timeframe	Frequency of monitoring
Gw_1	Hydrological	Groundwater levels and quality monitoring	Long-term	Quarterly for year 1 Annual for year 2-5
Gw_2				
Gw_3				
Gw_4				
Gw_5				
Sw_1		Monitoring of surface water levels and quality	Long-term	Quarterly for year 1 Annual for year 2-5
Sw_2				
Ec_1	Ecological	Monitoring within areas of 7230 Alkaline fens	Long-term	Seasonal for year 1 Every 3 years for year 2-5
Ec_2				
Ec_3				
Ec_4				

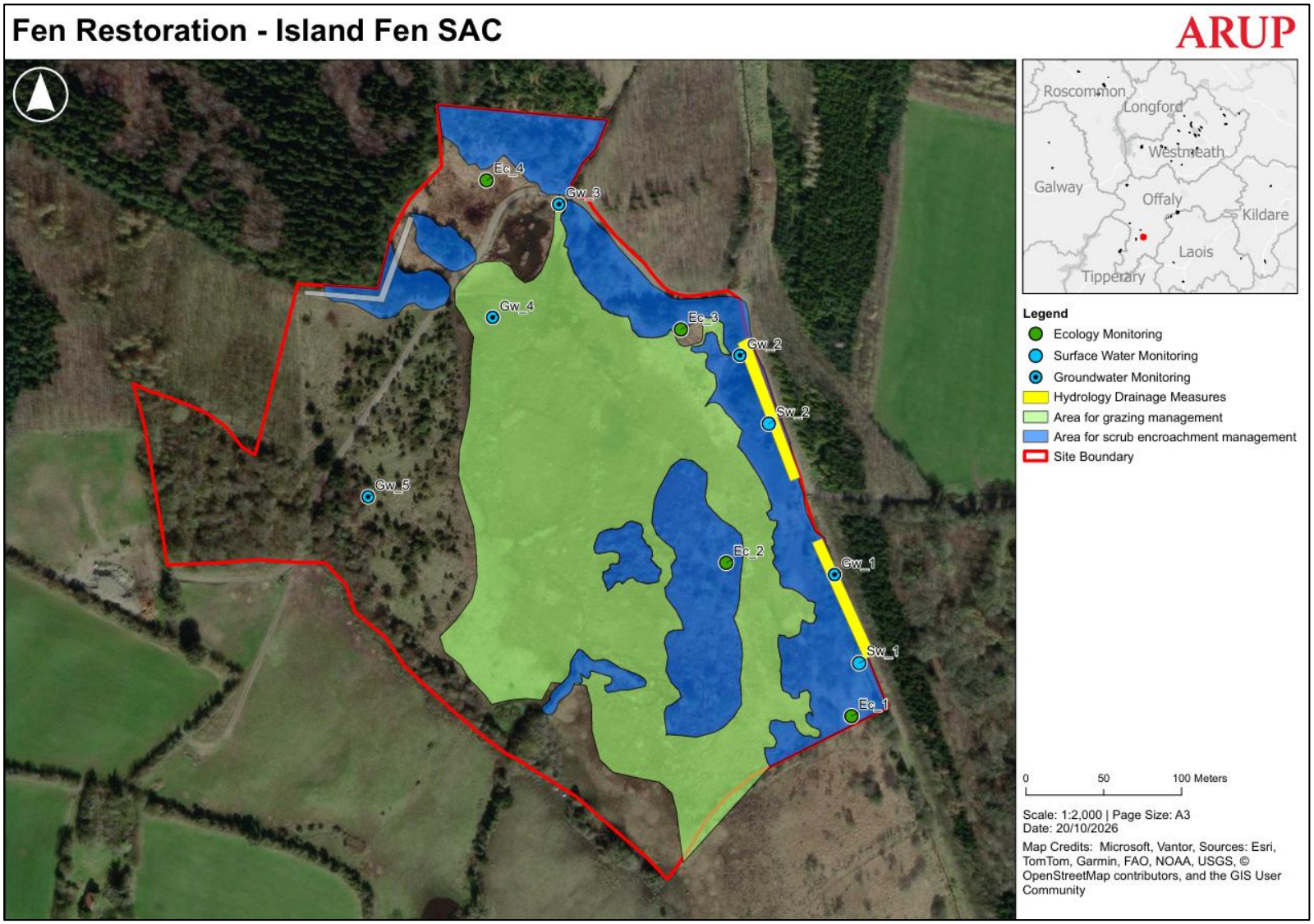


Figure 9-2: Proposed restoration measures and monitoring for Lisduff Fen SAC

Appendix D – Drainage Management Plan

NPWS Tóchar Midlands Wetland Restoration Scheme Fen Restoration Plan: Drainage Management Plan			
Site name	Island Fen SAC		
County	Offaly	NFS site No.	107007
Catchment overview:			
The site is located within the 25 Lower Shannon WFD Catchment and the Camcor_010 WFD Sub-catchment. The Clareen Stream/Fuarawn_020 (IE_SH_25C130600) drains the site in a north-westerly direction towards the River Shannon. This waterbody is assigned a Moderate WFD Status and is considered at risk of failing to achieve its WFD objectives. The site is generally flat, with ground elevations of approximately 86 mOD. Higher ground occurs immediately east of the site boundary, reaching elevations of approximately 127 mOD. The mapped drainage network is presented in Figure 1.			
WFD catchment	25B Lower Shannon	WFD Sub-catchment	Camcor_SC_010
Drainage Area	None	Drainage District	None
Responsible authority	None	Maintenance date	TBD
Surrounding landowners	Landowners and Forestry		
Wetland drainage			
Historical maps indicate that the area is associated with wet vegetation and shows the Clareen stream running from the south to north along the eastern perimeter of the site. A drain is also seen dispersing from the stream to the northwest. No springs or wells are seen.			
Surface water inflow	Clareen stream from the south	Surface water outflow	Clareen stream from the north
Groundwater inflow			
Internal drains	Field drains are located in the northwest and northeast of the site	Perimeter drains	Along the eastern boundary (Clareen stream)
On site hydrology measures			
On-site measure	Drain Blocking at multiple areas across the site Hydrological Monitoring	Role player	NPWS
Off-site hydrology measures			
Off-site measure	Engagement with landowners to avoid digging new drains	Role player	Surrounding landowners
On-site nutrient measures			
On-site measure	Buffer in the northeast site to reduce nutrient runoff	Role player	NPWS

NPWS Tóchar Midlands Wetland Restoration Scheme Fen Restoration Plan: Drainage Management Plan					
Water Monitoring					
Groundwater and surface water monitoring in a network of piezometers and standpipes at key locations within the site to monitor changes to water in order to establish if onsite measures area required such as drain blocking (Figure 2).					
Indicator	Water level	Location	Various locations across site	Role players	NPWS
A hydrological monitoring programme will be implemented, including the installation of piezometers and the use of existing piezometers. The network will include a transect of five piezometers located across the northeastern, northwestern and eastern part of the fen. The water level dynamics will be monitored by level loggers installed in the piezometers. Surface water monitoring will form part of the monitoring programme and will be undertaken at locations along the outflow and inflow drain. The monitoring data will be used to assess changes in drain water levels and evaluate the effectiveness of the proposed drain-blocking measures in raising water levels within the site. Rainfall and evaporation monitoring is proposed using the nearby Met Eireann weather station at Mullingar.					



Figure 1: Mapped drainage network at Island Fen

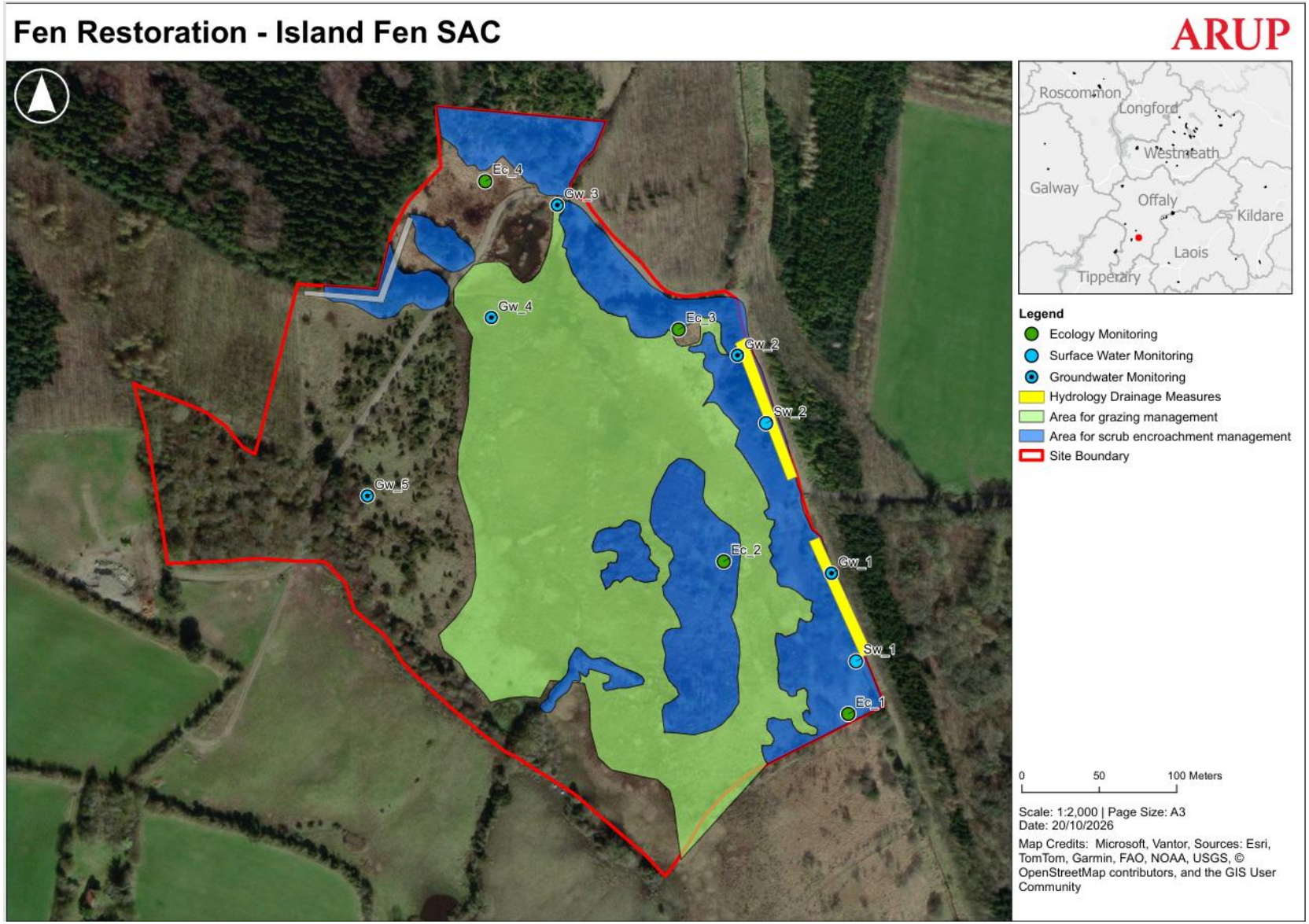


Figure 2: Hydrology measures and monitoring at Island Fen