APPENDIX 6

CHAPTER 8 HYDROLOGY AND HYDROGEOLOGY, REIAR

8. HYDROLOGY AND HYDROGEOLOGY

8.1 Introduction

8.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO Ireland (MKO) to provide a description and assessment of the residual direct and indirect effects of the peat extraction and ancillary activities at Lemanaghan Bog (the 'Application Site') on the water aspects (hydrology and hydrogeology) of the receiving environment, from 1988 to the present day. This chapter will also assess the potential effects of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan for the Application Site following the cessation of peat extraction in June 2020. As stated in Chapter 4 Description of the Development, July 1988 is the baseline environment as this is the year in which the EIA (Directive 85/337/EEC) Directive was required to be transposed into Irish Law. There is no legal requirement to complete a rEIAR on any of the activities occurring at the Application Site prior to the required transposition of this Directive. Nevertheless for completion, we provide a brief overview of the activities occurring at the Application Site from 1950 and the onset of site preparation works up to July 1988. The baseline hydrological and hydrogeological (water) environment in July 1988 is then described in detail along with a description of the description of activities from July 1988 to the cessation of peat extraction in June 2020, the management of the Application Site since June 2020 and the activities intended to be carried out at the Application Site into the future.

This chapter presents:

- An assessment of effects of the peat extraction and ancillary activities on the hydrological and hydrogeological environment (water environment);
- The baseline sensitivity of the receiving hydrological and hydrogeological environment has been assessed based on the baseline site conditions present in July 1988;
- The effects of the receiving hydrological and hydrogeological environment have been assessed over 3 no. phases of the life cycle of the Project. These phases include the Peat Extraction Phase (July 1988 – June 2020), the Current Phase (June 2020 – present day) and the Remedial Phase as described in Section 4.2.1 of Chapter 4 Description of the Development;
- The monitoring and control measures that were implemented during the Peat Extraction Phase from July 1988 to June 2020;
- The monitoring and control measures during the Current Phase (June 2020 to the present day);
- The proposed mitigation measures associated with the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan (Remedial Phase); and,
- The residual effects along with the cumulative effects from the proposed Lemanaghan Wind Farm development and other relevant projects in the vicinity of the Application Site.

8.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience include bog hydrology and windfarm drainage design. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types.

This chapter of the rEIAR was prepared by Michael Gill, Conor McGettigan and Nitesh Dalal.

Michael Gill (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 22 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. For example, Michael has worked on the EIARs for Oweninny WF, Cloncreen WF, and Yellow River WF, and over 120 other wind farm related projects across the country. Michael has also worked on rEIARs for Cleanrath WF, 41 no. Bord na Móna bogs, the Ballivor Bog Group, and also for a number of quarry sites.

Conor McGettigan (BSc, MSc) is an Environmental Scientist with 4 years' experience in the environmental sector in Ireland. Conor holds an M.Sc. in Applied Environmental Science (2020) and a B.Sc. in Geology (2016) from University College Dublin. Conor routinely prepares the land, soils and geology chapters of environmental impact assessment reports for developments on peatlands.). Conor assisted in the preparation of the land, soils and geology chapter of the rEIAR completed for the substitute consent application for the peat extraction activities at the Ballivor Bog Group.

Nitesh Dalal (B.Tech, PG Dip., MSc) is an Environmental Scientist with over 7 years' experience in environmental consultancy and environmental management in India. Nitesh holds a M.Sc. in Environmental Science from University College Dublin (2024), a PG Diploma in Health, Safety and Environment from Annamalai University, India (2021) and B.Tech. in Environmental Engineering (2016) from Guru Gobind Singh Indraprastha University, India (2016).

8.1.3 Scoping and Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Section 2.4 of Chapter 2 Background of the rEIAR. Details of these scoping responses pertaining to hydrology and hydrogeology are listed below and outlined in Chapter 2 of this rEIAR.

Inland Fisheries Ireland

A scoping request was issued to Inland Fisheries Ireland (IFI) on 30th August 2022 and a follow up was issued on the 21st June 2024. An acknowledgement of these requests were issued on the same dates. To date no responses have been received.

Geological Survey of Ireland

A scoping request was sent to the Geological Survey of Ireland (GSI) on the 30th August 2022 and again on the 21st June 2024. A response was received on the 7th September 2022 which was reconfirmed on the 7th July 2024, that comprised the following:

- List of relevant available datasets;
- Recommend referring to GSI Groundwater and Geothermal Unit run GW Climate project which is a groundwater monitoring and modelling project that aims to investigate the impact of climate change on groundwater in Ireland. This is a follow on from a previous project (GWFlood); and,
- Requested copy of reports detailing any site investigations carried out.

Environmental Protection Agency

A scoping request was issued to the Environmental Protection Agency (EPA) on 30th August 2022 and again on the 21st of June 2024. A response was received on 7th October 2022, which comprised of the following:

- The EPA presented guidance for the write-up of the rEIAR; and
- Attached a copy of the response from the Health Service Executive (see below).

Health Service Executive

A scoping request was issued to the Health Service Executive (HSE) on 30th August 2022 and again on the 21st of June 2024. The scoping response included the following items relevant to this assessment:

- Impacts on Population and Human Health should be considered.

Note that the effects on human health with respect to the water environment have been addressed in this rEIAR Chapter 8 Hydrology and Hydrogeology in Section 8.6.6.

Uisce Éireann

A scoping request was issued to Uisce Éireann on the 30th August 2022 and again on the 21st June 2024. An acknowledgement of the request was issued on the same dates. To date a scoping response has not been received.

Waterways Ireland

A scoping request was issued to Waterways Ireland on the 30th August 2022 and again on the 21st June 2024. To date a scoping response has not been received.

National Parks and Wildlife Service

A scoping request was issued to the National Parks and Wildlife Service (NPWS) on the 30th August 2022 and again on the 21st June 2024. To date a scoping response has not been received.

Offaly County Council

A scoping request was issued to Offaly County Council on the 30th August 2022 and again on the 21st June 2024. To date a scoping response has not been received.

8.1.4 Relevant Legislation

- The rEIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.
- The requirements of the following legislation are also complied with:
- Planning and Development Acts, 2000 (as amended);
- Planning and Development Regulations, 2001 (as amended);
- S.I. No. 477/2011: European Communities (Birds and Natural Habitats) Regulations, implementing EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and Directive 2009/147/EC on the conservation of wild birds (the Birds Directive);

- S.I. No. 293/1988: Quality of Salmon Water Regulations;
- Water Framework Directive (2000/60/EC) (as amended by Decision No. 2455/2011/EC; Directive 2008/32/EC; Directive 2008/105/EC; Directive 2009/31/EC; Directive 2013/39/EU; Council Directive 2013/64/EU; and Commission Directive 2014/101/EU ("WFD").
- S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722/2003 European Communities (Water Policy) Regulations, as amended, which implement EU Water Framework Directive (2000/60/EC) and provide for the implementation of 'daughter' Groundwater Directive (2006/118/EC);
- S.I. No. 122/2014: European Union (Drinking Water) Regulations, arising from EU Directive 98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and WFD 2000/60/EC (the Water Framework Directive);
- S.I. No. 684/2007: Waste Water Discharge (Authorisation) Regulations;
- S.I. No. 9/2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended;
- S.I. No. 296/2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended; and,
- S.I. No. 99/2023: European Union (Drinking Water) Regulations.

8.1.5 Relevant Guidance

The Chapter 8 of the rEIAR is carried out in accordance with the guidance contained in the following:

- Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- European Commission (2017): Environmental impact assessment of projects – Guidance on the preparation of the environmental impact assessment report (Directive 2011/90/EU as amended by 2014/52/EU);
- Environmental Protection Agency (2022): Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (2006): Environmental Management in the Extractive Industry;
- Institute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);
- Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2001;
- OPW (2009): The Planning System and Flood Risk Management;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018); and,
- Offaly County Council (2021): Offaly County Development Plan (2021-2027).

8.2 Methodology

8.2.1 Desk Study

A desk study of the Application Site and the surrounding area was completed in early 2021 to collect all relevant hydrological and hydrogeological data. The initial desk study was completed in advance of site walkover surveys and site investigations. The desk study was checked and updated, where necessary, in April and May 2025. The desk study included consultation with the following data sources:

- Integrated Pollution Control Licence (IPC) Boora Bog Group (Ref: P0500-01) Environmental Protection Agency, Appendix 4-1;
- Bord na Móna Lemanaghan Bog (Kilnagoolny) Draft Cutaway Decommissioning and Rehabilitation Plan (2024), Appendix 4-2;
- Annual Environmental Reports 2000-2024 (Appendix 4-3);
- IPC Licence P0500-01 Application (Available at EPA Headquarters on request);
- Inspection of production records at Lemanaghan Works;
- Aerial Maps from 1973 to 2020, Appendix 4-4;
- Environmental Protection Agency databases (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks and Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive "catchments.ie" Map Viewer (www.catchments.ie), including all relevant River Basin Management Plans (RBMPs);
- Bedrock Geology 1:100,000 Scale Map Series, Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports;
- OPW Flood Mapping Databases (www.floodinfo.ie);
- Environmental Protection Agency – "Hydrotool" Map Viewer (www.epa.ie);
- Aerial Photography, 1@5,000 and 6" base mapping; and,
- Myplan.ie: National Planning Applications Map Viewer (https://myplan.ie/national-planning-application-map-viewer).

8.2.2 Monitoring and Site Investigation Data

HES completed site inspections, walkover surveys, drainage mapping, and baseline monitoring/sampling at the Application Site as part of this remedial Environmental Impact Assessment (rEIAR) and to inform the proposed Lemanaghan Wind Farm planning application. These site investigations comprised of peat probing and drainage mapping completed by HES on 8th July 2021, 1st and 7th August 2024 and 17th April 2025. Surface water sampling and field hydrochemistry was completed on 7th August 2024 and 17th April 2025 in the watercourses draining the Application Site.

In addition to the site investigations completed by HES, several additional site investigations have been completed at the Application Site to further inform this rEIAR and the proposed Lemanaghan Wind Farm application. These site investigations included peat probing investigations completed by MKO on 24th September and 31st October 2024, and 5th February 2025. Fehily Timoney and Company (FTC) completed walkover surveys and peat probing investigations at the Application Site on the 7th September 2022. In addition, 3 no. phases of trial pit investigations have been completed at the Application Site by FTC (6th to 9th April 2021) and Irish Drilling Ltd (23rd to 28th March 2022, and 24th to 26th October 2023). IDL also drilled 10 no. boreholes at the Application Site between 8th and 24th November 2023.

In summary, site investigations completed to address the hydrology and hydrogeology chapter of this rEIAR included the following:

- Detailed walkover surveys and hydrological mapping of the Application Site and the surrounding area were undertaken whereby water flow directions and drainage patterns were recorded;
- A total of 722 no. peat probes have been completed at the Application Site by HES, MKO and FTC;
- Logging of subsoil exposures across the Application Site where mineral soils and peat profiles are exposed;
- Ground investigations completed by FTC and IDL comprising of 63 no. trial pits and 10 no. boreholes;
  - Field hydrochemistry measurements (electrical conductivity, pH, dissolved oxygen and temperature) and surface water flow measurements were taken to determine the origin and nature of surface water flows surrounding the Application Site during 2 no. monitoring rounds (7th August 2024 and 17th April 205); and,
  - A total of 18 no. surface water grab samples were taken to determine the baseline water quality of the primary surface waters originating from the Application Site during the 2 no. monitoring rounds.
  - Site-specific data obtained by HES was supplemented with recent and historic site-specific data supplied by the Applicant. These included Lidar data of the Application Site and water quality monitoring from 2000 to 2024 in compliance with the IPC Licence requirements.

8.2.3 Impact Assessment Methodology

The EPA Guidelines (EPA, 2022) for the assessment of likely significant effects require that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transfrontier nature (if applicable). The descriptors used in this environmental impact assessment are those set out in the EPA (2022) Glossary of effects as shown in Chapter 1 Introduction of this rEIAR.

In addition to the above methodology, the importance of the water environment receptors was assessed on completion of the desk study and site investigations. Levels of importance which are defined in Table 8-1 and Table 8-2 for the hydrological and hydrogeological environments are used to assess the effects that peat extraction may have had on them.

Table 8-1: Estimation of Importance of Hydrology Criteria (NRA, 2008)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation, e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Quality Class A (Biotic Index Q4, Q5). Flood plain protecting more than 50 residential or commercial properties from flooding. Nationally important amenity site for a wide range of leisure activities.

Importance	Criteria	Typical Example
High	Attribute has a high quality or value on a local scale	Salmon fishery locally important potable water source supplying >1000 homes. Quality Class B (Biotic Index Q3-4). Flood plain protecting between 5 and 50 residential or commercial properties from flooding.
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery. Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2-3). Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities. Local potable water source supplying <50 homes. Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding. Amenity site used by small numbers of local people.

Table 8-2: Estimation of Importance of Hydrogeology Criteria (NRA, 2008)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation, e.g. SAC or SPA status.
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation - NHA status. Regionally important potable water source supplying >2500 homes Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer Groundwater provides a large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer. Potable water source supplying >50 homes. Outer source protection area for locally important water source.

Importance	Criteria	Typical Example
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer Potable water source supplying <50 homes.

8.2.4 Overview of Impact Assessment Process

The conventional source-pathway-target model (see Figure 8-1below, top) was applied to assess the potential effects on downstream environmental receptors (see Figure 8-1 below, bottom as an example, earthworks - peat extraction) as a result of the peat extraction and ancillary activities.

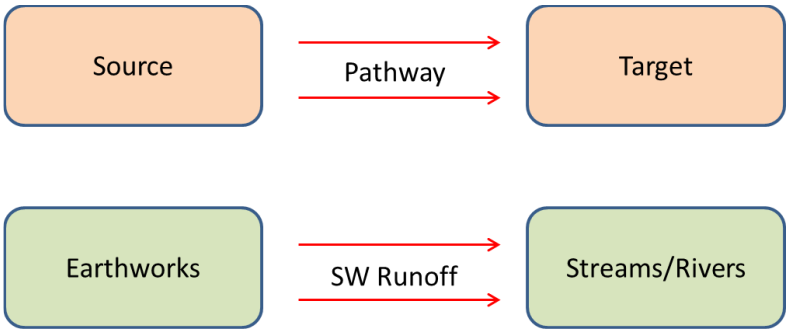

Figure 8-1: Conventional Source-Pathway-Target Model

The descriptors used in this environmental impact assessment are those set out in the EPA (2022) Glossary of effects as shown in Table 1-2 of Chapter 1 of this rEIAR. The description process clearly and consistently identifies the key aspects of any remedial impact source, namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

8.2.5 Study Area

The study area for the hydrological environment (surface water) is delineated by the surface water catchments within which the Application Site is located. The regional surface water catchments and sub-catchments within which the Application Site is located are detailed in Section 8.4.2.

The study area for the hydrogeological environment (groundwater) is delineated by the bedrock aquifers and groundwater bodies which are mapped beneath the Application Site. These bedrock aquifers and groundwater bodies are detailed in Section 8.4.7.

8.2.6 Limitations and Difficulties Encountered

Drainage works for peat extraction commenced at its earliest at the Application Site in 1950. The retrospective impact assessment has been carried out based on the reasonable availability of information relating to the peat extraction and ancillary activities. The retrospective assessment has been limited by the availability, completeness, accuracy and accessibility of historical baseline environmental data.

8.3 Site Land Use History Summary

The Application Site is a large bog which forms part of the Boora Bog Group. The Application Site comprises an area of 1,111 hectares (ha) within which bog drainage works began in 1950 followed by the commencement of peat extraction in 1960. The Application Site is located in County Offaly, 3km to the northeast of Ferbane, 7.8km southwest of Clara, and 8.7km south of Moate. The Application Site extends across several townlands which are listed below in Table 1-1 of Chapter 1. The Application Site

measures approximately 5.5km in length from north to south, and approximately 6.6km from east to west, at its widest point. Grid Reference co-ordinates for the approximate centre of the Application Site are E216096, N228101 (Irish National Grid Coordinates).

The Application Site is connected by rail link to the Bellair South Bog to the north and to the Blackwater Bog Group to the west. The R436 Regional Road passes along much of the southern boundary of the Application Site. Derrynagun and Curraghalassa bogs are both located south of the road R436. The N62 National Road skirts the extreme western tip of the Application Site. The L7002 local road passes through the northern part of the site and cuts off the northernmost sector. The current main access points to the Application Site includes an existing entrance off the N62 National Road and along the R436 into the Lemanaghan Works, adjacent to the south of the Application Site.

8.3.1 Site Topography

The topography of the Application Site has changed through time due to the historic peat extraction. As discussed in Chapter 7: Land Soils and Geology the topography of the Application Site was estimated to range between 54m-79mOD prior to the onset of any peat extraction or associated site preparation works (i.e. drainage and acrotelm removal). The topography has subsequently been lowered due to drainage related subsidence and in the historic peat extraction areas due to the removal of peat. Full details are presented in Section 7.3.2 of this rEIAR.

8.3.2 Historic Land Use Changes

The primary change to land at the Application Site associated with peat extraction and ancillary activities occurred during the initial drainage of the bog and the removal of vegetation in advance of peat extraction. Drainage ditches were inserted into the surface of the bog and drained the upper surface of the bog by lowering the local peat water table (full details on the drainage implemented at the Application Site are provided in Chapter 4). At this time, ancillary features were constructed including railway lines, canteens such as that at Lemanaghan Works. After the site was drained vegetation was removed from the bog surface, leaving only bare peat fields between the drains. During peat extraction and ancillary activities before 1988, only minimal soils/land change occurred and may have involved a change in the type of peat extraction *i.e.* sod or milled peat extraction. During peat extraction minor topographic changes have occurred annually due to the removal of peat from active extraction areas. Peat extraction and ancillary activities also prevented the revegetation and rehabilitation of the bog at that time, with the bog only beginning to rehabilitate once peat extraction ceased.

Land take and any land changes at the Application Site have been investigated using available aerial imagery dating from 1973 to 2020 (i.e. the year of the cessation of peat extraction). Bord na Móna Annual Reports were also consulted to help develop the timeline of changes across the Application Site. The observed changes in land and land take at the Application Site are discussed in the following paragraphs.

The first site preparation works comprising of site drainage and the clearance of vegetation commenced at the Application Site in 1950. An aerial image from 1973 shows that a large area of approximately 409.5ha in the centre of the Application Site had been drained and was subject to peat extraction by this time. A small area (approximately 5.6ha) of the Application Site had been drained but was not subject to peat extraction. Meanwhile, the remainder of the Application Site (approximately 683.6ha) had not been drained by 1973 and would have likely still been active raised bog.

Inspection of aerial imagery and Bord na Móna records show that the vast majority (approximately 968.7ha) of the Application Site had been drained by 1988 and was subject to peat extraction. Meanwhile, an area of approximately 65.1ha in the north of the Application Site, to the north of the local road, had been drained but had not yet been subject to peat extraction. Several smaller areas around the perimeter of the Application Site had not been drained at this time (61.2ha).

By 1995 peat was also being extracted from the area in the north of the Application Site which had been drained by 1988. Aerial images from 2004 and 2020 also that the vast majority of the Application Site was subject to peat extraction during this time. Inspection of aerial imagery also shows several NE-SW strips of land, of a similar orientation to the field drains, in the southwest of the bog which were no longer subject to peat extraction. Based on site walkover surveys these areas correspond with areas of cutover bog which has begun to revegetate. Sufficient time has elapsed between the cessation of peat extraction in these areas to allow for revegetation to commence. Peat extraction ceased across the entire Application Site in June 2020, and much of the site still comprises of bare cutover peat fields.

Several small areas of bog around the perimeter of the Application Site were neither drained nor subject to peat extraction by 1988. These areas largely remained intact and have not been drained due to their peripheral location around the Application Site.

Peat extraction was formally ceased at the Application Site by Bord na Móna in June 2020. This allowed the former bare peat production fields to begin to revegetate; however, this will likely take some time and measures to aid the site rehabilitation are outlined in the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan (Appendix 4-2).

8.3.3 Existing Site Description and Topography

Corine land cover maps (2018) (www.epa.ie) show that the Application Site is predominantly comprised of 'peat bogs'. Landcover in the surrounding area is mapped as 'agricultural pastures' while small areas of 'transitional woodland scrub' are mapped along the northern and eastern boundaries of the Application Site. A small area of 'coniferous forestry' is located to the south. Meanwhile, Corine also map an area of 'land principally occupied by agriculture with significant areas of natural vegetation' in the interior of the bog, but outside of the Application Site boundary.

Current land and landcover in the Application Site was verified during site walkover surveys and from inspection of recent aerial imagery and Bord na Móna habitat mapping. Peat extraction had ceased at the Application Site by the end of June 2020. All stockpiles had been removed from the Application Site by 2024. The decommissioning works relating to the railway network within the Application Site are estimated to be completed by 2025. Land use at the Application Site now comprises primarily of bare cutaway peat with developing pioneer vegetation.

Maps of the Applicant's historic peat extraction areas (refer to Section 4.5 in Chapter 4 of the rEIAR) for 2020 indicate that 699ha was subject to peat extraction whilst peat was no longer being extracted from 354.2ha of former peat extraction fields. According to this map, the areas where peat extraction ceased, towards the south and southwest of the Application Site, corresponds with the areas which are beginning to revegetate as identified on aerial imagery.

The current topography of the Application Site is relatively flat with an elevation range of between approximately 46 and 60mOD (metres above Ordnance Datum). Topography at the Application Site has been modified through peat extraction and ancillary activities including associated drainage works. Today the highest elevations are found at headlands and remnant peat banks which create a boundary berm, forming a basin effect within the former extraction areas of the bog. These remnant peat banks and headlands provide an approximation (albeit drained and subsided) of the original ground elevations which existed across the Application Site prior to the commencement of any peat extraction and ancillary activities.

Topography across the Application Site is shown in Figure 8-2.

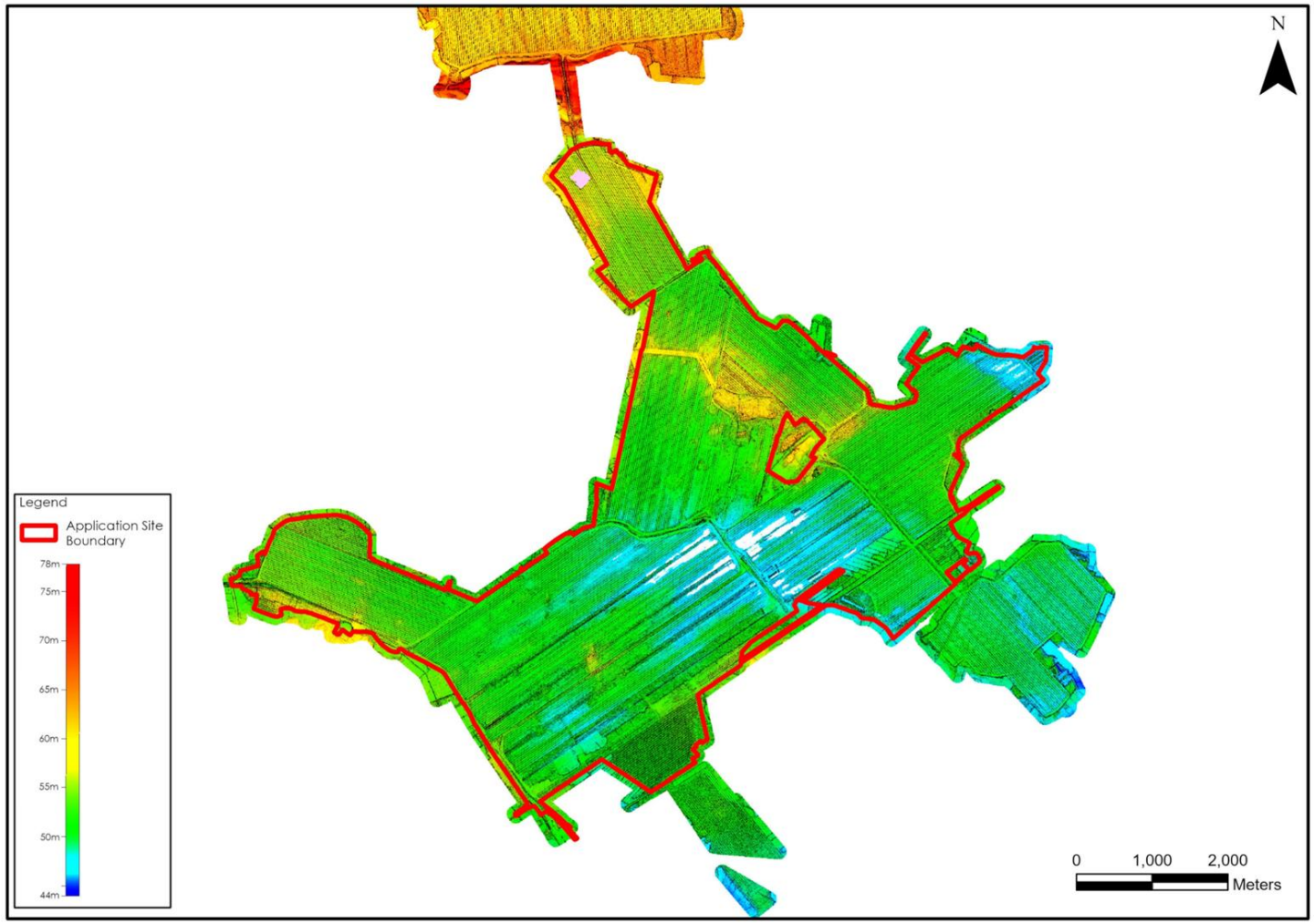

Figure 8-2: Topography across the Application Site

8.4 Establishing the 1988 Baseline Environment

8.4.1 Water Balance

Long term Average Annual Rainfall (AAR) and evaporation data were sourced Met Éireann (www.met.ie).

The closest rainfall station is located at Lemanaghan (Bord na Mona), situated immediately to the southwest of the Application Site along the R436. The data from this rainfall station indicates an AAR of 886.2mm. Met Éireann also provide a grid of AAR for the entire country for the period of 1991 to 2020. Based on this more site-specific modelled rainfall values, the 30-year AAR (1991-2020) assigned to location E216000, N228000 (at the centre of the Application Site) is 914mm/yr. The monthly modelled rainfall data for this location are presented in Table 8-3.

Table 8-3: Local Average long-term Rainfall Data (mm)

Location: Centre of Application Site						X-Coord: 216000				Y-Coord: 228000		
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
86	69	65	58	59	74	77	80	70	91	92	93	914

The closest synoptic station where the average Potential Evapotranspiration (PE) is recorded is at Birr, approximately 22km southwest of the Application Site. The long-term average PE for this station is 444.9mm/yr. This value is used as a best estimate of the site PE. Actual Evaporation (AE) at the Application Site is estimated as 422.7mm/yr (which is 0.95 × PE).

The Effective Rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the Application Site is calculated as follows:

Effective rainfall (ER) = Average Annual Rainfall (AAR) – Actual Evaporation (AE)

= 914 mm/yr – 422.7mm/yr

ER = 491.3mm/yr

Based on groundwater recharge coefficient estimates from the GSI (www.gsi.ie), the Application Site has a groundwater recharge coefficient of 4%. This means that the hydrology of the Application Site is characterised by very high surface water runoff rates and very low groundwater recharge rates. This is supported by observations made during site walkover surveys with the Application Site and the surrounding area containing a high density of surface water features (field drains and main bog drains within the Application Site and streams in the surrounding lands). Therefore, conservative annual recharge and runoff rates for the Application Site are estimated to be 19.65mm/yr and 471.65mm/yr respectively.

The water balance presented above is unlikely to have changed significantly from 1988 to the data period covered by the 1991-2020 Met Éireann data. Raised peat bogs are an excellent store of water. Pre-development when the storage capacity of the peat is reached surface water runoff will occur whereby rainwater would have moved slowly across the bog before discharging to fens and other wetland habitats at the bog margin. In the July 1988 baseline and in the present day, however, drainage channels act as preferential flowpaths which allow surface water to leave the Application Site. These channels generally have a low gradient and the on-site drainage systems have some inherent storage and attenuation, and likely release runoff water at slightly higher rates than that of pre-development times. Meanwhile, the runoff rates between the July 1988 baseline and the present day are unlikely to have changed significantly as drainage had been inserted at the Application Site by July 1998. There

may have been a very slight decrease in runoff rates due to the upgrade in silt ponds at the Application Site in the 1990s (refer to Section 8.4.4.3).

Met Éireann's Translate Project (https://www.met.ie/science/translate) provides projections for a range of future climate change scenarios, as Ireland's future climate will depend on global greenhouse gas emissions reductions. The severity of any future climate change will depend on the degree of future warming. In a 1.5°C world, average winter and summer precipitation rates are projected to be 3.08mm/day and 2.23mm/day respectively in Co. Offaly. Meanwhile, in a 4°C world, the average winter and summer precipitation rates in Co. Offaly are projected to be 3.37mm/day and 2.02mm/day respectively.

8.4.2 Regional and Local Hydrology

Regionally, the Application Site is located in a total of 3 no. surface water catchments. The vast majority of the Application Site is located in the Lower Shannon surface water catchment within Hydrometric Area 25A of the Shannon Irish River Basin District (Shannon IRBD). Meanwhile, a small area in the northwest of the Application Site is located within the Lower Shannon surface water catchment within Hydrometric Area 25B of the Shannon IRBD. Furthermore, a small section towards the north of the Application Site is located in the Upper Shannon surface water catchment within Hydrometric Area 26G of the Shannon IRBD (www.epa.ie). Therefore, all surface waters draining the Application Site will eventually discharge to the River Shannon. The River Shannon flows to the southwest approximately 10km northwest of the Application Site before veering to the southeast at Shannonbridge, approximately 15km west of the Application Site. The River Shannon then flows to the southwest, north of Banagher, approximately 17km southwest of the Application Site before eventually discharging into Lough Derg.

Within the Upper Shannon regional surface water catchment (26G), the Application Site (c. 26ha) is located in the Shannon Lower sub-catchment (Shannon[Lower]_SC_010) and the Boor_010 WFD river sub-basin. This area of the Application Site is drained by the Boor River. Within this WFD river sub-basin the EPA named the Ballynahown Stream (EPA Code: 26B17) flows to the northwest from the vicinity of the Application Site. For reference, this stream is referred to locally on the 25" basemaps and on the Discovery Series Maps as 'The Brook'. For the remainder of this rEIAR Chapter 'The Brook' will be referred to as the Ballynahown Stream for consistency with the EPA mapping. The Ballynahown Stream discharges into the Boor River (EPA Code: 26B07) approximately 6.5km northwest of the Application Site. The Boor River the continues to the west for 4.5km before it discharges into the River Shannon (EPA Code: 26S02).

Within the Lower Shannon (25B) regional surface water catchment, the Application Site (c. 41ha) is located in the Shannon Lower sub-catchment (Shannon[Lower]_SC_030) and the Blackwater(Shannonbridge)_010 WFD river sub-basin. The closest EPA mapped watercourse is the EPA named Holy Well of Clongawny Stream (EPA Code: 25H29) which flows to the northwest approximately 950m west of the Application Site and discharges into the Blackwater River (EPA Code: 25B27) approximately 3.3km northwest of the Application Site. The Blackwater River then continues to the southwest before discharging into the Lower River Shannon (EPA Code: 25S01) approximately 13.5km southwest of the Application Site and southeast of the village of Shannonbridge.

As stated above, the majority of the Application Site (c. 1043ha) is located within the Lower Shannon (25A) regional surface water catchment. On a more local scale within this catchment, the Application Site is situated in the River Brosna sub-catchment (Brosna_SC_060) and 3 no. WFD river sub-basins. The easternmost section of this area of the Application Site is located in the Brosna_100 WFD river sub-basin (83.413ha). In this area the EPA named Fortified House Castlearmstrong Stream (EPA Code: 26F69) flows southwards immediately to the east of the Application Site. This stream discharges into the Brosna River (EPA Code: 25B09) approximately1.3km to the east. Meanwhile, the majority of the Application Site (716.305ha) is located in the Lemanaghan Stream_010 WFD river sub-basin with the Lemanaghan Stream (EPA Code: 25L04) flowing southwards through the centre of the Application Site.

This stream discharges into the Brosna River approximately1.2km south of the Application Site. Within this WFD river sub-basin the EPA map another stream to flow to the southwest along the northern boundary of Derrynagun Bog. This stream, referred to by the EPA as the Lemanaghan (EPA Code: 25L72) discharges into the Lemanaghan Stream to the south of the Application Site. In addition, the west of the Application Site (243.716ha) is located in the Brosna_110 WFD river sub-basin. Here the EPA named Kilcolgan Beg Stream (EPA Code: 25Q21) flows to the south from the Application Site, passing to the west of Curraghalassa Bog discharging into the Brosna River.

Downstream of the Application Site the Brosna River then continues to flow to the west before it discharges into the Lower River Shannon approximately14.5km to the southwest. The River Shannon itself then continues to flow to the southwest before discharging into Lough Derg near Portumna.

Table 8-4 summarises the location of Application Site with respect to WFD surface water catchments, sub-catchments and WFD river sub-basin. Regional and local hydrology maps are shown as Figure 8-3 and Figure 8-4 below.

The hydrological environment described above for the present day would have been the same as the July 1988 baseline hydrological environment. However, the nomenclature of the WFD classification has only existed since 2000. Meanwhile, the rivers have existed in their current form since post glacial times.

Table 8-4: WFD Catchments, sub-catchments and river-basins and receiving waterbodies

Catchment	Sub-catchment	WFD River Sub-basin	Area of Application Site (ha)
Upper Shannon (26G)	Shannon[Lower]_SC_010	Boor_020	~26
Lower Shannon (25A)	Brosna_SC_060	Blackwater(Shannonbridge)_010	~40
Lower Shannon (25B)	Shannon[Lower]_SC_030	Brosna_100	~83
		Lemanaghan Stream_010	~718
		Brosna_110	~244

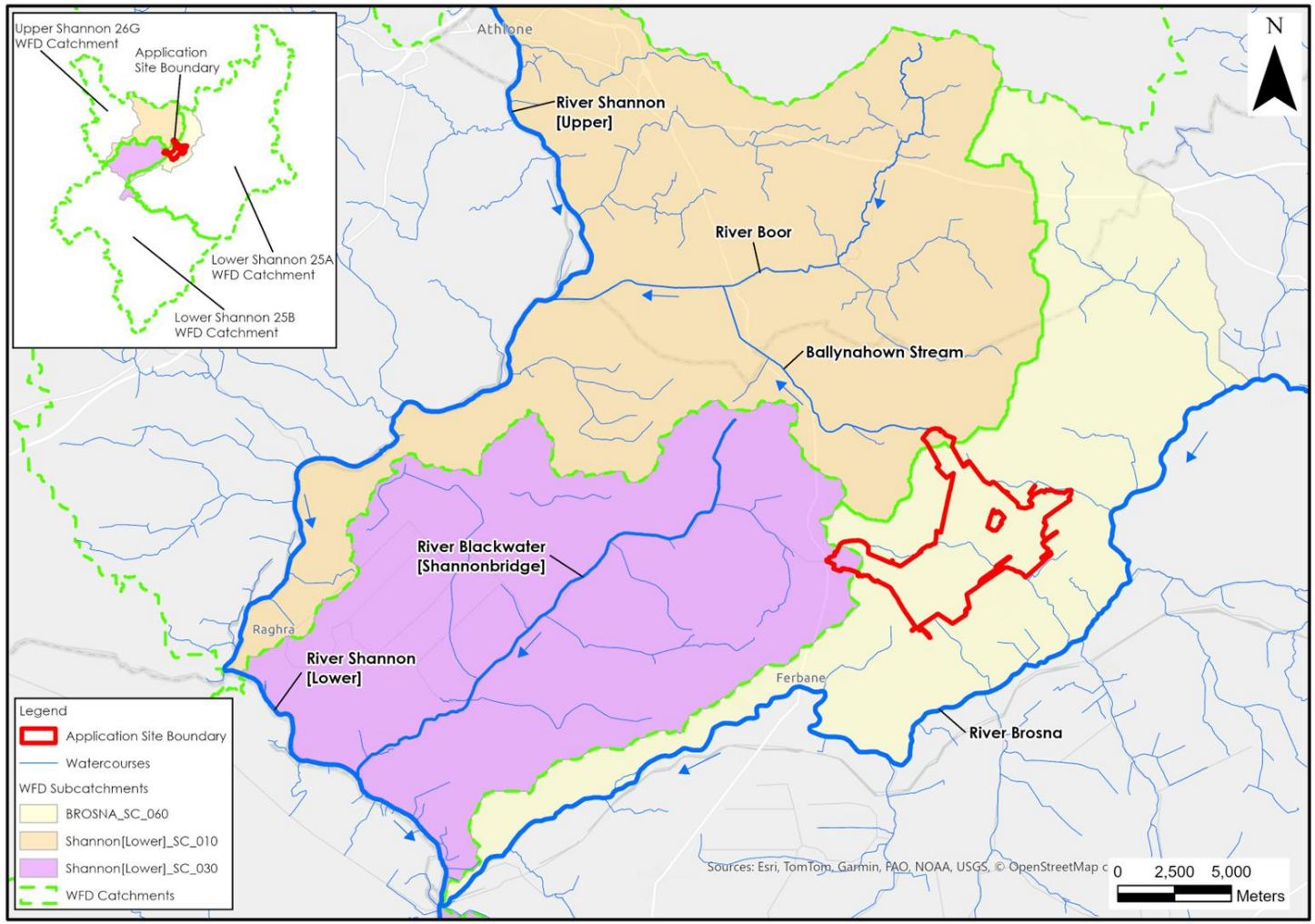

Figure 8-3: Regional Hydrology Map

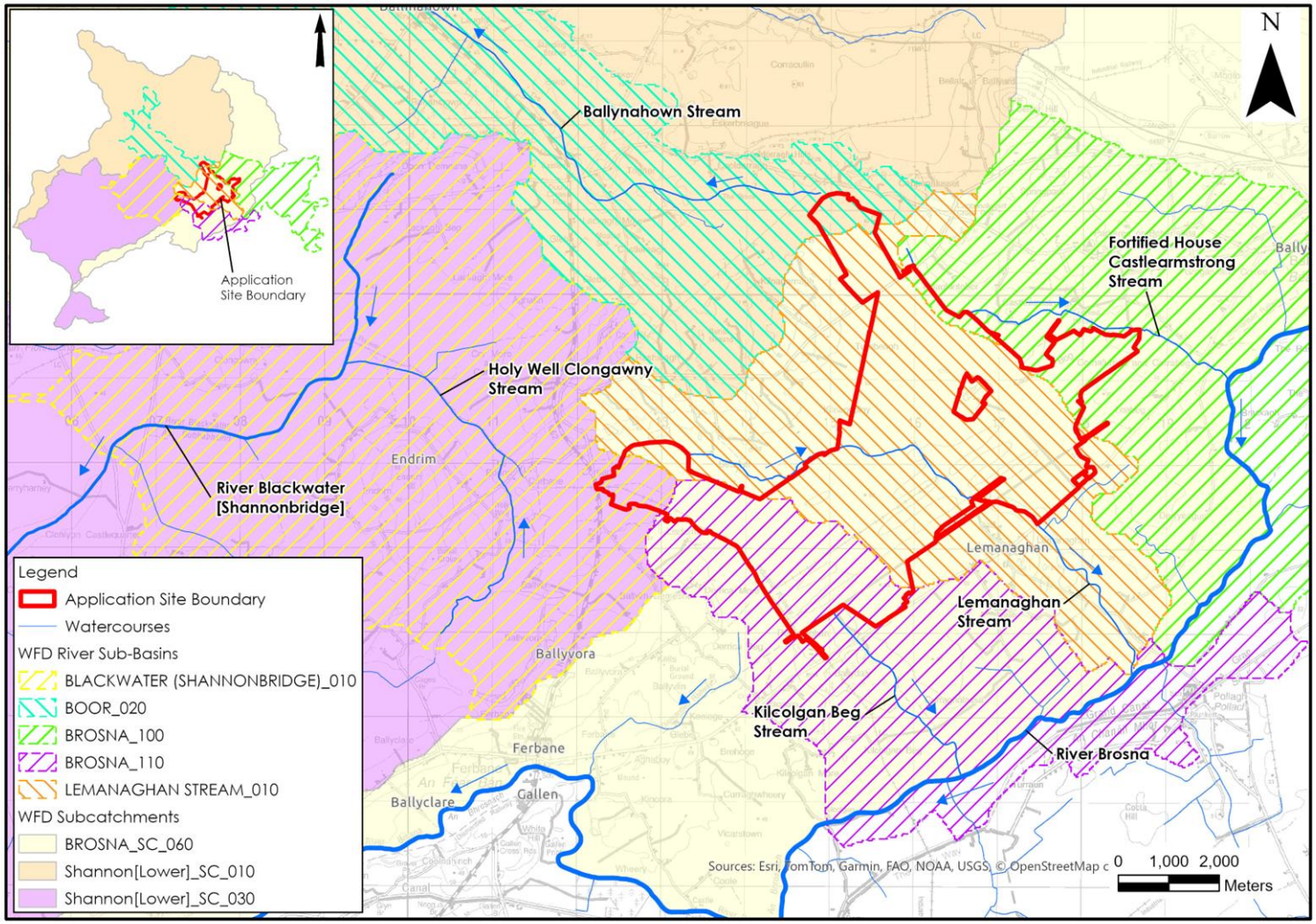

Figure 8-4: Local Hydrology Map

8.4.3 Surface Water Flows

Data on volumetric flow exceedance was acquired from OPW gauging stations (www.waterlevel.ie) for the Brosna River and the River Shannon downstream of the Application Site. No OPW gauges are located on the small 1st and 2nd order streams which drain the Application Site, or on the Blackwater or Boor rivers downstream of the Application Site. The data from the OPW includes observed flows and are displayed as exceedance flows. A 95%tile flow relates to the flow which will be exceeded within the river 95% of the time *i.e.* a 95%tile flow of $1m^3/s$ would indicate that 95% of the time, the flow in that river is at or above $1m^3/s$.

The flow volumes in the Brosna River to the south of the Application Site increase progressively downstream as more tributaries discharge into this river. For example, the 50%ile and 95%tile flows in the Brosna River at Ferbane (OPW Station Number: 25006) downstream of the Application Site are $13.309m^3/s$ and $3.877m^3/s$ respectively. The catchment area of the Brosna River at this gauging station is $1,207km^2$. Meanwhile, the 50%tile and 95%tile flows further downstream on the Brosna River at Moystown (OPW Station Number: 25011) are approximately $14.56m^3/s$ and $4.2m^3/s$ respectively. The catchment area of the Brosna River at this gauging station is $1,227km^2$.

The flow volumes increase further in the River Shannon due to its signficantly large upstream catchment. The 50%tile and 95%tile flow volumes in the River Shannon at Banagher (OPW Station Number: 25017) are $32.61m^3/s$ and $32.39m^3/s$. The catchment area of the River Shannon at Banagher is $7,989km^2$.

Given that no OPW gauging stations are located on the streams in the immediate vicinity of the Application Site, the EPA's Hydrotool database, available on www.catchments.ie, was consulted. The Hydrotool dataset contains estimates of naturalised river flow duration percentiles. The 95%tile flow at Hydrotool Node 25_3141 on the Lemanaghan Stream is estimated to be $0.057m^3/s$. The 95%tile flow at Hydrotool Node 26_4032 on the Ballynahown Stream is estimated to be $0.029m^3/s$ while the 95%tile flow on the Blackwater River at Node 25_3095 is estimated to be $0.059m^3/s$. These flow volumes are significantly smaller than those recorded by the OPW in the Brosna River and in the River Shannon.

The Hydrotool data is presented alongisde the OPW recorded flow volumes in Figure 8-5. The location of the OPW gauging stations and the consulted Hydrotool Nodes are shown in Figure 8-4 above.

Meanwhile, the flow volumes at the bog outfalls in the immediate vicnity of the Application Site range from 0.01 – $0.1m^3/s$. Therefore, based on the above, the waterbodies in the vicinity of the Application Site, with smaller flow volumes, would have had the greatest potential to be impacted by peat extraction and ancillary activities. The potential for effects decreases progressively downstream due to the dilution effect associated with increasing flow volumes and larger upstream catchment areas.

The hydrological environment described above, in terms of surface water flow volumes and flow variations in response to rainfall events, for the present day would have been the same as the July 1988 baseline hydrological environment.

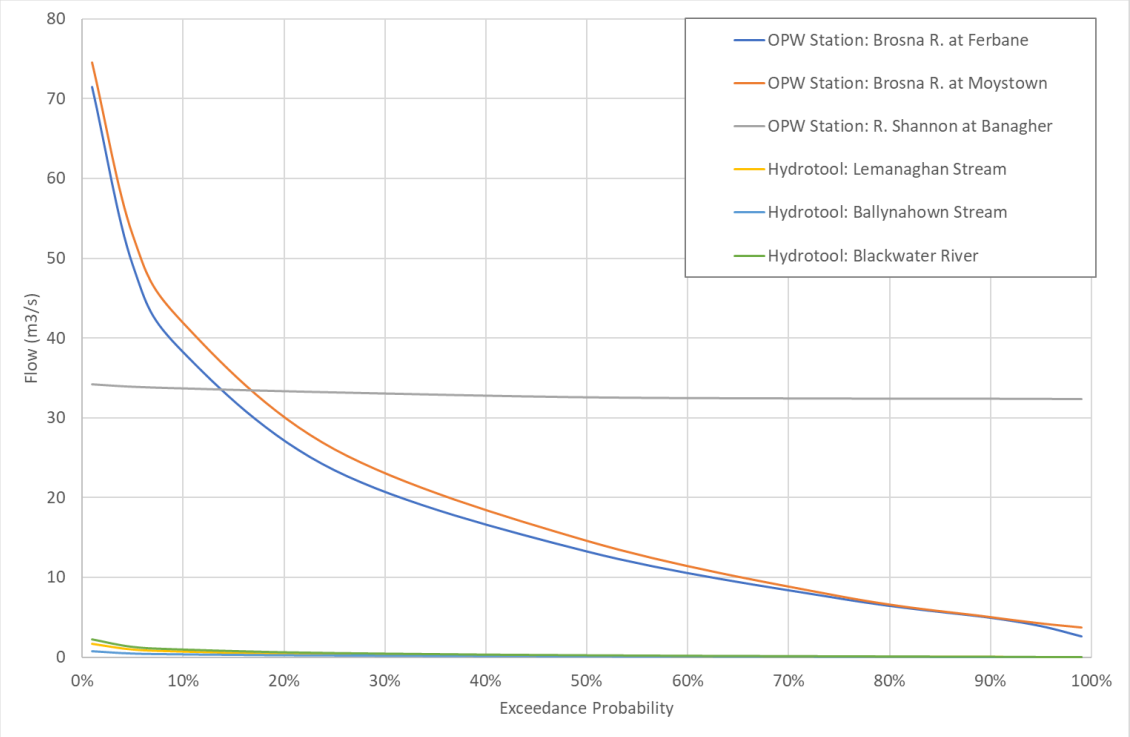

Figure 8-5: Flow Duration curves for Watercourses Downstream of the Application Site

8.4.4 Site Drainage

8.4.4.1 Pre – July 1988 Bog Drainage

Table 8-5 summarises the year of drainage and the year that peat extraction first began at the Application Site.

Drainage ditches to drain the upper surface of the bog by lowering the local water table were inserted across the Application Site at different times. As drainage was installed, vegetation clearance was undertaken once ground conditions were suitably dry to facilitate the movement of machinery to complete such works. The earliest aerial imagery of the Application Site available was captured in 1973. It is estimated that at that point, approximately 409.5ha across the Application Site was cleared, drained and subject to peat extraction, and a total of 5.6ha were drained, but not cleared of vegetation or subject to peat extraction. In 1988 this increased to 968.7ha across the Application Site being cleared, drained, and subject to peat extraction, and a total of 78.6ha were drained but not subject to peat extraction.

Table 8-5: Peat Extraction Activity Timeline at the Application Site.

Bog Name	Bog Area (Ha)	Commencement of Site Preparation Works including drainage insertion (Year)	First Extraction (Year)
Lemanaghan Bog	1,111	1950	1960

Sod Peat Extraction – Drainage Design

Sod peat extraction commenced at the Application Site in 1960 and ceased in 1984.

The drainage for sod peat extraction comprised of the opening of large open drainage ditches, known as "trenches", at approximately 240m across the peat extraction area. The trenches were typically 2m wide and 3 to 4 metres deep. These trenches served as the beginning of the based bank from which sod peat was ultimately extracted. Typically, the large sod peat fields were approximately 700 to 1,800m in length and discharged to the end of the large drainage trenches. Small, piped outfalls were installed perpendicular to the drains where needed to drain low areas that formed along the sod peat field. The pipes used were either concrete or clay pipes with a small diameter of between 150mm and 300mm.

These bogs utilised Archimedes screw pumps where levels did not allow for gravity drainage. As the sod peat machine (bagger) was electrically powered a power supply for the pumps was easily obtained from the existing internal distribution network.

The large drainage trenches were continuously maintained using mechanical excavators or draglines and were continuously deepened as sod peat was extracted from the bog to lower the drainage level.

Milled Peat Extraction - Drainage Design

The drainage design for milled peat extraction comprised the insertion of parallel surface water drains, created by machine excavators, at intervals of 15m. Vegetation was then stripped from the bog between these drains to form the peat extraction fields. The drains were first opened by towing a plough cutting 50cm deep by turning the sod over and as a result, the surface water was removed. After one year the drains were deepened and the spoil removed. This step was repeated for a period of approximately 5-7 years until a stable drain approx. 1.5m deep was established. The fields were then chambered to facilitate rainwater run-off and prevent standing water on the production fields. The drains generally fall towards the headland which is located at both ends of each production field. This headland allows for the plant such as harrowers, millers or ridgers to turn from one field into the next field. The open drains are generally piped across the end of each production field to facilitate peat extraction plant and machinery to travel from field to field. The drainage network continues by either open channel or pipe to a silt pond or ponds prior to discharging from the Bord na Móna site to a local watercourse. The Application Site was primarily drained via gravity however 2 no. pumps are present along the EPA mapped Lemanaghan Stream.

Silt Ponds

Following the establishment of the Bord na Móna silt committee, it was decided in 1974 to control all effluent by means of specially designed and construction silt ponds. A copy of the meeting minutes from the Bord na Móna Production Manager in March 1976 setting out the recommendations of the silt committee is included in Appendix 4-8, which directs that "*at all milled peat bogs in production, works should carry out surveys and select sites for silt ponds as recommended*". Further Bord na Móna records show that silt pond measures were introduced across all Bord na Móna bogs, including the Application Site, in the early to mid-1980s in response to the 1977 Water Pollution Act.

Silt ponds were installed to trap and reduce the emission of suspended solids to surface water bodies originating from activities associated with peat extraction, such as suspended peat particles generated from the production fields and collected in the bog drainage network as well as run-off from workshop areas.

The first silt ponds were constructed at the Application Site prior to 1988, with these ponds being designed with an upper limit of 100mg/l of silt runoff (determined by An Bord Pleanála (now An Coimisiún Pleanála) decision regarding effluent at Littleton Bog - refer to Appendix 4-8). The design of silt ponds is detailed in Section 4.3.5.9, with silt ponds typically being 8m in width, 1.5m deep and of variable length. In some locations, baffles have been installed within the ponds to reduce the energy in the flow and elongate the pond thereby increasing residence time and aiding settlement. The inlet and outlet pipes at the silt ponds control the flow velocity, with velocity within the silt pond being less than 0.1m/s. Silt ponds are cleaned twice a year and are all located hydraulically upgradient of discharge/outfall points.

8.4.4.2 1988 Baseline Bog Drainage

By 1988, manmade drainage ditches existed across much of the Application Site. In essence, the major changes from a hydrological perspective occurred within the bog during the initial drainage, prior to July 1988. Consequently, no major hydrological changes would have occurred following the initial drainage apart from minor alteration of drainage ditches as peat extraction progressed.

Inspection of satellite imagery and Annual Reports reveal that the Application Site was subject to milled peat extraction by July 1988. The associated drainage to facilitate milled peat extraction was already in situ, with field drains predominantly in a northwest-southeast orientation. The bog included 9 no. artificial silt ponds, 9 no. surface water emission points, and 8 no. gravity flow surface water outflows which remain in-situ today. A summary of the baseline drainage in place at the Application Site is presented in Table 8-6.

Table 8-6: July 1988 Baseline Drainage

Bog Name	Drainage Type	No. Silt Ponds	No. Surface Water Discharge Locations	No. Pumps
Lemanaghan Bog	Milled peat drainage	9	9	0

8.4.4.3 Peat Extraction Phase Drainage (1988 – 2020)

By 1988, drainage had already been inserted at the Application Site to facilitate milled peat extraction.

Drainage of the Application Site including silt pond locations and drainage outfalls are detailed in full in Section 8.4.4.4 below.

Silt Ponds

Several changes to the on-site bog drainage system occurred during this phase of the development. These changes were predominantly associated with silt ponds and attempts to reduce the concentrations of suspended sediment being discharged from the bog drainage systems to local surface watercourses. Upgrades to silt ponds were undertaken at the Application Site in the 1990s following the Harkins Internal Bord na Móna Report (1990) which highlighted the issue of elevated suspended sediment concentrations in discharge from the bog drainage network. The report revealed that a total of approximately 50m^3 of sludge per hectare of bog was being discharged to nearby surface watercourses every year (refer to Chapter 4). Following this, the silt ponds were designed to cater for the settling of sufficient amounts of silt providing the ponds were de-sludged at least twice per annum. A second pond was installed adjacent to the first to facilitate desludging (i.e., used as a backup when the first pond reached silt storage capacity and underwent desludging).

Since 2000, the bog drainage network has been operating in accordance with the existing Integrated Pollution Control Licences, with all drainage water from bog units in the licensed area discharged via an appropriately designed silt pond treatment arrangement. The silt ponds serving operation bogs have been sized in accordance with a condition in the existing Integrated Pollution Control Licence (P0501-01) which states:

> *Within three years of date of grant of this licence all existing silt ponds serving operational bogs shall achieve the following minimum performance criteria (flood periods excepted):*
>
> *Maximum flow velocity < 10 cms-1*
>
> *Silt design capacity of lagoons, minimum 50m^3 per nett ha of bog serviced*

Silt ponds were generally designed and constructed with a width of 8 metres, however, in some cases, silt ponds are up to 12 metres in width. Silt ponds of 12m width are only provided in areas where access is available to both sides of the silt ponds for cleaning. The length of the silt pond will vary depending on the capacity required (i.e. proportional to the area of catchment being drained). In some locations, baffles have been installed within the ponds to reduce the energy in the flow and elongate the pond thereby increasing residence time and aiding settlement. Silt ponds are generally excavated to a depth of 1.5 metres below the pipe invert level, however in some locations, due to restricted space, the silt pond depth is greater than this. Low-velocity flow through the silt pond is generally controlled by inlet and outlet pipes at the silt ponds or upstream of the silt pond. These pipes control the velocity of the flow into and out of the silt ponds so that the velocity within the silt pond itself is less than 0.1 m/sec. The silt ponds are usually cleaned twice a year and are all located hydraulically upgradient of discharge/outfall points.

Pumps

Two pumps were active at the Application Site during the Peat Extraction Phase. It is estimated the first pump was installed and commissioned in 2009 with the second pump installed and commissioned by 2019. These two pumps were installed to supplement the drainage on site where additional dewatering was deemed necessary. Discharges from the pumps would have been to the drainage on site and eventually to the silt ponds for treatment before eventually discharging off site.

8.4.4.4 Current Phase Drainage (June 2020 – Present)

The topography of the Application Site is relatively flat with an elevation range of between approximately 46 and 60mOD (metres above Ordnance Datum) with gentle slopes in some locations.

Surface water is drained from the Application Site via a network of field drains typically spaced at 15 to 20m intervals, piped drained drains, main drains, headland drains, and silt ponds. These drains discharge to collector/headland drains along the perimeter of the bog, which eventually discharges to a series of large silt (settlement) ponds. 2 no. pumps have been used to drain the Application Site as following a period of peat extraction drainage by gravity was no longer feasible as the water levels in the surrounding streams were higher than the water level in the bog. Drainage waters are then discharged to off-site drainage channels which flow into the local river network.

A flow diagram for the existing drainage system is shown as Figure 8-6 below.

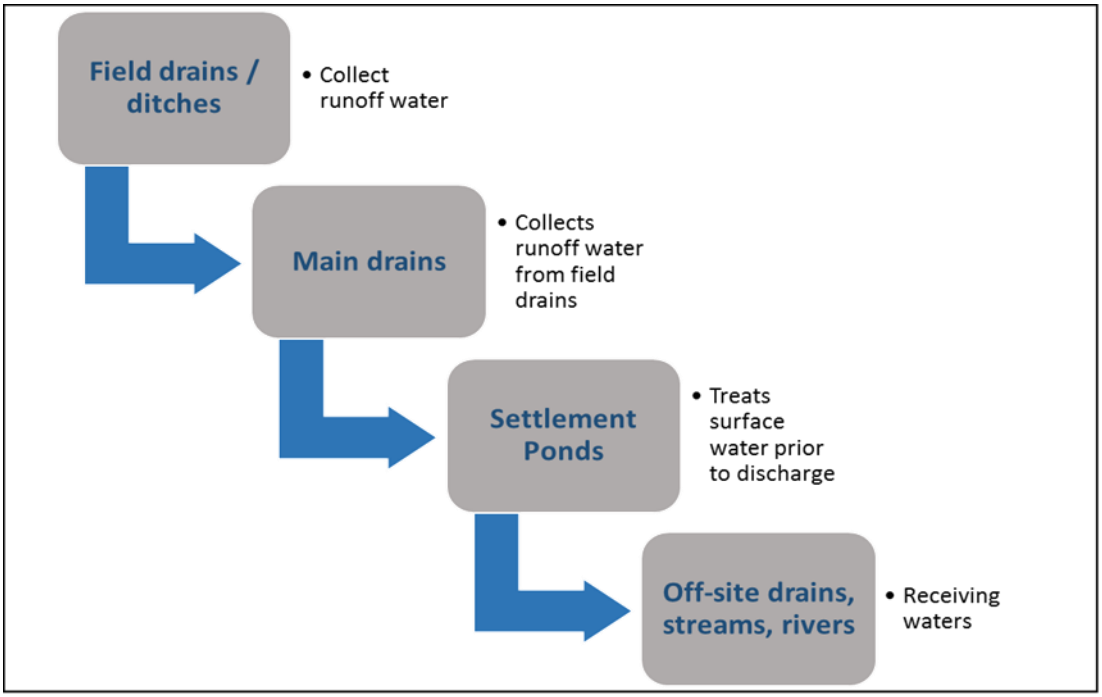

Figure 8-6: Existing Drainage System at the Application Site

A detailed hydrological audit of flowpaths for the Application Site to its eventual discharge point at the regional catchment scale was completed for the Application Site.

Drainage from the Application Site discharges through 8 no. gravity surface water outfalls (SW19, SW19A, SW19B, SW22, SW22A, SW22B, SW22C and SW22D). The locations of these outfalls and the receiving surface waterbodies are detailed below and in Figure 8-7.

- In the east of the Application Site, within the Brosna_100 WFD river sub-basin, there are a total of 4 no. discharge points (SW22, SW22A, SW22B and SW22C) to the EPA named Fortified House Castlearmstong Stream;
- Within the Boor_020 WFD river sub-basin, there is 1 no. outfall (SW22D) to the EPA named Ballynahown Stream (referred to locally as theBrooks Stream);
- Within the Lemanaghan Stream_010 WFD river sub-basin, there are a total of 2 no. outfalls (SW19 and SW19A) to the EPA named Lemanaghan Stream; and,
- To the west, within the Brosna_110 WFD river sub-basin, there is 1 no. outfall (SW19B) to the EPA named Kilcolgan Beg Stream, a tributary of the Brosna River.

Note that despite approximately 41ha of the Application Site being mapped in the catchment of the Blackwater River, there are no surface water discharge points (outfalls) within this sub-catchment. Drainage in this area of the Application Site is directed, via field and main drains, into the Brosna sub-catchment and discharges to the tributaries of the Brosna River.

The respective settlement ponds and their outfall pipe elevations are presented in Table 8-7 below. Outfall pipe elevations range from 44.59 – 52.23mOD (metres above Ordnance Datum) with the greatest outfall elevations recorded in the north of the Application Site at SW22D. Outfalls generally discharge to nearby surface water bodies as mapped by the EPA or into smaller drains that flow towards these mapped watercourses.

There are 8 gravity flow surface water outflows and, associated silt ponds, in the Application Site. There is also a central area of the bog drained by pumps P15-03 and P15-04 and this pumped outfall flows through a series of silt ponds before discharging through SW19. 7 of the 8 no. outfall discharge into tributaries of the Brosna River whilst, SW22D in the north, discharges into the Ballynahown Stream, a

tributary of the Boor River. As seen in , all surface water discharge from the Application Site ends up in the River Shannon. A schematic hydrological flowpath diagram is presented as Figure 8-8.

Table 8-7: Site Drainage from the Application Site

Settlement Pond ID	Easting	Northing	Outfall Pipe Elevation (mOD)	Nearby Surface Watercourse (EPA Name)	Distance from Outfall to Mapped Watercourse (m)
SW22D	614848	731164	53.24	Ballynahown Stream	200
SW22C	615893	730342	52.23	Fortified House Castlearmstrong Stream	100
SW22B	616097	730096	51.22	Fortified House Castlearmstrong Stream	50
SW22A	616846	729572	48.07	Fortified House Castlearmstrong Stream	200
SW22	618591	729624	44.59	Fortified House Castlearmstrong Stream	Direct discharge to watercourse
SW19	617162	727554	Not available	Lemanaghan Stream	40
SW19A	617427	727372	45.98	Lemanaghan Stream	Direct discharge to watercourse
SW19B	614916	726519	46.13	Kilcolgan Beg	Direct discharge to watercourse

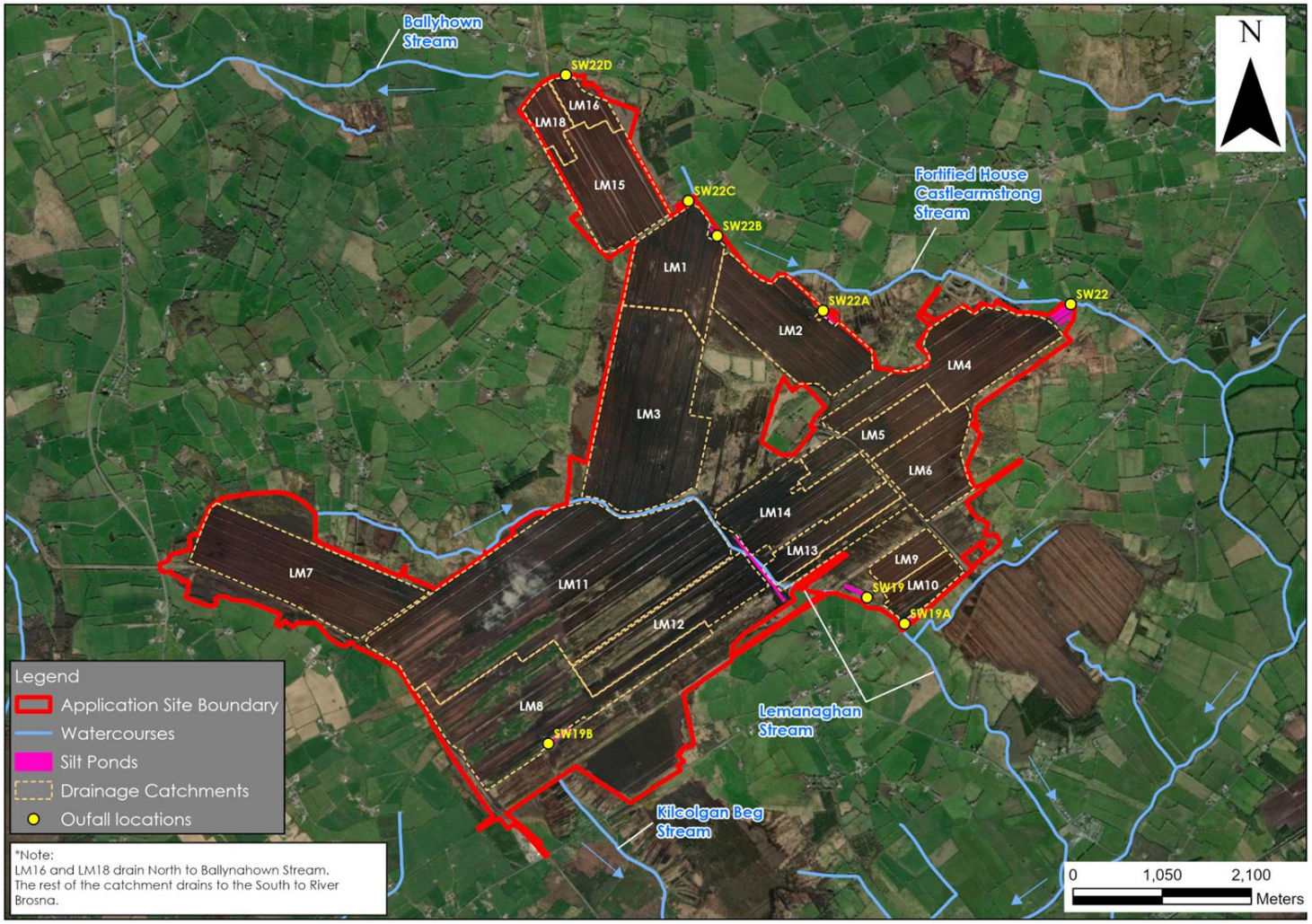

Figure 8-7: Drainage Catchments, Silt Ponds and Outfall Locations at the Application Site

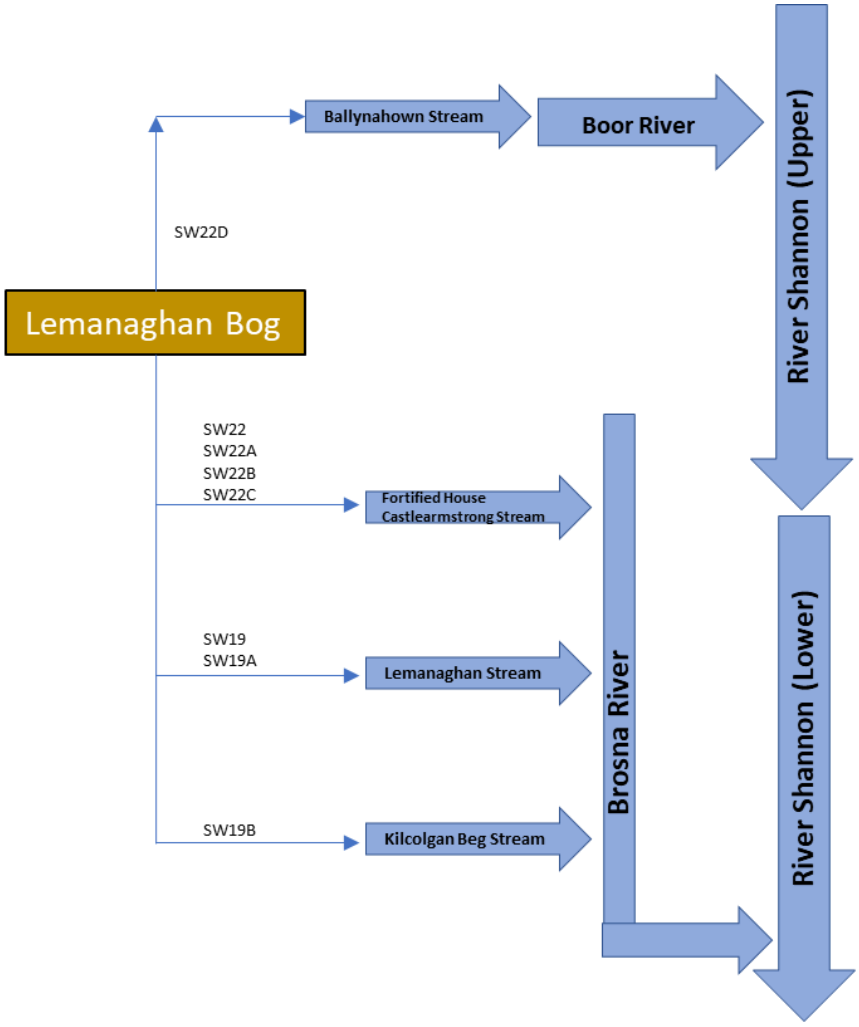

Figure 8-8: Surface Water Outfalls and Downstream Receiving Waterbodies

8.4.5 Flood Risk Assessment

This section presents an overview of the Flood Risk Assessment (FRA) undertaken for the Application Site. The full FRA for the Application Site is provided in Appendix 8-1.

To identify those areas as being at risk of flooding, OPW's indicative river and coastal flood map (www.floodinfo.ie), CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.floodinfo.ie) and historical mapping (i.e. 6" and 25" base maps) were consulted. Identifiable map text on local available historical 6" or 25" mapping for the Application Site do not identify any lands that are "liable to flood".

Based on the EPA/GSI soil map for the area no regions of alluvium are mapped within the Application Site boundary. However, some alluvium (fluvial deposits) is recorded along many of the local streams and rivers in the lands surrounding the Application Site.

No recurring or historic flood incidents were identified within the Application Site from the OPW's Past Flood Events Map. However, 1 no. recurring flood incidence has been recorded along the R436 at Lemanaghan (Flood ID: 2906), approximately 500m from the Application Site where low lying flat land is noted to flood annually following heavy rainfall. A second recurring flood event is also mapped approximately 1km west of the Application Site at Derrica Beg (Flood ID: 2907). Here low-lying land

and roads flood annually following heavy rain. In addition, several historic and recurring flood events have been recorded along the Brosna River to the south of the Application Site.

Where complete, the CFRAM OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the PFRA maps. No CFRAM mapping has been completed for the area of the Application Site. The OPW's National Indicative Flood Maps (NIFM) shows that some of the Application Site to be located in Fluvial Flood Zone A, associated with flooding along the Lemanaghan Stream. However, the vast majority of the Application Site is mapped outside of the 1 in 100-year and 1 in 1,000 year flood zones and is deemed to be at low risk of fluvial flooding (Fluvial Flood Zone C).

Site walkover surveys have revealed that the EPA mapped Lemanaghan Stream has been modified within the Application Site and now forms part of the bog drainage infrastructure. A large arterial drain was noted to flow along the course of the EPA mapped Lemanaghan Stream. This drain receives water from field drains which drain the adjacent peat fields. 2 no. pumping stations, operated by Bord na Móna (1 no. pump has been operational since 2009 with the second since 2019 and have reduced the risk of flooding at the Application Site), were also noted along this large drain, and the operation of these pumping stations would have removed water from the lower lying parts of the bog and raised, and discharged, that water to the outfalls along the Lemanaghan Stream. In general, pumping stations and flood protection embankments are not used in flood modelling, and the risk of flooding is defined (by creating flood zones/maps) in the absence of flood defence.

Site walkover surveys indicate that the surface of the cutover bog contains an extensive network of peat drains with surface water outflows from the bog. This existing drainage network has reduced the risk of pluvial flooding across much of the Application Site.

8.4.6 Surface Water Quality

8.4.6.1 EPA Biological Q-Rating Monitoring

The Biological Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from 0-1 (Poor) to 4-5 (Good/High). EPA Q-rating monitoring (i.e. biological monitoring data) of river waterbodies began in the early 1970s and continues to the present day. The results of this monitoring provides an indication of water quality trends in the streams and rivers downstream of the Application Site.

8.4.6.1.1 *Pre-1988*

Prior to July 1988, historic Q-data is available from 1971 to 1986 for the Brosna, Shannon (Lower), Shannon (Upper) and Blackwater (Shannonbridge) Rivers in the vicinity and downstream of the Application Site. Table 8-8 shows that the historic Q-values ranged from Q3 ('Poor' Status) to Q5 ('High' Status) during this time period.

Within the Shannon Lower_SC_010 sub-catchment, no EPA Q-monitoring was completed prior to 1988 in the Ballynhanown Stream or the Boor River downstream of the Application Site. The closest downstream location for which a Q-rating for this period is available is located on the River Shannon at Clonmancoise (Station Code: RS26S021800). Here the River Shannon achieved a Q5 rating ('High' status) in 1976 and a Q4 rating ('Good' status) in 1984.

Within the Shannon Lower_SC_030 sub-catchment, no EPA Q-monitoring was completed prior to 1988 in the Holy Well Clongawny Stream. The closest downstream location for which Q-rating data for this period is available is located on the Blackwater River at Blackwate Bridge (Station Code: RS25B270200). At this location the Blackwater River achieved a Q3 rating ('Poor' status) in 1984. Note that despite the Application Site being mapped within this sub-catchment that there was no discharge from the Application Site to any watercourse within sub-catchment.

The majority of the Application Site, including 7 of the 8 no. outfalls, is located in the Brosna_SC_060 sub-catchment. Upstream of the Application Site, the Brosna River at Ballycumber Bridge (Station Code: RS25B090700) achieved a Q4 rating ('Good' status) on 4 no. occassions during this period (1971, 1974, 1978, and 1984). The Brosna River at this location also achieved a Q4-5 rating ('High status') in 1982. Meanwhile, downstream of the Fortified House Castlearmstrong Stream the Brosna River achieved a Q-rating of Q4 (Good' status) in 1987 at a Bridge northwest of Pollagh (Station Code: RS25B090760). Further downstream, and downstream of the Lemanaghan and Kilcolgan Beg Streams, several Q-ratings are also available during this period on the Brosna River near Kilcolgan (Station Code: RS25B090800). Dring this period the Q-ratings fluctuated between Q4-5/Q5 ('High' status) (1971, 1974, 1987) to Q4 ('Good' status) (1978 and 1984). Further downstream at Ferbane (Station Code: RS25B090950), the Brosna River achieved Q4-5 ratings ('High' status) in 1984 and 1987. Downstream of Ferbane, the Brosna River experienced a deterioration from Q4-5 ('High' status) in 1978 to Q3-4 ('Moderate' status) in 1984 but reovered to Q4-5 by 1987.

The available Q-rating data does not indicate any signficant detioration in water quality during the period prior to July 1988.

Table 8-8: EPA Q-Rating Status (Pre-1988)

River	Station ID	Location	EPA Q-Ratings	
Brosna_SC_060 sub-catchment				
Brosna River	RS25B090700	Ballycumber Bridge	1971, 1974, 1978, 1984 – Q4 (Good)	1984 – Q4-5 (High)
Brosna River	RS25B090760	0.5km NW of Pollagh	1987 – Q4 (Good)	
Brosna River	RS25B090800	Brosna - Bridge near Kilcolgan	1971, 1974, 1987 - Q4–5 (High)	1978, 1984 – Q4 (Good)
Brosna River	RS25B090950	Ferbane Bridge	1984, 1987 – Q4-5 (High)	
Brosna River	RS25B091000	Bellmount d/s Ferbane	1984 – Q3-4 (Moderate)	1971, 1974, 1978, 1987 – Q4-5/Q5 (High)
Shannon Lower_SC_010 sub-catchment				
River Shannon	RS26S021800	Clonmacnoise	1976 – Q5(High)	1984 – Q4 (Good)
Shannon Lower_SC_030 sub-catchment				
Blackwater River	RS25B270200	Blackwater Bridge	1984 – Q3 (Poor)	

8.4.6.1.2 July 1988 Baseline

Biological Q-rating data is not specifically available for the year of 1988 at all EPA monitoring locations in the vicinity and downstream of the Application Site. This is to be expected as the EPA do not complete annual monitoring but rather across intervals of several years. Therefore, for locations where no monitoring was completed in 1988, the Q-ratings from other years was taken as the baseline Q-rating. This is specified in Table 8-9.

Within the Shannon Lower_SC_010 sub-catchment, no EPA Q-monitoring was completed on the Ballynhanown Stream. However, the Boor River was assigned a Q-rating of Q4 ('Good' status) upstream of its confluence with the Ballynahown Stream in 1988 (Station Code: RS26B071100). The closest downstream location for which a Q-rating for this period is available is located on the River Shannon at Clonmancoise (Station Code: RS26S021800). Here the River Shannon achieved a Q4 rating ('Good' status) in 1984.

Within the Shannon Lower_SC_030 sub-catchment, the Blackwater River have achieved 'High' (Q4-5) status at a bridge northeast of Derryharry (Station Code: RS25B270110) in 1988. Further downstream

the Blackwater River achieved 'Poor' Status (Q3) at Blackwater Bridge on 1988 (Station Code: RS25B270200).

Within the Brosna_SC_060 sub-catchment, upstream of the Application Site, the Brosna River at Ballycumber Bridge (Station Code: RS25B090700) achieved a Q4-5 rating ('High' status) in 1987. Q-ratings on the Brosna River in the vicnity of the Application Site date from 1987, and range from Q4 ('Good' status) at a bridge northwest of Pollagh (Station Code: RS25B090760) to Q4-5 ('High status) near Ferbane (Station Code: RS25B090950).

Table 8-9: Baseline (July 1988) Q-ratings

River	Station ID	Location	EPA Q-Ratings
Brosna_SC_060 sub-catchment			
Brosna River	RS25B090700	Ballycumber Bridge	1987 – Q4-5 (High)
Brosna River	RS25B090760	0.5km NW of Pollagh	1987 – Q4 (Good)
Brosna River	RS25B090800	Brosna - Bridge near Kilcolgan	1987 – Q5 (High)
Brosna River	RS25B090950	Ferbane Bridge	1987 – Q4-5(High)
Brosna River	RS25B091000	Bellmount d/s Ferbane	1987 – Q4-5 (High)
Shannon Lower_SC_010 sub-catchment			
Boor_010	RS26B071100	Bridge N.W. of Kilbillaghan	1988 – Q4 (Good)
River Shannon	RS26S021800	Clonmacnoise: at Jetty	1984 – Q4 (Good)
Shannon Lower_SC_030 sub-catchment			
Blackwater River	RS25B270110	Bridge ENE of Derryharry	1988 - Q4-5 (High)
Blackwater River	RS25B270200	Blackwater Bridge	1988 – Q3 (Poor)

8.4.6.1.3 Peat Extraction Phase (July 1988 – June 2020)

EPA Q-rating monitoring has been completed at several dates and at multiple locations on the Brosna, Boor, Shannon (Lower), Shannon (Upper) and Blackwater (Shannonbridge) rivers in the vicinity and downstream of the Application Site during the Peat Extraction Phase (July 1988 to June 2020). The Q-values over this period are summarised in Table 8-10 and are presented graphically in Figure 8-9 and Figure 8-10.

Within the Shannon Lower_SC_010 sub-catchment, Q-ratings upstream and downstream of the Application Site portray a similar pattern. The Q-ratings on the Boor River upstream of the Application Site (Station Code: RS26B071100) were predominantly of 'Good' status (Q4). There was a slight deterioration to 'Moderate' status (Q3-4) in 2008, but the water quality recovered to 'Good' status in subsequent monitoring rounds completed in 2014, 2017 and 2020. A similar pattern was recorded downstream of the Application Site (i.e. downstream of the Ballynahown Stream) which was of 'Good' status from the earliest available Q-rating in 2002 to 2011. 'Moderate' status was achieved in 2014 and 2017 before a recovery to 'Good' status in 2020.

Within the Shannon Lower_SC_030 sub-catchment, the Q-ratings on the Blackwater River downstream of the Application Site at a bridge northeast of Derryharry (Station Code: RS25B270110) fluctuated between Q3-4 and Q4. High status (Q4-5/Q5) was not achieved during the Peat Extraction Phase but was the 1988 baseline. However, note that there are no surface water discharges within this sub-catchment.

Meanwhile, within the Brosna_SC_060 sub-catchment, the Q-ratings in the Brosna River upstream of the Application Site experienced a deterioration in comparison with the baseline rating of Q4-5 at Ballycumber Bridge (Station Code: RS25B090700). The Brosna River at this monitoring location fluctuated achieved a Q3-rating ('Poor' status) in 1996 and a Q3-4 rating ('Moderate' status) in 1993, 1999 and 2002. The status improved to Q4 ('Good' status) for 4 no. monitoring rounds completed between 2005 and 2017. The Q-ratings of the Brosna River in the vicinity of the Application Site portray a similar pattern. At a bridge near Kilcolgan (Station Code: RS25B090800), the experienced an initial deterioration in comparison with the baseline rating of Q5 which was assigned based on the 1987 monitoring round. The Brosna River at this location was found to be of 'Poor' status in 1993 and 1999 and 'Moderate' status in 1996 and 2002. The status improved to 'High' status in 2005 and remained at 'Good' status from 2011 to 2017.

Figure 8-9 and Figure 8-10 show the changes in Q-values in local watercourses in the vicinity of the Application Site. On Figure 8-9, the Q-ratings on the Brosna River upstream of the Application Site at Ballycumber Bridge are shown in bold (green dashed line) to allow for easy comparison with the Q-ratings of those stations located downstream. As stated above, a similar trend occurred upstream and downstream of the Application Site. Meanwhile, Figure 8-10 shows the Q-ratings on the Boor and Blackwater rivers. Note that no Q-ratings are available for the Blackwater River upstream of the Application Site. However, as stated previously, there was no discharge to surface waters in this sub-catchment. The Q-ratings of Boor River upstream of the Application Site near Kilbillaghan are shown in bold (green dashed line) and show a similar trend in Q-values as the downstream monitoring stations.

Table 8-10: Summary of Q-Ratings During the Peat Extraction Phase (July 1988 – June 2020)

River	Station ID	Location	EPA Q-Rating (Years)	Q-Value Status Range	
Brosna_SC_060 sub-catchment					
Brosna River	RS25B090700	Ballycumber Bridge	3 – 4 (1993 – 2017)	Poor	Good
Brosna River	RS25B090760	0.5km NW of Pollagh	3.5 – 4 (1993 – 2017)	Moderate	Good
Brosna River	RS25B090800	Brosna - Bridge near Kilcolgan	3 – 4.5 (1989 – 2017)	Poor	High
Brosna River	RS25B090950	Ferbane Bridge	4 – 4.5 (1989 – 2017)	Good	High
Brosna River	RS25B091000	Bellmount d/s Ferbane	3 – 4.5 (1989 – 2017)	Poor	High
Shannon Lower_SC_010 sub-catchment					
Boor River	RS26B071100	Bridge N.W. of Kilbillaghan	3.5 – 4 (1988 – 2020)	Moderate	Good
Boor River	RS26B071200	Boor - Bridge NW of Ballynahownwood	3.5 – 4 (2002 – 2020)	Moderate	Good
River Shannon	RS26S021800	Clonmacnoise: at Jetty	3 – 4 (1996 – 2020)	Poor	Good
Shannon Lower_SC_030 sub-catchment					
Blackwater River	RS25B270110	Br ENE of Derryharry	3.5 – 4.5 (1988 – 2017)	Moderate	High
Blackwater River	RS25B270200	Blackwater Br	3 – 4 (1988 – 2017)	Poor	Good

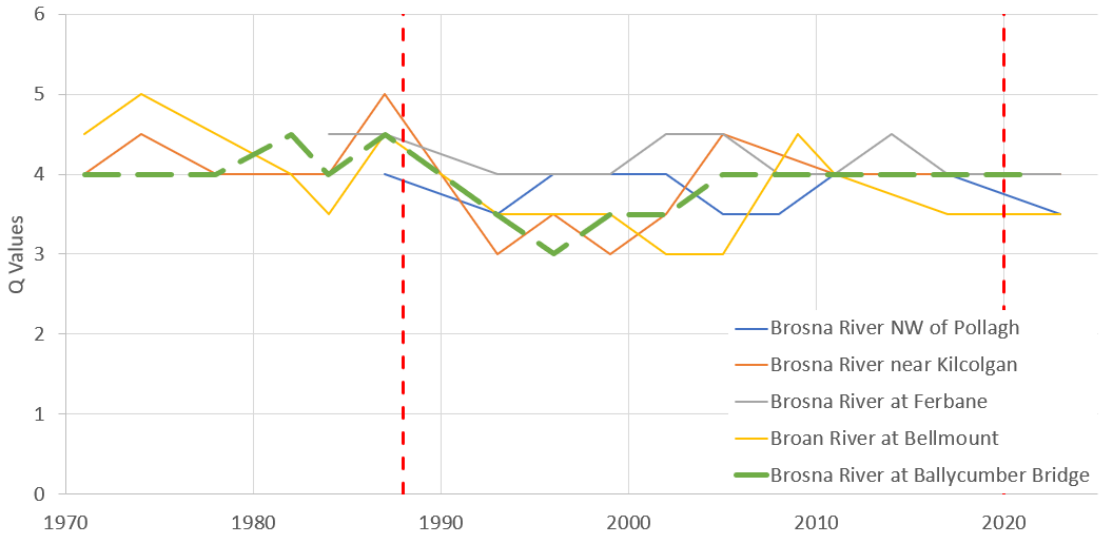

Figure 8-9: Biological Q-Rating Changes in Brosna_SC_060 sub-catchment

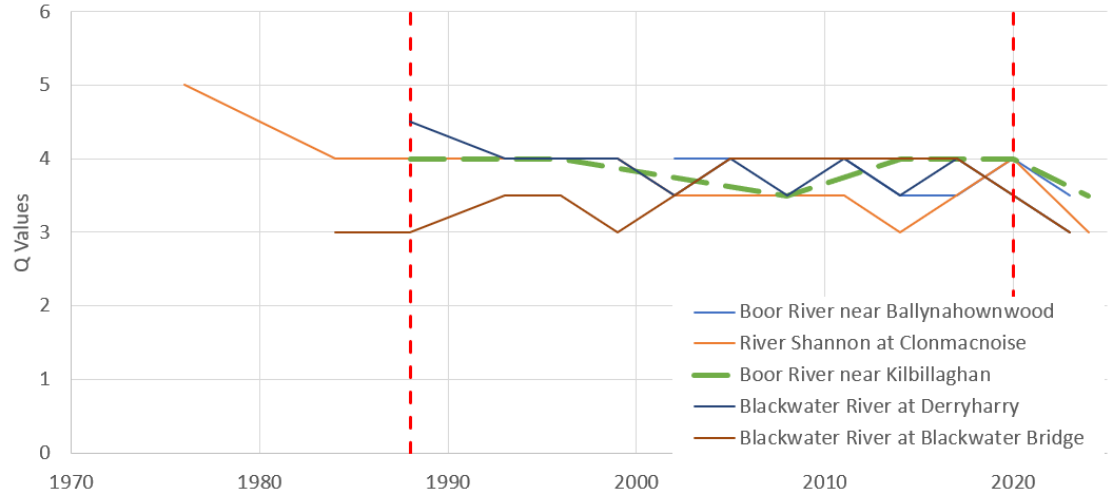

Figure 8-10: Biological Q-Rating Changes in the Shannon Lower_SC_010 and _030 sub-catchments

8.4.6.1.4 EPA Q-Ratings During Current Phase (June 2020 - Present)

The most recent Q-rating data for EPA monitoring points on the Brosna, Blackwater and Boor rivers are shown in Table 8-11 below.

Within the Shannon Lower_SC_010 sub-catchment, the Boor River achieved a Q3-4 rating upstream (Station Code: RS26B071100) and downstream (Station Code: RS26B071200) of the Application Site in 2023.

Within the Shannon Lower_SC_030 sub-catchment,, the Blackwater River achieved a Q3 rating downstream of the Application Site at a bridge northeast of Derryharry (Station Code: RS25B270110) and at Blackwater Bridge (Station Code: RS25B270200).

Within the Brosna_SC_060 sub-catchment, upstream of the Application Site at Ballycumber, the Brosna River achieved 'Good' status in 2021 (RS25B090700). The Brosna River achieved 'Moderate' status in 2023 at Pollagh, upstream of its confluence with the Lemanaghan Stream. Further downstream the Brosna River was assigned a Q4 in 2023 near Kilcolgan and Ferbane (RS25B090800 and RS25B090950). Further downstream at Bellmount downstream of Ferbane, the Brosna River has been assigned a Q-rating of Q3-4 in 2023 (RS25B091000).

A map of EPA monitoring locations for the most recent round of monitoring is shown as Figure 8-11.

Table 8-11: Most Recent (2021-2024) Q-ratings downstream of the Application Site

River	Station ID	Location	EPA Q-Rating (Year)	Q-Value Status
Shannon Lower_SC_010 sub-catchment				
Boor River	RS26B071100	Bridge NW of Kilbillaghan	2024	Q3-4 (Moderate)
Boor River	RS26B071200	Bridge NW of Ballynahownwood	2023	Q3-4 (Moderate)
River Shannon	RS26S021800	Clonmacnoise: at Jetty	2024	Q3 (Poor)
Shannon Lower_SC_030 sub-catchment				
Blackwater River	RS25B270110	Bridge ENE of Derryharry	2023	Q3 (Poor)
Blackwater River	RS25B270200	Blackwater Bridge	2023	Q3 (Poor)
Brosna_SC_060 sub-catchment				
Brosna River	RS25B090700	Ballycumber Bridge (upstream of site)	2021	Q4 (Good)
Brosna River	RS25B090760	0.5km NW of Pollagh	2023	Q3-4 (Moderate)
Brosna River	RS25B090800	Bridge near Kilcolgan	2023	Q4 (Good)
Brosna River	RS25B090950	Ferbane Bridge	2023	Q4 (Good)
Brosna River	RS25B091000	Bellmount downstream of Ferbane	2023	Q3-4 (Moderate)

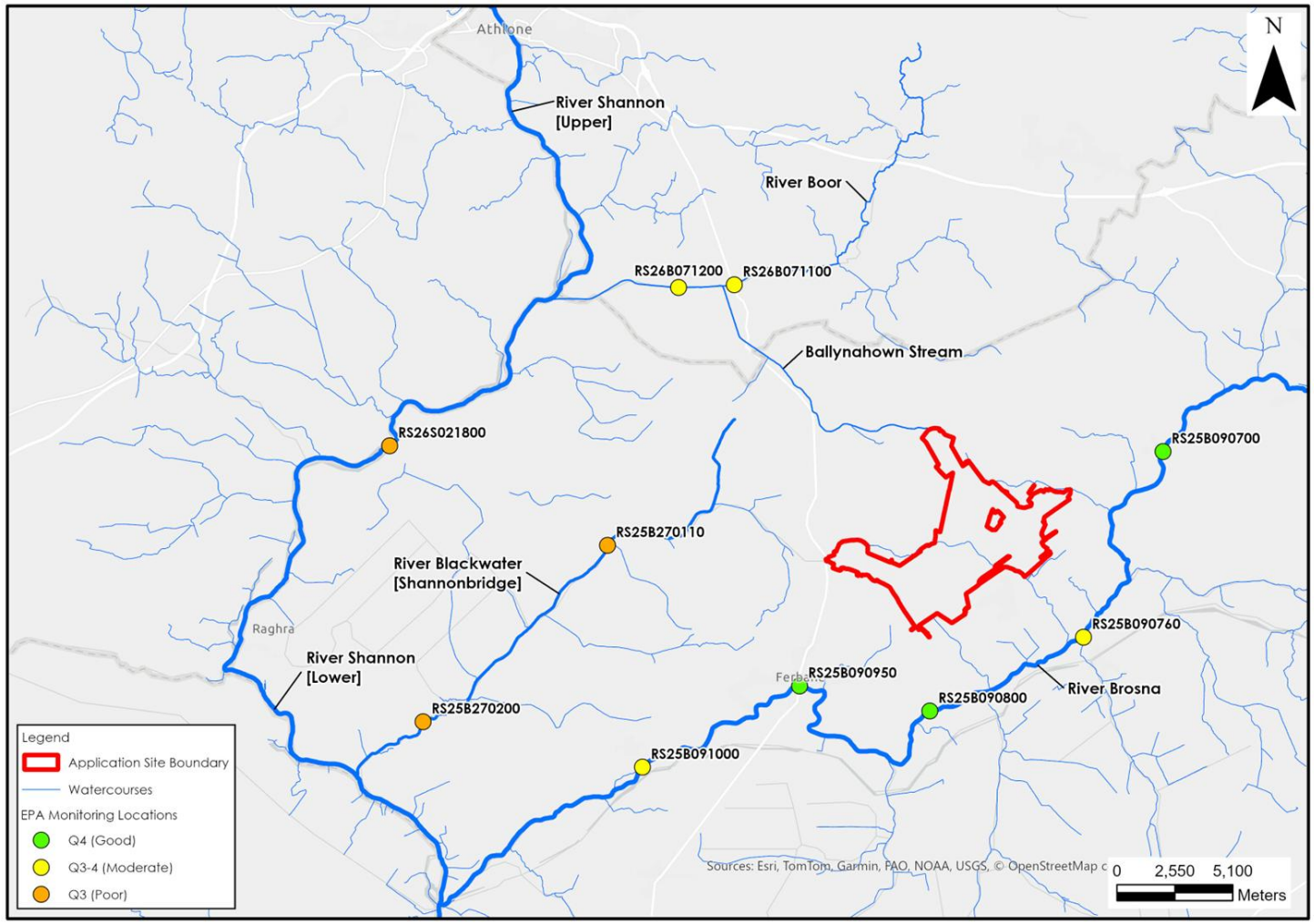

Figure 8-11: EPA Monitoring Locations

8.4.6.2 Bord na Móna Monitoring

8.4.6.2.1 *Pre - 2000*

Before the implementation of the IPC Licence requirements and associated monitoring discussed in Section 8.4.6.2.2 below, limited monitoring of surface water quality and emissions was completed at the Application Site by the Applicant.

However, as discussed in Chapter 4 several mitigation measures designed to protect surface water quality were in place prior the IPC Licence. These measures related to the storage and maintenance of vehicles, refuelling procedures, the maintenance of internal drains, pumps and waste management. No records of surface water quality monitoring exist from this time period.

Silt ponds were constructed at the Application Site in the mid-1980s, with no water/silt control measures present before this date. These silt ponds were constructed with an upper design limit of 100mg/l of suspended sediment.

8.4.6.2.2 *IPC Licence Monitoring (2000-Present)*

The Applicant has been conducting monitoring of emissions to water from the Boora Bog Group from 2000 to the present as set out in IPC Licence P0500-01. Annual monitoring was not completed at the Application Site, as the monitoring was rotated between the different bogs which comprise the larger Boora Bog Group. However, monitoring data from the Application Site is available for 11 no. years between 2000 and 2024. A summary of the results is presented in Table 8-12.

Stormwater (i.e. rainwater run-off from roof and non-process areas such as carparks) derived on-site is released into a local waterbody following basic treatment. The IPC Licence requires that stormwater (from roof and non-process areas such as carparks) is managed to ensure that no pollutants are released into the receiving environment. Where run-off comprises of only roof water it is directed directly to a drain. Runoff from other areas such as carparks is passed through a hydrocarbon interceptor before discharge. Discharges (from roof and non-process areas such as carparks) are inspected and sampled on a monthly basis. The primary treatment criteria used to define adequate treatment of stormwater is COD mg/l. Monthly sampling was completed with results being generally well below the COD trigger levels. Occasionally elevated concentrations occurred when machinery had been washed down immediately prior to sampling and subsequent results returned to satisfactory levels.

The IPC Licence has also required that wastewater at the Application Site be managed to ensure no pollution results when wastewaters were discharged into local surface waterbodies. Two types of wastewaters were produced at the Application Site: process wastewater from the activities associated directly with peat extraction operations, and sanitary wastewater from toilets and canteens. All process wastewater from peat extraction areas is treated via a silt pond drainage system which has been inspected and maintained in accordance with Condition 6 of the IPC Licence (P0500-01). Treated wastewater is released into a tributary of the Boor River (Ballynahown Stream) and several tributaries of the Brosna River (Fortified House Castlearmstrong Stream, Lemanaghan Stream and Kilcolgan Beg Stream). IPC Licence requirements comprise of quarterly grab samples on a select number of silt pond outlets across the Boora Bog Group.

A total of 57 no. grab samples have been taken at the outfalls from the Application Site (between Q4 2000 and Q2 2024). These samples have been analysed for COD, pH, Ammonia, Total Phosphorous, Suspended Solids, Total Solids and Colour. The emission limit values are 35mg/l suspended solids, 3.7mg/l total ammonia, and 100mg/l COD.

As shown in Figure 8-12, no exceedances of Ammonia (I/PV (parameter value) for A3 water is 4mg/L) have been recorded from the outfalls at the Application Site. Concentrations of ammonia ranged from

0.01 to 3mg/l, with an average of 0.88mg/l. No. exceedances have been recorded above the IPC Licence trigger limit of 3.7mg/l total Ammonia.

As shown in Figure 8-13, 4 no. exceedances of the IPC limit for Suspended Solids have been recorded in outfalls from the Application Site. The concentrations of suspended solids ranged from <2 to 174mg/l, with an average concentration of 15.7mg/l. A total of 4 no. exceedances are reported for the period from 2000-2024 which comprised a total of 57 no. samples. However, these exceedances are outliers with 93% of all data being well below the 35mg/l threshold. 3 of the 4 no. exceedances occurred in the early years of the IPC Licence, and following housekeeping and improvements to silt control, the concentrations of suspended solids have generally been compliant. For example, a total of 35 no. samples have been taken since 2014, with an average of concentration of 7mg/l.

As shown in Figure 8-14, 2 no. exceedances of COD have been recorded in outfalls from the Application Site. The mean concentration of COD lies below the IPC Limit of 100mg/l. The mean concentration of COD was 52.76mg/l. Reduced flow and increased temperature can influence COD concentrations.

Other parameters recorded during the sampling included ortho-phosphate and pH. Ortho-phosphate remained relatively stable across the monitoring period and with concentrations ranging from <0.01 to 0.11. pH values were generally within the recommended 6 – 9 range, however, 7 no. pH recordings were below the lower pH limit of 6. It is not uncommon to record low pH concentrations from peat bogs. In general, however, pH values emanating from peat extraction areas remain relatively constant and in line with background levels.

Incidents Reporting

According to the EPA Leap Database (https://leap.epa.ie/licence-profile/P0500/compliance) no incidents or contamination events have been recorded at the Application Site.

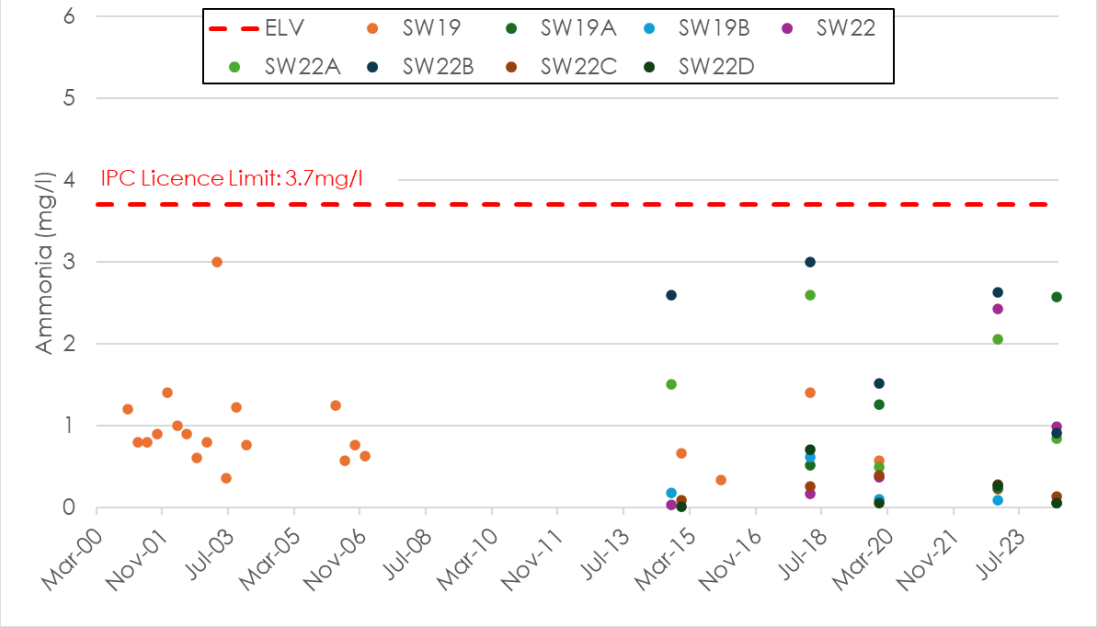

Figure 8-12: Bord na Móna Ammonia Monitoring (2000-2024)

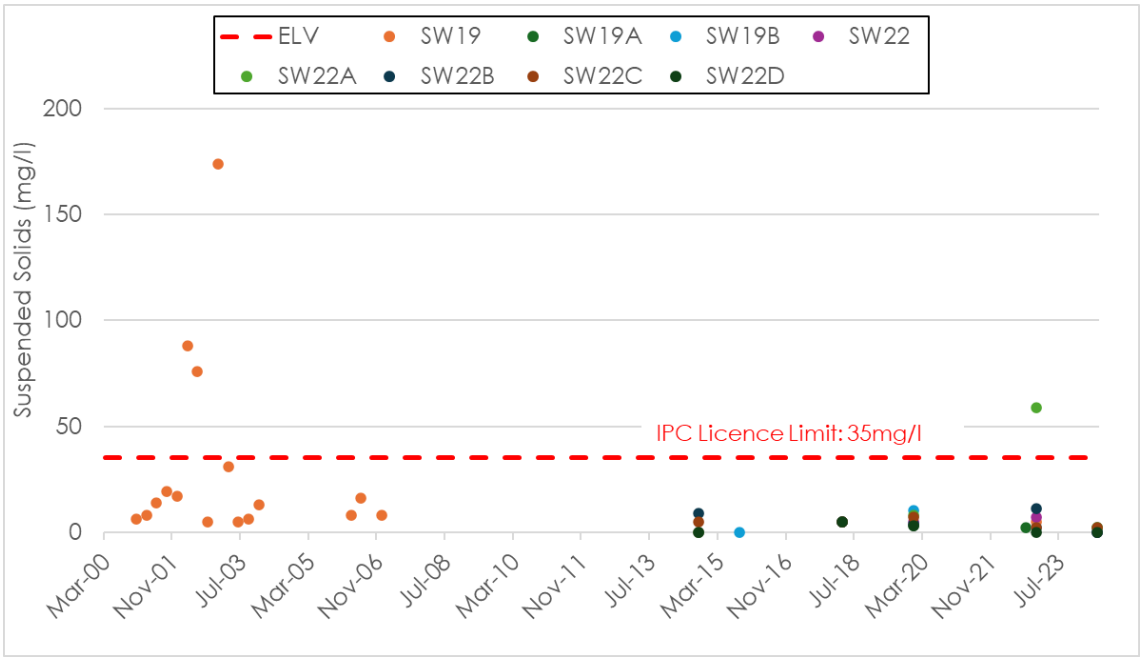

Figure 8-13: Bord na Móna Suspended Solids Monitoring (2000-2024)

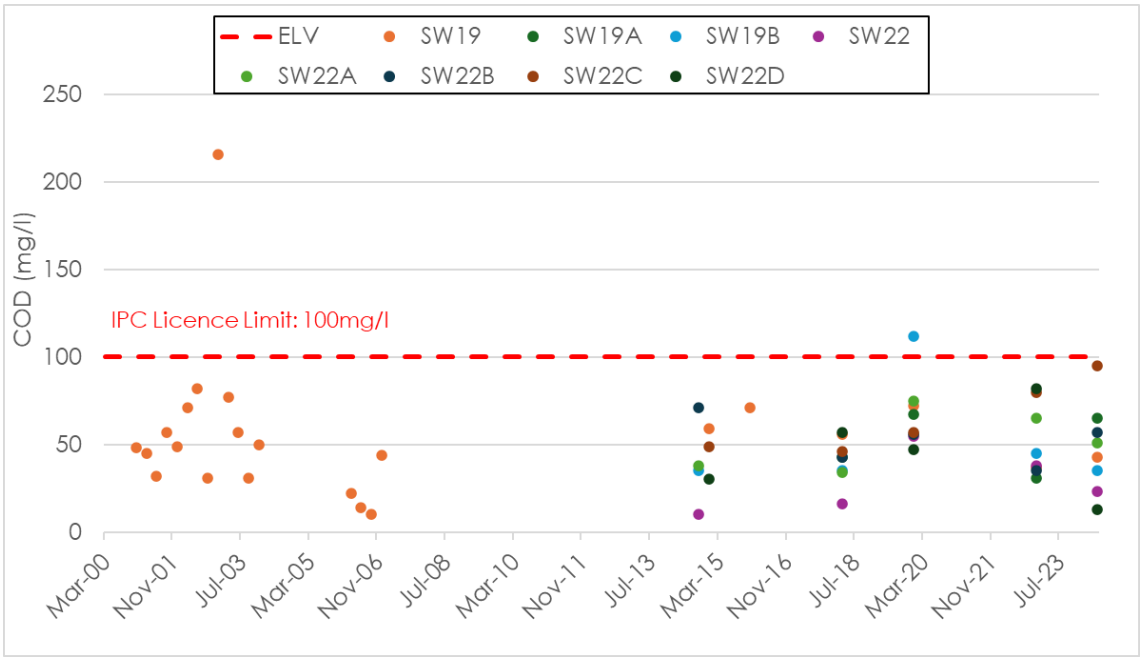

Figure 8-14: Bord na Móna COD Monitoring (2000-2024)

Table 8-12: Bord Na Móna water quality monitoring data (2000-2024)

Bog Name	COD (mg/L)	pH [H^+]	Ammonia (mg/L)	Ortho Phosphorous (mg/L)	Suspended Solids (mg/L)
	Range	Range	Range	Range	Range
Lemanaghan	<10 -216	4.8 – 8.1	0.01 – 3	<0.01 – 0.11	<2 - 174
IPC Licence Limit	100mg/l	6 – 9	3.7g/l	-	35mg/l
n - (number of sample results)	57	57	57	N/A	57
No. Exceedances	2	7	0	N/A	4
% Compliant	96.5%	88%	100%	N/A	93%

8.4.6.3 HES Surface Water Quality Monitoring (2024 - 2025)

Field hydrochemistry measurements of unstable parameters, electrical conductivity (µS/cm), pH (pH units) and temperature (°C) were taken at 8 no. surface water sampling locations on 7th August 2024 and at 10 no. surface water sampling locations on 17th April 2025. SW3 and SW7 were not accessible during the August 2024 monitoring round. The results of the field hydrochemistry are listed in Table 8-13. The monitoring locations were typically small streams and drainage channels and are shown on Figure 8-15.

The surface water samples indicate a basic type surface water, with pH ranging from 7.31 to 8.52. Dissolved oxygen ranged from 3.15 to 12.21mg/l, specific electrical conductivity ranged from 484 to 748µS/cm, turbidity ranged from 1.16 to 28.1 NTU and temperate ranged from 9.3 to 16.1°C.

Table 8-13: Field Parameters - Summary of Surface Water Chemistry Measurements (07/08/2024 and 17/04/2025)

Location ID	Temp °C	DO (mg/l)	SPC (µS/cm)	pH	Turbidity
SW1	11.2 - 16.1	7.3 - 10.76	484 - 545	7.92 - 8.37	1.16 - 1.84
SW2	10.1 - 15.1	7.72 - 10.4	512 - 572	7.84 - 8.25	1.17 - 1.76
SW3	10.1	6.76	514	7.31	21.8
SW4	10.9 - 14.6	7.58 - 11.4	599 - 657	7.87 - 8.1	1.79 - 2.78
SW5	9.3 - 14.5	7.34 - 10.49	678 - 679	7.88 - 8.25	1.59 - 28.1
SW6	10.1 - 14	8.49 - 12.21	656 -721	7.99 - 8.35	3.23 - 3.96
SW7	11.5	10.23	748	7.48	9.78
SW8	10.8 - 15.8	9.25 - 10.92	598 - 606	8 - 8.52	3.07 - 13.9
SW9	10.1 - 13.8	9.54 - 11.18	657 - 731	7.94 - 8.44	2.82 - 3.29
SW10	11 - 14.9	3.15 - 8.92	589 - 613	7.65 - 7.86	10.8 - 17.2

Surface water grab samples were also taken at these locations for laboratory analysis on 7th August 2024 and 17th April 2025. Results of the laboratory analysis are shown alongside relevant water quality regulations in Table 8-14 below. The laboratory reports are attached as Appendix 8-2.

Suspended solid concentrations ranged from <5 to 60mg/l. Suspended solid concentrations were below the S.I 293/1988 threshold limit of 25mg/l in all samples except for SW10 on 17th April 2025. The elevated levels of suspended solids in this sample can be attributed to disruption of the streambed during sampling.

A total of 7 of the 18 no. samples (approx. 39%) achieved 'High' status with respect to ammonia concentrations (i.e. ≤0.04mg/l). Meanwhile, 10 no samples (approx. 55.5%)were below the 'Good' status threshold (i.e. ≤0.065mg/l). Biological Oxygen Demand (BOD) achieved 'Good' status, in 6 no. samples, with regards to the threshold of ≤1.5mg/l .All samples achieved 'Good' status with respect to ortho-phosphate (≤0.035mg/l). Nitrate concentrations ranged from <5.0- 10.4mg/l . Chloride concentrations ranged from 14.3 to 30.3mg/l.

Table 8-14: Laboratory Data (07/08/2024 and 17/04/2025)

Location ID	Suspended Solids (mg/l)	BOD_5 (mg/l)	Orthophosphate (mg/l)	Nitrate (mg/l NO_3)	Ammonia (mg/l)	Chloride (mg/l)
EQS	**≤25([1])**	**≤ 1.3 to ≤ 1.5([2])**	**-≤ 0.035 to ≤0.025([2])**	**-**	**-≤0.065 to ≤0.04([2])**	**-**
SW1	<5 – <10	2	<0.02	<5.0	0.08 – 0.13	15.2 – 15.8
SW2	<5 – <10	2	<0.02	<5.0 – 5.3	0.02 – 0.07	15.6 – 16.8
SW3	16	4	<0.02	<5.0	1.31	18.7
SW4	<5 – <6	<1 – 3	<0.02	<0.05 – 7.7	0.02 – 0.03	16.1 – 16.3
SW5	<5 – <6	<1 – 2	<0.02	<5.0 – 10.2	0.05 – 0.08	17.6 – 17.7
SW6	<5 – 8	<1 – 3	<0.02	7.5 – 7.9	<0.02 – 0.05	15.6 – 15.7
SW7	<5	<1	<0.02	6.2	<0.02	15.9
SW8	<6 – 7	1 – 2	<0.02	8.6 – 9.7	0.02 – 0.10	25 – 30.3
SW9	<5 – <6	<1	<0.02	8.4 – 10.4	0.04 – 0.06	19.6 – 19.8
SW10	<6 – 60	4 – 7	<0.02	<5.0	0.91 – 1.94	14.3 – 16.4

(+) S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations, 1988.
(*) S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended).

[1] *S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations*
[2] *S.I. No. 272/2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy).*

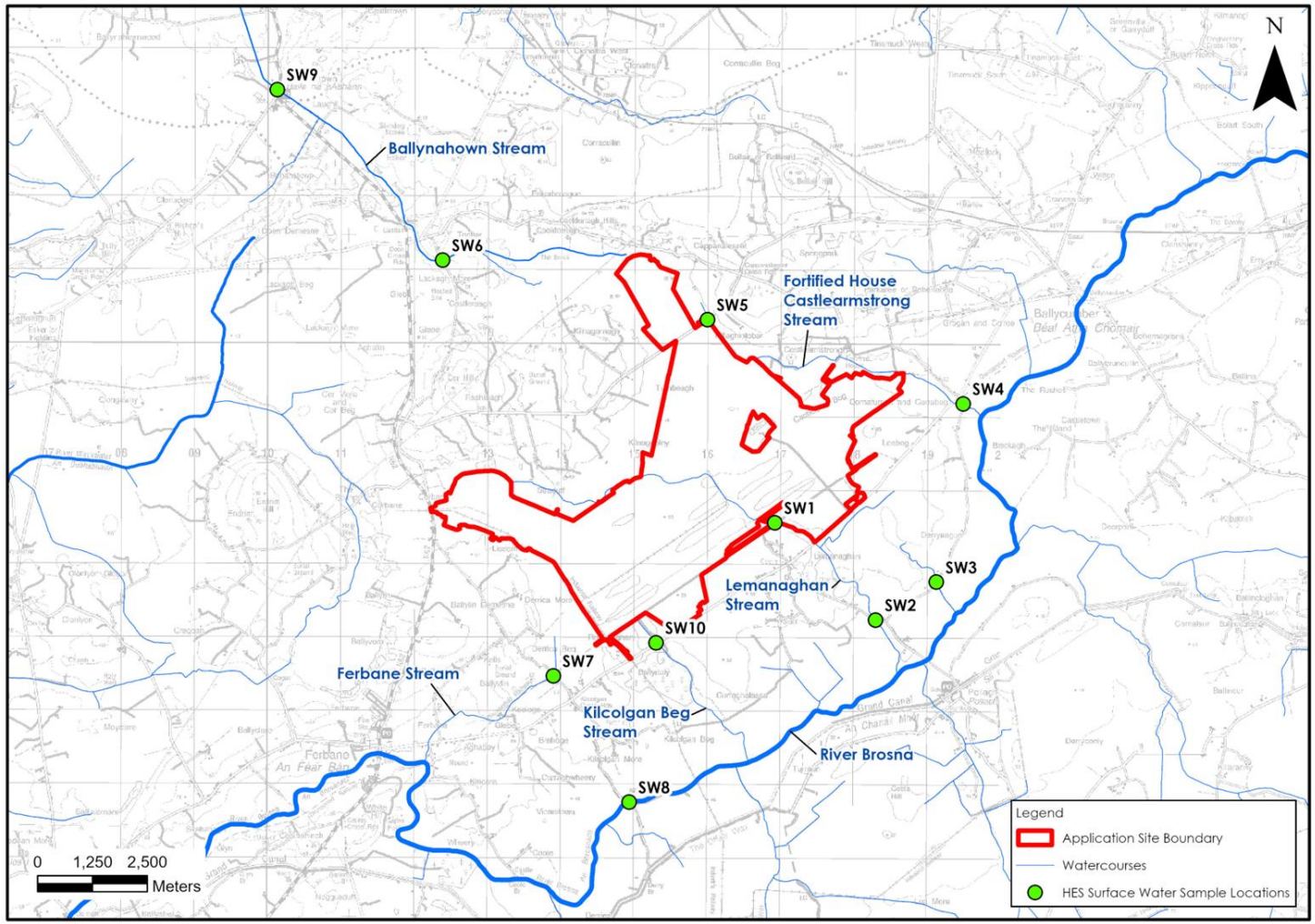

Figure 8-15: HES Surface Water Sampling Locations (2024-2025)

8.4.7 Hydrogeology

As stated in Section 7.3.5.1 of Chapter 7 – Land, Soils and Geology, the Application Site is underlain by several bedrock geological formations associated with the Ferbane Inlier, a northeast to southwest trending anticlinal fold which contains Devonian Kiltorcan-type Sandstones in its core. These sandstones are overlain by Dinantian Sandstones, Shales and Limestones which are in turn overlain by Dinantian Lower Impure Limestones. The Ferbane Fault is mapped along the northwestern side of the inlier and downthrows the succession to the northwest.

The bedrock geological formations which underlie the Application Site are predominantly classified by the GSI as being Locally Important Aquifers - Bedrock which is Moderately Productive only in Local Zones (Ll) (www.gsi.ie). These bedrock geological formations include the massive, unbedded, lime-mudstones of the Waulsortian Limestone Formation which underlie the northwest of the Application Site, the dark muddy limestones and shales of Ballysteen Formation and the limestone, mudstone and sandstones of Navan Beds. Meanwhile, the Old Red Sandstones, found in the core of the Ferbane Inlier, are classified by the GSI as a Locally Important Aquifer - Bedrock which is Generally Moderately Productive (Lm). A bedrock geology aquifer map is attached as Figure 8-16.

In terms of Groundwater Bodies (GWBs), the Application Site is underlain by a total of 3 no. GWBs. The vast majority of the Application Site is underlain by the Clara GWB (IE_SH_G_240). A small area in the north of the Application Site is underlain by the Inny GWB (IE_SH_G_110) whilst some of the south of the Application Site is underlain by the Ferbane GWB (IE_SH_G_089). The Boor Gravels GWB (IE_SH_G_258) is also located in close proximity to the Application Site.

The Clara GWB is described as poorly productive bedrock (PP). The GSI's Clara GWB Characterisation Report (GSI, 2003) states that this GWB is comprised of generally low transmissivity and storativity rocks. Groundwater flow generally occurs along fractures, joints and major faults, with flows generally concentrated in the upper 15m of the aquifer. Within the pure limestones, transmissivities may be enhanced due to limestone dissolution, with an epikarst layer likely to exist at the top of the Pure Unbedded Limestones (i.e. the Waulsortian Limestones in the area of the Application Site). Diffuse recharge occurs across much of this GWB but particularly where bedrock is close to the surface. Groundwater flow paths are short (<30-300m) with flow directions controlled by local topography. Groundwater discharges to the local streams and rivers which cross the GWB.

The Ferbane GWB underlies the south of the Application Site. The Ferbane GWB is characterised by productive fissured bedrock (FI). The GSI's Ferbane GWB Characterisation Report (GSI, 2003) states that this GWB is comprised of high transmissivity fissured bedrock associated with the Devonian Kiltorcan-type Sandstones. Transmissivities in the GWB are in the range of 20-90m^2/day. Diffuse recharge will occur across the GWB. Groundwater flow will be along fractures, joints and faults. The normal faults cutting across this GWB act as discharge zones for groundwater, particularly where the GWB is confined beneath the Clara GWB.

Meanwhile, a very small section in the north of the Application Site is underlain by the Inny GWB. This GWB is classified as poorly productive bedrock (PP). The GSI's Inny GWB Characterisation Report (GSI, 20030 states that this GWB is composed primarily of low permeability rocks, although localised zones of enhanced permeability occur along faults and in the vicinity of fault zones. Recharge occurs diffusely through subsoils but especially in upland areas of this GWB. Groundwater in generally unconfined, with most flow occurring near the surface of the rock. Groundwater flow paths will be short (30-300m) and groundwater will discharge to numerous surface waterbodies crossing the aquifer.

While diffuse recharge occurs across most of the GWBs described above, in the vicinity of the Application Site groundwater recharge is restricted by peat and its underlying low permeability lacustrine clay and shell marl. Groundwater movement through the underlying subsoil glacial deposits will be relatively slow unless higher permeability sands and gravels are present. Recharge is likely to be

limited to the perimeter of the site where the peat is thin or absent (the presence of peat will prevent rapid recharge to underlying regional groundwater systems).

Based on topography and regional surface water drainage flows, groundwater flow direction across much of the Application Site is likely to be southwards the Brosna River. Meanwhile in the north and northwest, groundwater flows towards the Boor and Blackwater rivers. Groundwater gradients in the area of the Application Site are low, reflecting surface topography.

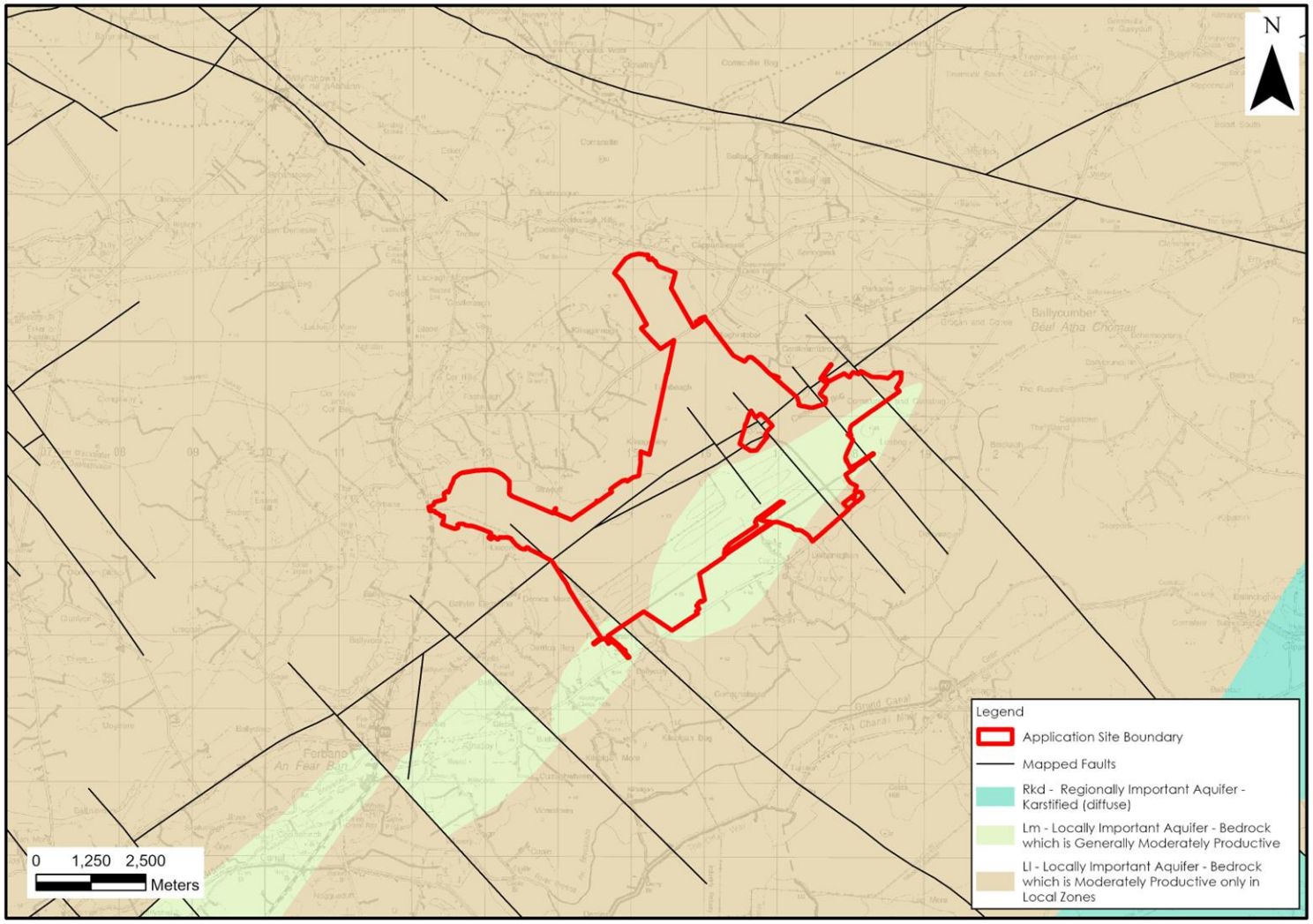

Figure 8-16: Bedrock Geology Aquifer Map

8.4.8 Groundwater Vulnerability

The GSI describe groundwater vulnerability as a term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities. Groundwater vulnerability embodies the characteristics of the intrinsic geological and hydrogeological features at a site that determine the ease of groundwater contamination. Groundwater vulnerability is related to recharge acceptance, whereby in areas where recharge occurs more readily, a higher quantity of contaminants will have access to groundwater.

The GSI mapped groundwater vulnerability rating of the bedrock aquifers underlying Application Site ranges from 'Low' to 'High'. The vast majority of the Application Site is mapped as having 'Low' groundwater vulnerability. A small region of 'Moderate' groundwater vulnerability is mapped towards the centre of the Application Site, in the lands surrounding the mineral soil island. Meanwhile, a very small, isolated pocket of 'High' groundwater vulnerability is mapped in the centre of the Application Site. This area corresponds with a small area mapped by the GSI as being underlain by gravels derived from limestones along the course of the EPA mapped Lemanaghan Stream.

Based on site walkover surveys and site investigations (722 no. peat probes, 63 no. trial pits and 10 no. boreholes), the Application Site is overlain by peat deposits with an average thickness of 2m. The peat is underlain by shelly marl, lacustrine clay and/or glacial till comprised of sandy silty/clay or silty/clayey sands or gravels. Bedrock was encountered at depths ranging from 1.7mbgl to 14.6mbgl with an average depth of 9.3mbgl. Given the presence of low permeability peat at the surface of Application Site which is in turn underlain by low permeability lacustrine clay and till, the groundwater vulnerability at the Application Site is considered to be predominantly 'Low'. Some local areas of 'Moderate' or 'High' groundwater vulnerability may occur where the overburden deposits are thin (refer to Table 8-15).

Groundwater recharge at the Application Site will be low and surface water is considered to be the main sensitive receptor. Therefore, local surface water features, such as drains and streams, are more vulnerable to pollution than groundwater at the Application Site.

Table 8-15: Groundwater Vulnerability and Subsoil Permeability and Thickness (Groundwater Protection Schemes Report 1999)

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	(Sand/gravel aquifers only)	(<30 m radius)
Extreme (E)	0 - 3.0m	0 - 3.0m	0 - 3.0m	0 - 3.0m	-
High (H)	>3.0m	3.0 - 10.0m	3.0 - 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0 - 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A = not applicable.
(2) Precise permeability values cannot be given at present.
(3) Release point of contaminants is assumed to be 1-2 m below ground surface.

8.4.9 Karst Features

Karst features are mapped by the GSI and available through the GSI online viewer (www.gsi.ie).

Groundwater vulnerability is extremely high in karst areas due to the high degree of interconnection between surface and groundwaters in these areas. However, the GSI do not map the presence of any karst features within the Application Site. Furthermore, no karst features were recorded during the site walkover surveys or site investigations (722 no. peat probes, 63 no. trial pits and 10 no. boreholes).

Several karst features are mapped in the land surrounding the Application Site, within the area mapped to be underlain by the Waulsortian Limestone Formation. Local karst features are shown in Figure 8-17. Karst features mapped within 1km of the Application Site are as follows:

- A swallow hole is mapped approximately 300m to the north of the Application Site in the townland of Castlearmstrong;
- A spring is mapped approximately 500m to the north of the Application Site in the townland of Castlearmstrong;
- A spring is mapped approximately 970m to the north of the Application Site in the townland of Parkaree; and,
- Superficial solution features associated with Ballylin Mushroom Rock are mapped approximately 1.15km southwest of the Application Site in the townland of Ballylin.

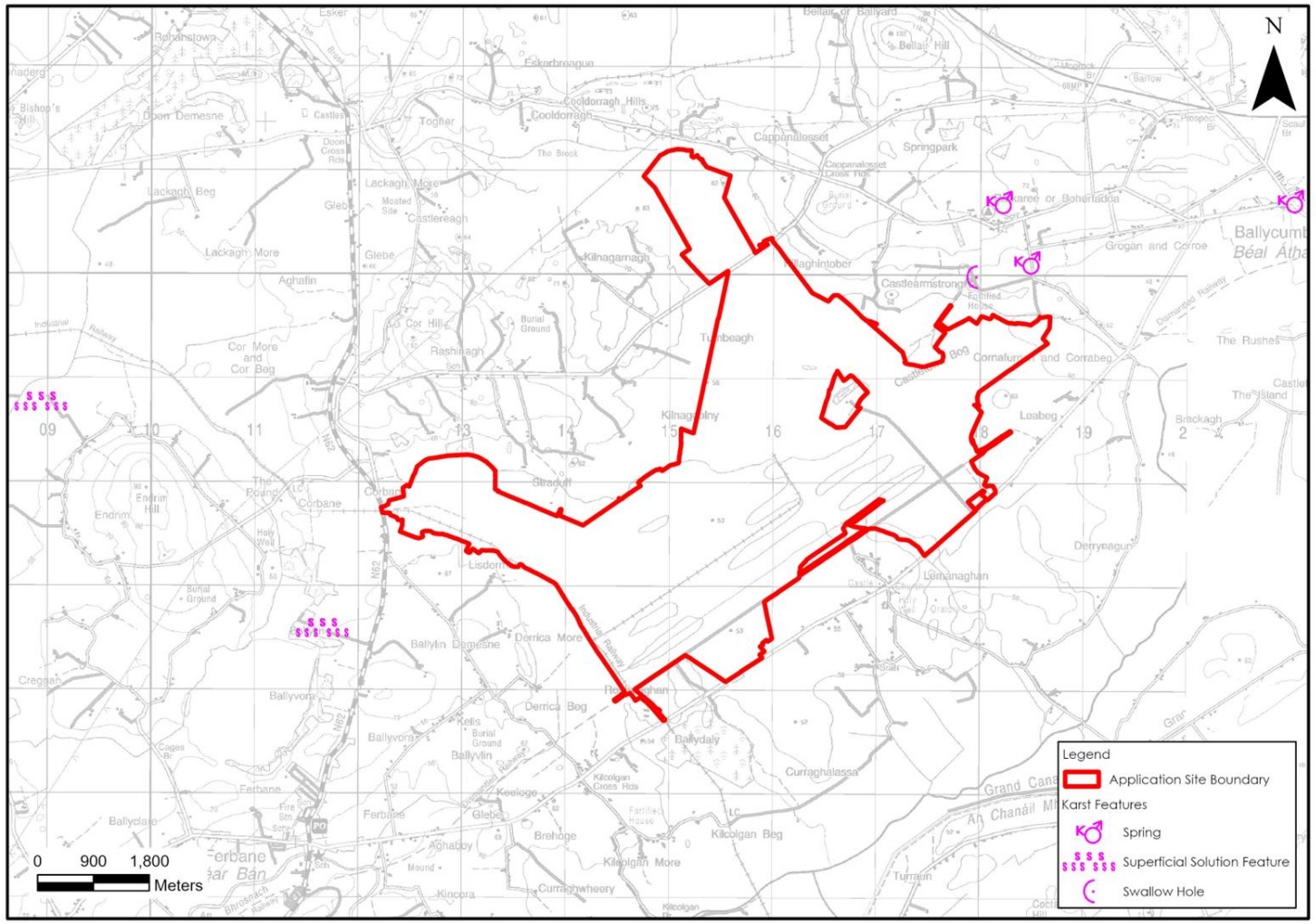

Figure 8-17: GSI Mapped Karst Features

8.4.10 Groundwater Hydrochemistry

There is no groundwater quality data for the aquifers underlying the Application Site. Groundwater sampling would generally not be undertaken during the process of peat extraction, as groundwater quality impacts would not be anticipated given the shallow nature of the peat extraction works, the presence of low permeability soils and subsoils which restrict groundwater recharge, and the low potential for groundwater dispersion and movement within the aquifer as outlined in the preceding sections. Consequently, no groundwater sampling was required as part of the IPC Licence conditions for the extraction of peat at the Application Site.

The GSI's Clara GWB Characterisation Report (GSI, 2003) states that hydrochemistry data for the Clara GWB is limited. Due to the nature of the bedrock geology, groundwaters within this GWB will have a calcium-bicarbonate signature. By analogy with nearby similar GWBs, groundwaters are likely to be very hard (ranging from 380-450mg/l $CaCO_3$) and with high electrical conductivities (600 – 800µS/cm). These values are typical of groundwaters from limestone and are typical of groundwaters in Co. Offaly. pH is generally neutral. Within the Lower Impure Limestones hydrogen sulphide can reach unacceptable levels, while iron and manganese may exceed EU Drinking Water Limits. These components come from the muddy parts of the rock units.

The GSI's Ferbane GWB Characterisation Report (GSI, 2003) states that groundwaters in the Ferbane GWB have moderate alkalinities (180-220mg/l $CaCO_3$), with conductivities ranging from 485-600µS/cm. pH is neutral to slightly alkaline. The hydrochemical signature of these groundwaters varies between calcium-bicarbonate to calcium-magnesium-bicarbonate, reflecting the ion exchange which occurs in this sandstone aquifer.

Meanwhile, no hydrochemistry data is available for the Inny GWB (GSI, 2003). However it can be assumed that these groundwaters will have a calcium-bicarbonate signature. The hydrochemistry of this GWB will vary between the different rock units however the Impure Limestones underlying the Application Site will have similar characteristics to the Clara GWB outlined above.

8.4.11 Water Framework Directive Water Body Status & Objectives

The EU Water Framework Directive (2000/60/EC), as amended by Directives 2008/105/EC, 2013/39/EU and 2014/101/EU ("WFD"), was established to ensure the protection of the water environment. The Directive was transposed in Ireland by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722/2003).

The Water Action Plan 2024 was published in September 2023 and is Ireland's 3rd River Basin Management Plan. It's objectives include the following:

- Ensure full compliance with relevant EU legislation;
- Build on the achievements of the 2nd Cycle;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2027;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at restoring impacted waters and protecting waters from deterioration.

Our understanding of these objectives is that surface waters, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures

employed, i.e. there should be no negative change in status at all. Furthermore any development must not in any way prevent a waterbody from achieving at least good status by 2027.

We note that there is no requirement to assess the peat extraction and ancillary activities at the Application Site which pre-date 2003 and the required transposition of the WFD Directive into Irish Law. The impacts of the activities on the WFD status of downstream and underlying waterbodies are assessed in Appendix 8-3.

8.4.12 Groundwater Body Status

Local Groundwater Body (GWB) status and risk results are available from (www.catchments.ie) and are summarised in Table 8-16 below. This status is defined based on the quantitative status and chemical status of each GWB.

All GWBs underlying the Application Site achieved 'Good' status in all 3 no. WFD cycles (2010-2015, 2013-2018 and 2016-2021). These GWBs have been deemed to be "not at risk" of failing to meet their respective WFD objectives. No significant pressures have been identified to be impacting upon these GWBs.

Table 8-16: WFD Groundwater Body Status

Groundwater body	Status 2010-2015	Status 2013-2018	Status 2016-2021	3rd Cycle Risk Status	WFD Pressures
Clara	Good	Good	Good	Not at risk	None
Ferbane	Good	Good	Good	Not at risk	None
Inny	Good	Good	Good	Not at risk	None
Boor Gravels	Good	Good	Good	Not at risk	None

8.4.13 Surface Water Body Status

A summary of the WFD status and risk result of Surface Water Bodies (SWBs) in the vicinity and downstream of the Application Site are shown in Table 8-17 below.

Within the Shannon Lower_SC_010 sub-catchment, SW22D discharges to the EPA named Ballynahown Stream. This stream forms part of the Boor_020 SWB which achieved 'Good' status in the latest WFD cycle (2016-2021). This was an improvement on the 'Moderate' status which this SWB achieved previously. Further downstream, the Boor_020 SWB discharges into the Shannon (Upper)_120 SWB. The Shannon (Upper)_120 and _130 SWBs achieved "Poor" and "Moderate" status respectively in the latest WFD cycle. Meanwhile, upstream of the Application Site , the Boor_010 SWB experienced a deterioration in WFD status from 'Good' status in the 1st cycle to 'Moderate' status in the subsequent cycles. Within this sub-catchment, the Boor_020 SWB is considered to be 'not at risk' of failing to meet its WFD objectives. No significant pressures have been identified to be impacting on this SWB. Further downstream, the Shannon (Upper)_120 SWB is deemed to be 'at risk' with hydromorphology listed as the significant pressure.

Within the Shannon Lower_SC_030 sub-catchment , the Blackwater(Shannonbridge)_010 and _020 SWBs downstream of the Application Site achieved "Poor" and "Moderate" status respectively in the latest WFD cycle. Both of these SWBs experienced a deterioration in WFD status from the 'Good' status which they were assigned in the 2nd WFD cycle (2013-2018). These SWBs are deemed to be 'at risk' of failing to meet their WFD objectives. Extractive industry (peat) has been listed as being the significant pressure on these SWBs. Note that there is no surface water discharge from the Application Site within this sub-catchment.

Meanwhile, within the Brosna_SC_060 sub-catchment, SW22, SW22A, SW22B and SW22C discharge to the EPA named Fortified House Castlearmstrong Stream which forms part of the Brosna_100 SWB.

SW19 and SW19A discharge to the Lemanaghan Stream_010 SWB whilst SW19B discharges to the EPA named Kilcolgan Beg Stream which forms part of the Brosan_110 SWB. These receiving SWBs all achieved 'Moderate' status in the latest WFD cycle. The Brosna_100 SWB achieved 'Moderate' status in all 3 no. WFD cycles, whilst the Lemanaghan Stream_010 SWB and the Brosna_110 SWBs experienced a deterioration in WFD status from the 'Good' status which they achieved in the 2nd WFD cycle 92013-2018). Further downstream the Brosna River (Brosna_120, 130 and 140 SWBs), the River Shannon (Shannon(Lower)_010, _020 and _030 SWBs) and Lough Derg all achieved 'Moderate' status in the latest WFD cycle. Meanwhile, upstream of the Application Site, the Brosna_090 SWB achieved 'Good' status in all 3 no. WFD cycles.

With respect to risk status, the Brosna River in the vicinity and downstream of the Application Site is 'deemed to be risk'. The risk status of the Lemanaghan Stream_010 SWB is currently 'under review'. Agriculture is listed as a significant pressures on the Brosna_100 and _110 SWBs in the vicinity of the Application Site. Hydromorphology is also listed as a significant pressures on the Brosna_110 SWB.

A full WFD Compliance Assessment is attached as Appendix 8-4.

Table 8-17: Summary WFD Information for Surface Water Bodies

River Waterbody	Status 2010-2015	Status 2013-2018	Status 2016-2021	3rd Cycle Risk Status	WFD Pressures
Shannon Lower_SC_010 sub-catchment					
Boor_010	Good	Moderate	Moderate	At risk	Anthropogenic
Boor_020	Moderate	Moderate	Good	Not at risk	None
Shannon(Upper)_120	Poor	Poor	Poor	At risk	Hydromorphology
Shannon(Upper)_130	Unassigned	Poor	Moderate	Under Review	None
Shannon Lower_SC_030 sub-catchment					
Blackwater(Shannonbridge)_010	Moderate	Good	Poor	At Risk	Extractive Industry
Blackwater(Shannonbridge)_020	Good	Good	Moderate	At Risk	Extractive Industry
Brosna_SC_060 sub-catchment					
Brosna_090	Good	Good	Good	Not at risk	None
Brosna_100	Moderate	Moderate	Moderate	At risk	Agriculture
Lemanaghan Stream_010	Unassigned	Good	Moderate	Under Review	None
Brosna_110	Good	Good	Moderate	At Risk	Agriculture & Hydromorphology
Brosna_120	High	Good	Moderate	At risk	Agriculture
Brosna_130	Good	Moderate	Moderate	At risk	Anthropogenic
Brosna_140	Moderate	Moderate	Moderate	At risk	Hydromorphology
Shannon(Lower)_010	Unassigned	Unassigned	Moderate	Under Review	None
Shannon(Lower)_020	Good	Moderate	Moderate	At risk	Anthropogenic
Shannon(Lower)_030	Unassigned	Moderate	Moderate	Under Review	None
Lough Derg	Poor	Moderate	Moderate	At risk	Agriculture, Hydromorphology & Invasive Species

8.4.14 Designated Sites and Habitats

Within the Republic of Ireland designated sites include National Heritage Areas (NHAs), Proposed National Heritage Areas (pNHAs), candidate Special Areas of Conservation (SAC) and Special Protection Areas (SPAs).

The Application Site is not located within any designated site. However, there are downstream hydrological connections to the designated sites as described below.

Within the Shannon Lower_SC_010 sub-catchment, the River Shannon Callows SAC/pNHA (Site Code: 000216) and the Middle Shannon Callows SPA (Site Code: 004096), are located approx. 9km to the northwest of the Application Site. The Application Site is hydrologically connected to this SAC/pNHA/SPA via the Ballynahown Stream (receives discharge from SW22D) and the Boor River. The length of the hydrological flowpath between the Application Site and this SAC/pNHA/SPA is approx. 10.5km.

Within the Brosna_SC_060 sub-catchment, the River Shannon Callows SAC/pNHA (Site Code: 000216) and the Middle Shannon Callows SPA (Site Code: 004096), are located approx. 13.6km to the southwest of the Application Site. The Application Site is hydrologically connected to this SAC/pNHA/SPA via the tributaries of the Brosna River which receive discharge from the Application Site (SW22, SW22A, SW22B, SW22C, SW19, SW19A and SW19B). The length of the hydrological flowpath between the Application Site and the SAC/pNHA/SPA in this sub-catchment is approx. 22.1km.

Meanwhile, there is no direct hydrological connection to any designated site within the Shannon Lower_SC_030 sub-catchment due to the lack of any surface water discharge.

With respect to timelines, the Middle Shannon Callows SPA was designated in 1996, whilst the River Shannon Callows SAC was designated in 2002. Therefore, the baseline environment at the time of designation occurred during the Peat Extraction Phase.

Other designated sites in the vicinity of the Application Site are as follows:

- Clara Bog SAC and pNHA (Site Code: 000572), approx. 3.6km to the east. This SAC/pNHA is located upstream and upgradient of the Application Site;
- Ferbane Bog SAC and pNHA (Site Code: 000575), approx. 1.9km to the west. This SAC is located upstream and upgradient of the Application Site;
- Grand Canal pNHA (Site Code: 002104), approx. 2.1km to the south. This pNHA lies to the south of the Brosna River which acts as a hydrological barrier between the Application Site and this pNHA;
- Ballyduff Esker pNHA (Site Code: 000885), approx. 8.5km to the east. This pNHA is located upstream and upgradient of the Application Site;
- Woodfield Bog pNHA (Site Code: 000586), approx. 9km to the northeast. This pNHA is located upstream and upgradient of the Application Site;
- Clonydonnin Bog NHA (Site Code: 000565), approx. 2.5km to the north. There is no hydrological connection between the Application Site and this NHA;
- Kilkormac Esker pNHA (Site Code: 00906), approx. 9km to the southeast. The Brosna River acts as a hydrological barrier between the Application Site and this pNHA;
- Lough Boora pNHA (Site Code: 001365), approx. 7km to the south. The Brosna River acts as a hydrological barrier between the Application Site and this pNHA;
- Moyclare Bog SAC and pNHA (Site Code: 000581), approx. 5.5km to the west. This SAC is located upstream of the Application Site;
- Pilgrim's Road Esker SAC (site Code: 001776), approx. 7.8km to the northwest. There is no hydrological connection with this SAC;

- Mongan Bog SAC/pNHA (Site Code: 000580) and SPA (Site Code: 004017), approx. 9km to the northwest There is no hydrological connection with this SAC;
- Doon Esker Wood pNHA (Site Code: 001830), approx. 4km to the northwest. There is no hydrological connection between the Application Site and this pNHA;
- Clonlyon Glebe Bog pNHA (Site Code: 000893), approx. 4km to the west. This pNHA is located downstream of the Application Site on the southern banks of the Blackwater River. However, there is no discharge from the Application Site within this sub-catchment; and,
- Fin Lough SAC and pNHA (Site Code: 000576), approx. 8.5km to the northwest. The Blackwater River acts as a hydrological barrier between the Application Site and this SAC/pNHA.
- A map is local designated sites is shown as Figure 8-18.

Nutrient Sensitive Areas

The Brosna River to the south, and downstream of the Application Site, is identified as a Nutrient Sensitive Area (NSA) under the WFD. The River Shannon downstream of the Boor River is also listed as an NSA.

Designated Salmonid Waters

No watercourses in the vicinity or downstream of the Application Site are designates salmonid protected waters.

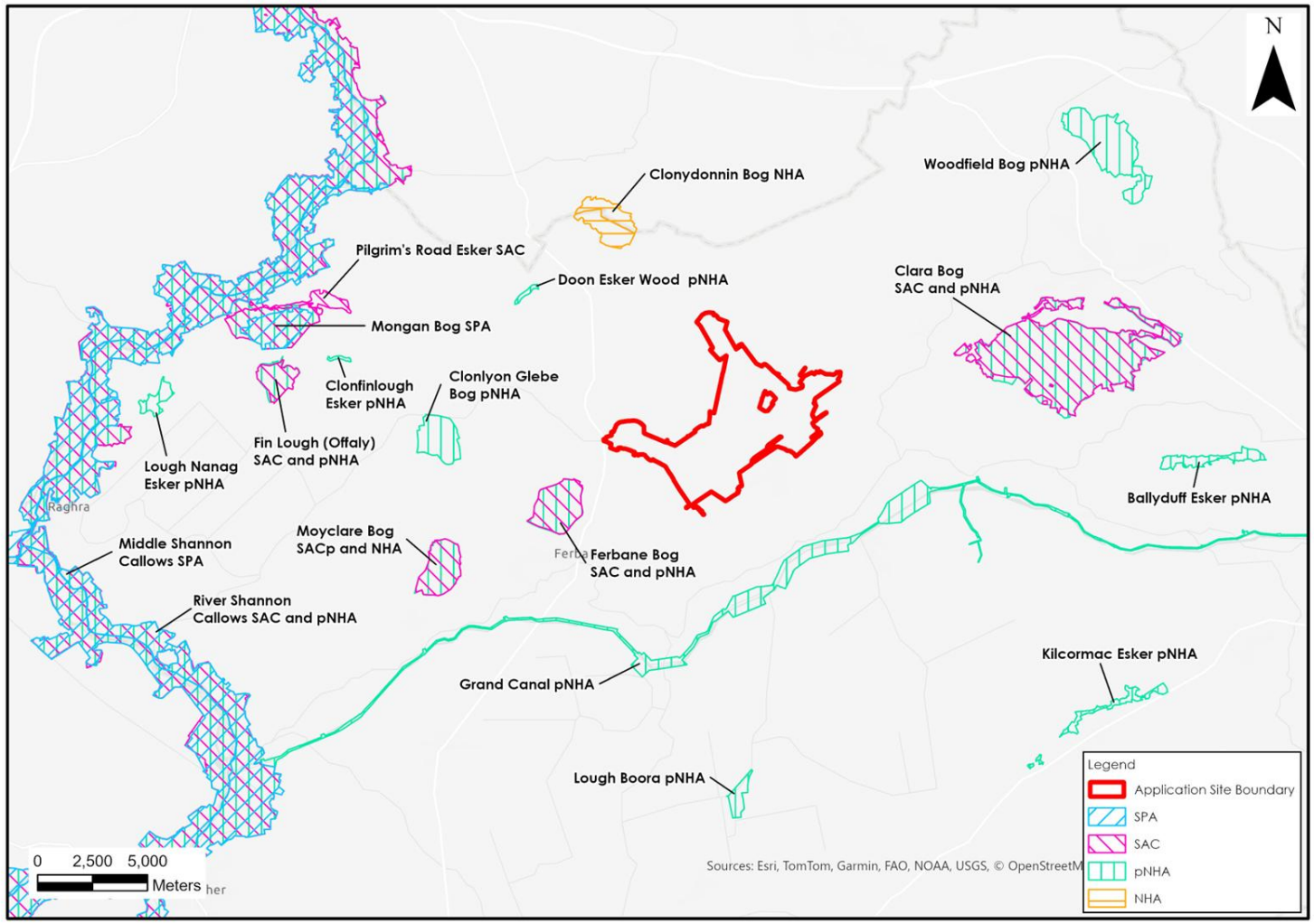

Figure 8-18: Map of Local Designated Sites

8.4.15 Water Resources

8.4.15.1 Groundwater Resources

There are no mapped Public Water Supplies (PWS) or Group Water Schemes (GWS) within the Application Site. Local groundwater resources are shown on Figure 8-19.

The closest GSI mapped GWS is the Boher Leamonaghan GWS, located approximately 0.6km northeast of the Application Site in the townland of Castlearmstrong. The mapped source protection area for this GWS does not fall within the Application Site. At its closest point the southern boundary of the source protection area is 400m north of the Application Site.

The closest mapped Public Water Supply (PWS) is the Ferbane PWS, located approximately 2.5km southwest of Ferbane in the townland of Skehanagh. The mapped outer source protection area for this PWS is located in excess of 5km from the Application Site. The boreholes associated with the Ferbane PWS are located ~5.3km from the Application Site.

A search of private well locations (wells with location accuracy of 1–50m were only sought) was undertaken using the GSI well database (www.gsi.ie). Several wells are mapped by the GSI in the vicinity of the Application Site. The groundwater well associated with the Boher GWS spring (GSI Well Name: 2021NEW002), with a locational accuracy of up to 20m, is mapped in the townland of Castlearmstrong, approximately 250m from the Application Site. Another borehole with a locational accuracy of 20m is mapped approximately 900m from the Application Site at Boher National School (GSI Well Name: 2023SEW003). 2 no. wells with a locational accuracy of 100m are mapped in the townland of Kilnagarnagh.

To overcome the poor accuracy problem of other GSI mapped wells it is conservatively assumed (for the purpose of assessment only) that every private dwelling in the area has a well supply and this impact assessment approach is described further below. (Please note wells may or may not exist at each property, but our conservative rationale here is that it is better to assume a well may exist at each downgradient property and assess the potential impacts from the Project on such assumed wells, rather than make no assessment and find out later that groundwater wells do actually exist).

An information request was submitted to Uisce Éireann for the location of all Uisce Éireann groundwater abstraction locations within 5km of the Application Site was submitted. A total of 2 no. Uisce Éireann groundwater abstraction points were identified within 5km of the Application Site. These 2 no. groundwater wells are associated with the Boher (Boher Lemanaghan) GWS. 1 no. well, referred to by Uisce Éireann as the Castlearmstrong Well 1 is located approximately 80m from the Application Site in the townland of Castlearmstrong. Castlearmstrong Well 1 is adjacent to Well 2. A second supply, referred to by Uisce Éireann as the Bellair Well, is located approximately 1.3km from the Application Site in the townland of Bellair. No other Uisce Éireann groundwater well supplies were identified within 5km of the Application Site.

8.4.15.2 Surface Water Resources

In terms of surface waters, several SWBs downstream of the Application Site have been listed in Article 7 Abstraction for Drinking Water.

The Shannon(Upper)_120 SWB has been identified as a Drinking Water Protected Area (DWPA). This DWPA is associated with the Uisce Éireann's abstraction for the Athlone Water Supply. The maximum daily abstraction volume is 19,350m^3/day. The river intake is located on the River Shannon downstream of Lough Ree (upstream of the Application Site). The Shannon (Lower)_010 SWB is also listed as a DWPA. This abstraction is associated with the Banagher PWS with a daily abstraction volume of 2,688m^3/day. This PWS is located downstream of the Application Site.

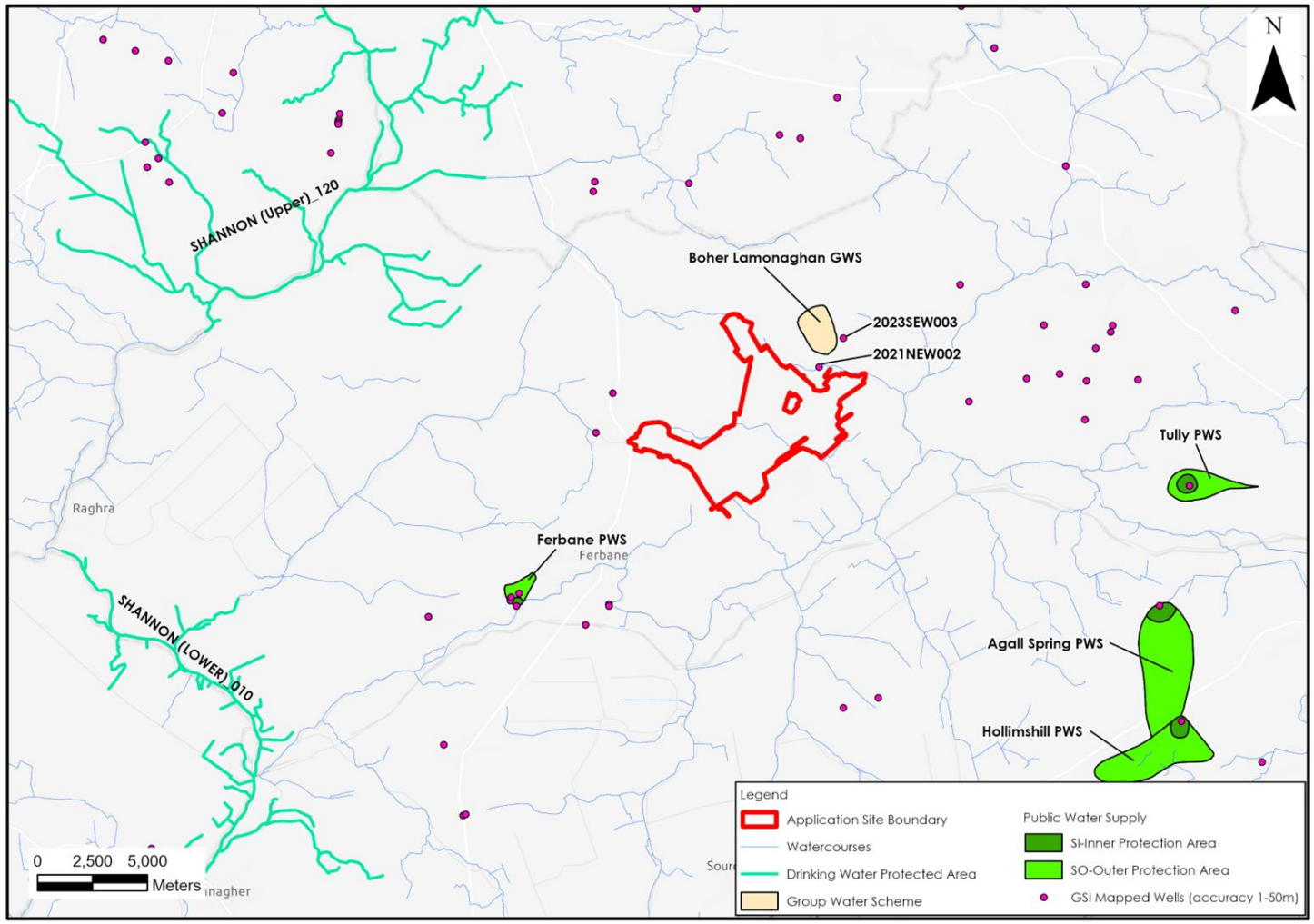

Figure 8-19: Groundwater Resource Map

8.4.16 Receptor Sensitivity

Due to the nature of peat extraction and ancillary activities, being near surface activities, impacts on groundwater quality and quantity are generally negligible as there is still considerable depths of peat remaining at the Application Site, although deep perimeter drains may have local drainage impacts on surrounding land. Surface water quality is the main sensitive receptor as drainage of the Application Site will potentially have altered the local natural hydrological regime.

Based on the criteria set out in Table 8-2 above, the Locally Important Aquifers underlying the Application Site can be classed as being of Medium Importance. The primary risks to groundwater during peat extraction and ancillary activities, would have been from hydrocarbon spillage and leakages from plant serving and facilitating the peat extraction and ancillary activities. The Application Site is covered in cutover peat which in turn is underlain by lacustrine clay and/or silt dominated glacial deposits and these layers act as a protective cover to the underlying bedrock aquifers. The glacial deposits are not mapped as an aquifer in this area, but they are likely to be used locally as a water supply and therefore they can also be classed as sensitive to groundwater pollution. However, due to the presence of the peat and silt/clay layers (which have low permeability and act as a barrier to infiltration), any contaminants which may be accidentally released on-site are more likely to travel to nearby streams within surface runoff.

For the purposes of a conservative assessment the following groundwater receptors are included in the impact assessment:

- The Locally Important Bedrock Aquifers underlying the Application Site;
- The WFD status of the Clara, Inny and Ferbane GWBs (the Boor Gravels GWB has not been included in the impact assessment as it does not overlap with the Application Site);
- The Boher Leamonaghan GWS (note that the Ferbane PWS has been omitted from the impact assessment due to its distant location from the Application Site (>5km) and the near surface nature of the peat extraction and ancillary activities); and,
- All private groundwater wells supplies in the lands surrounding the Application Site.

Surface waters are the main sensitive receptors associated with the Project given that the Application Site discharges via 8 no. surface water outfalls to tributaries of the Boor and Brosna rivers. At the beginning of the assessment period i.e., the July 1988 baseline, the Brosna, Boor and Blackwater rivers in the vicinity of the Application Site were of Very High Importance due to their baseline 'High' and 'Good' biological Q-ratings. During peat extraction and ancillary activities, the main risks to local surface water quality would have been increased concentration of suspended solids and increased flow volumes downstream. In addition, hydrocarbon spillage and leakages would have been a constant potential threat to water quality during peat extraction and ancillary activities.

The following surface water receptors are included in the impact assessment:

- The EPA named Ballynahown Stream and the Boor River further downstream which receive discharge from the Application Site via SW22D;
- The EPA named Fortified House Castlearmstrong Stream, and the Brosna River further downstream, which receive discharge from the Application Site via SW22, SW22A, SW22B and SW22C;
- The EPA named Lemanaghan Stream, and the Brosna River further downstream, which receives discharge from the Application Site via SW19 and SW19A;
- The EPA names Kilcolgan Beg Stream, and the Brosna River further downstream, which receive discharge from the Application Site via SW19B;

- The Blackwater River has been included for the purposes of a conservative assessment given its proximity to the Application Site, however, it is important to note that there are no surface water discharges to this river or any of its tributaries; and,
- The WFD status of all receiving SWBs downstream of the Application Site.

In terms of designated sites, the River Shannon Callows SAC/pNHA and the Middle Shannon Callows SPA are included in the impact assessment given the hydrological connectivity which exists between the Application Site and the River Shannon. All other designated sites have been screened out of the impact assessment given their distant location from the Application Site and the lack of hydrological or hydrogeological connectivity.

The surface water abstraction associated with the Banagher PWS (Shannon (Lower)_010 DWPA) is also included in the assessment due to its location downstream of the Application Site. The Athlone PWS (Shannon (Upper)_120 DWPA) has been screened out of the impact assessment due to its location upstream of the Application Site.

8.5 Characteristics of the Project

8.5.1 Peat Extraction Phase (July 1988 – June 2020)

A full description of the peat extraction and ancillary activities completed at the Application Site from July 1988 to June 2020 are described in detail in Chapter 4.

By 1988 peat extraction and ancillary activities were well established at the Application Site. Sod peat extraction had ceased and milled peat extraction was well underway. By this time drainage had been inserted and railway infrastructure was in place. The main access point to the Application Site was off the Regional Road R436 to the south of the Application Site, into the Lemanaghan Works area. Drainage was already installed, predominantly in a northwest-southeast orientation. The Application Site included 9 no. artificial silt ponds, 9 no. surface water discharge points and 8 no. gravity flow surface water outflows which remain in-situ today.

During this time period milled peat extraction occurred at the Application Site. Milled peat extraction requires good solar drying condition and can occur anytime from April onwards once suitable drying conditions are present. There are 4 no. stages involved in the process of milled peat extraction outlined below:

- Milling – Involves breaking the top 10-15mm of the peat surface into peat crumbs by powered milling drums which are towed behind tractors. This layer if milled peat has a moisture content of approximately 80%.
- Harrowing – The peat crumbs are left to dry after milling. To assist the drying process, the loose peat is harrowed and turned over. The harrow consists of a series of spoons which are towed behind a tractor.
- Ridging – Once the peat has dried to 45-55% moisture content it is gathered into ridges in the centre of each production field. The ridger consists of a pair of blades towed in an open V behind a tractor, which channels the loose crop into a ridge.
- Harvesting – This is the final stage in the milling process. Each ridge is lifted by a harvester and transferred and dropped on top of the adjoining fields ridge, until 5 ridges have been accumulated together forming a peat storage stockpile. These stockpiles are covered until ready for use. There are approximately 12 harvests a year, depending on weather conditions.

As part of the development of the bog for milled peat extraction, parallel surface water drains were created at intervals of 15m, with the section of bog between the drains referred to as production fields. The fields are slightly convex to facilitate runoff and to prevent surface water ponding. The drains fall towards the headland, located at the ends of the production fields. The drains are piped across the

headland, allowing machinery to pass from one field to the next. The drainage network then continues to a series of silt ponds prior to discharging to a local watercourse. By 1988, milled drainage had already been implemented across much of the Application Site. Only small areas around the perimeter of the Application Site had not been drained at this time.

The peat extraction areas were served by a railway line which was moved around the Application Site as different areas came in and out of production. During this period several level crossings, rail underpasses, and other infrastructures were constructed at the Application Site to support peat extraction operations. A welfare facility was also provided at the Application Site. This took the form of a small building and provide workers on peat extraction fields a clean area to take lunch/tea breaks and provide welfare facilities. While facilities were available at the Lemanaghan Works offices adjacent to the Application Site, this smaller outpost was situated on the Application Site to provide easier access to workers further away from the central works buildings. The facility includes a septic tank and provided welfare facilities for workers at the Application Site during the Peat Extraction Phase. This facility was constructed between 2004 and 2009.

In terms of environmental monitoring, control and monitoring measures have been implemented at the Application Site since May 2000 in accordance with IPC Licence conditions (Refer to Section 4.7). Prior to 2000, control measures were also implemented with respect to silt control, storage and maintenance of machinery, refuelling and waste management (refer to Section 4.3.5).

8.5.2 Current Phase (June 2020 – Present Day)

The Current Phase of the Project includes all activities carried out at the Application Site from the cessation of peat extraction in June 2020 to the present day.

During this period activities at the Application Site have been limited to the undertaking of decommissioning activities as outlined in Section 4.8. of Chapter 4, with no industrial peat extraction occurring. All peat stockpiles had been removed from the Application Site by 2024. The decommissioning works relating to the railway network within the Application Site are estimated to be completed by 2025.

The drainage infrastructure, silt ponds and surface water discharge locations continue to be in operation and to be maintained as per the IPC Licence requirements. The silt ponds are maintained in accordance with Condition 6 of the IPC Licence, which states that all drainage from boglands is discharged via appropriately designed silt ponds which are desilted twice a year. The silt arising from these operations is either stockpiled a safe distance from drainage features or spread onto peat extraction fields.

Environmental monitoring continued during the Current Phase of the Project in accordance with IPC Licence conditions.

8.5.3 Remedial Phase

It is currently proposed to implement a Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan at the Application Site. This rehabilitation is required in order to fulfil the requirements of Condition 10.2 of the IPC Licence No. P0500-01. The Draft Cutaway Bog Decommissioning and Rehabilitation Plan (2024), included as Appendix 4-2, will be subject to consultation as well as input from the EPA prior to their implementation across the Application Site.

The objective of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan is to stabilise and rehabilitate the peat bog within the Application Site. The plan uses bespoke interventions designed to firstly stabilise the environment and secondly to rehabilitate the site as much as possible by placing the existing peatland environments on a path towards naturally functioning peatlands.

The Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan for the Application Site will be undertaken using standard best practices (refer to Appendix III of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan included as Appendix 4-2).

Prior to the finalisation of and submission of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan to the EPA, a baseline ecology survey will be carried out to determine the status of natural colonisation, the potential for targeted revegetation and/or rewetting and the future development at the Application Site to ensure stabilisation of the future cutaway. The Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan which outlines the proposed rehabilitation for the Application Site has been prepared. The most appropriate rehabilitation approach is chosen for individual areas of the bog reflecting local ecological and hydrological factors. Table 8-18 outlines a high-level overview of the actions proposed. Further details can be found in the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan in Appendix 4-2.

The Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan comprises short-term planning actions, short-term practical actions and long-term actions. The initial short-term planning actions will involve seeking approval of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan from the EPA. In addition, detailed site plans of how the various rehabilitation measures will be applied will be developed and a review of all issues and constraints which may affect how the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan will be completed. The short-term planning actions will also ensure that all activities associated with the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan will be completed in accordance with the requirements of the IPC Licence. Several short-term actions will be completed in the first 2 years following EPA approval of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan . These actions will include intensive drain blocking and monitoring of the rehabilitation measures. Silt ponds will continue to function during this phase. Longer term actions (>3 years) include the evaluation of the success of the short-term rehabilitation measures and undertake further remediation where necessary. Long-term monitoring, aftercare and maintenance will be completed until the IPC Licence is surrendered. We understand that during this phase of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan , silt ponds will be assessed and decommissioned if necessary.

Much of the work associated with the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan will occur during the initial stages of the plan. Once drain blocking and other measures have been implemented the operational activities will comprise non-intrusive ecological and hydrological monitoring and may also include minimal maintenance and repair works.

Table 8-18: Type of and areas for rehabilitation measures at Lemanaghan Bog

Type	Code	Description	Area (Ha)
Deep peat cutover bog	DPT1	Regular drain blocking (3/100 m) + modifying outfalls and managing water levels with overflow pipes	441
Dry cutaway	DCT1	Modifying outfalls and managing water levels with overflow pipes	328
Wetland cutaway	WLT1	Modifying outfalls and managing water levels with overflow pipes	122
Marginal land	MLT1	No work required	110
Constrained area	Constraint	Constraint - active turbary	113

Total Area		1114[3]

**Note that the types of rehabilitation and areas of rehabilitation may change in response to stakeholder consultation and refinement of the rehabilitation measures.*

8.6 Assessment of Significant Effects and Control/Mitigation Measures

8.6.1 Do -Nothing Scenario

As outlined in the EPA Guidelines (May 2022), the description of 'Do-Nothing Effects' relates to the environment as it would be in the future should the Project not be carried out. Peat extraction was underway at the Application Site prior to the required date for the transposition of the EIA Directive in 1988. If peat extraction and related activities had ceased from 1988 onwards, then consequently there would have been no further peat extraction from the site and therefore no impact on Hydrology and Hydrogeology.

For those lands which as of 1988 had been subject to the installation of drainage in preparation for peat extraction but not peat extraction itself, it is assumed in the 'do-nothing' scenario that drainage would have remained insitu. Maintenance works to keep established drainage channels clear would have ceased as of 1988 in the 'do-nothing' scenario. It is likely that these areas would have been subject to natural recolonisation of the bog surface.

However, consideration must be given to the following:

- The legislative mandate given to Bord na Móna in the form of the Turf Development Act 1946, as amended) to acquire and develop peatlands; and
- The uncertainty with respect to the planning status of the activity did not arise until 2019 and was not evident in 1988.

Therefore, this 'Do-Nothing' option was not the chosen option. Peat extraction and ancillary activities have occurred at the Application Site from July 1988 onwards. A decision to cease peat extraction at the Application Site was taken in 2020 and the Application Site needs to be considered in the context of regularising (without prejudice) the planning status of the lands to facilitate future development (subject to planning consent as required). The Application Site has and will continue to revegetate, and there will be a change from areas of cutover peatland to revegetated peatland. These are described in the individual chapters of the rEIAR.

As part of Bord na Móna's statutory obligations under IPC Licence requirements, a Cutaway Bog Decommissioning and Rehabilitation Plan will continue to be implemented for the Application Site separate to, and independent of, the Substitute Consent application. The implementation of this plan is included in the impact assessment below.

8.6.2 Identification of Impacts

8.6.2.1 Peat Extraction Phase (July 1988 – June 2020)

The Peat Extraction Phase of the Project includes all peat extraction and ancillary activities undertaken from July 1988 to the cessation of peat extraction in June 2020.

[3] *Total hectares are inclusive of the Application Site and adjacent bogs Curraghlassa and Derrynagun, as discussed in the Decommissioning and Bog Rehabilitation Plan 2024.*

8.6.2.1.1 Effects of Bog Drainage on Bog Hydrogeology

Impacts on bog hydrogeology can occur through drainage, both by surface water drainage and by groundwater drainage. Surface water drainage (increased frequency of drains and deeper perimeter drains) can impact peat water levels and have an indirect impact on surface vegetation. Increased drainage can also lead to increased runoff volumes from bog units, and this can alter the hydrology (by increased flow volumes, and increased magnitude of downstream flooding events) of the downstream receiving waters. Deep perimeter (bog perimeter) drains can alter the local underlying groundwater hydrogeology as they often intersect the mineral soil layers below the bog.

To determine likely Zones of Influence (ZoI) of bog drainage infrastructures HES has previously completed a Peatland Hydrology Study as defined in Appendix 8-4. From that study, the following conservative ZoIs are defined for the Applicant's bog units:

- Field drains can have a ZoI on peat water levels at a distance of up to 30m;
- Deep perimeter bog drains can have a ZoI on peat water levels at a distance of <100m;
- The ZoI of facebank drains depends on the height of the facebank. But a conservative ZoI for a 1.5m high facebank drain is 60m; and,
- The ZoI of Bord na Móna's pumping stations (which are generally <5m deep) on local groundwater levels is likely to be <300m (Please note that 2 no. pumping stations were located at the Application Site during the Peat Extraction Phase).

These ZoIs are used in the assessment below, and also in the assessment of impacts on designated sites and groundwater supplies.

As stated in Section 8.3.2 the vast majority (approximately 968.7ha) of the Application Site had been drained by 1988 and was subject to peat extraction. Meanwhile, an area of approximately 65.1ha in the north of the Application Site, to the north of the local road, had been drained but had not yet been subject to peat extraction. Several smaller areas around the perimeter of the Application Site had not been drained at this time.

Following the initial drainage, which preceded July 1988, there would have only been minor annual changes in local bog hydrology and hydrogeology associated with the annual removal of peat and the deepening of drains if required. According to figures supplied by the Applicant, the total volume of peat removed from the Application Site from July 1988 to June 2020 is estimated to be 3,351,248 tonnes (4,021,498m^3 with an average of 125,672m^3 extracted per year). The depths of peat removed from each area of the Application Site would vary as each area has experienced its own unique history of peat extraction. As peat can act as a hydraulic sponge providing storage of water, the removal of peat potentially acts to reduce the [water] storage capacity of the Application Site. However, when peat water levels within the Application Site were reduced historically through initial bog drainage, the [water] storage capacity of the top ~0.5 – 1m of peat (dependent on the depth of drains) was essentially removed.

As such, the primary and significant hydrological and hydrogeological changes commenced when the initial drainage occurred and the development of ancillary activities was installed (e.g. railway lines, machine passes, canteen structures, work sites, welfare facilities, mobile fuel tanks, fixed fuel tanks, and peat loading facilities). These works predate July 1988.

Pathways: Groundwater volume and water level drawdown.

Receptors: Peat Bog Hydrogeology.

Assessment of effects in the absence of control measures: As the vast majority of the Application Site was already drained by July 1988, the effect of continuing peat extraction until June 2020 would not have resulted in any major alteration of the local hydrogeological regime. The peat water table and

underlying groundwater table at the bog had already been locally lowered during their initial draining which pre-dated July 1988. Only minor annual changes would have occurred during this phase of the Project. The effects on bog hydrogeology in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.1.1 *i.e.* permanent, moderate, negative, direct, long-term likely effect on the bog hydrogeology, and is Not Significant.

Control Measures:

The following measures were in place to mitigate against the effects of groundwater drainage of the bog on the bog hydrogeology:

- Field drains with low gradients and shallow depths (<1.0m);
- Silt ponds, as well as being a control measure for sediment from the bog, also acted as attenuation measures for higher flows during peak rainfall events. Each metre length of silt pond provides ~12m3 of water storage, which aided in slowing down the discharge from the bog units;
- Silt ponds were cleaned at least twice a year to maintain adequate storage and treatment (sedimentation/settlement) capacity; and,
- Pipeline capacities were designed based on a runoff rate of 1.7l/s/Ha, which is equivalent to the greenfield runoff rates.

8.6.2.1.2 *Effects of Bog Drainage on Downstream Surface Water Hydrology/Quality*

Hydrological changes at the Application Site commenced when the initial drainage occurred. The initial implementation of the bog drainage was at that time a significant change to the local hydrology. Peat can act as a hydraulic sponge providing storage of water. However, with the implementation of bog drainage, the water levels in the peat bog are lowered and the capacity of the bog to store water is reduced. The available water storage within the bog would have provided a small buffer for downstream flooding.

In terms of surface water quality, the primary potential negative impact on surface water quality would be the increase in suspended solid entrainment in surface waterbodies. The greatest risk of suspended sediment entrainment occurs during times of major earthworks, such as during the removal of vegetation and the construction of the bog drainage network. This potential pathway would pose a significant risk to local surface water quality downstream of the Application Site.

By 1988 the vast majority of the Application Site was already artificially drained. Consequently, the continued drainage of the bog during the Peat Extraction Phase of the Project would have been limited in its potential to alter the hydrological regime in downstream watercourses. However, during the Peat Extraction Phase, there was an ongoing risk of elevated concentrations of suspended solids making their way into downstream surface watercourses from the erosion of peat sediment via the bog drainage network. This potential pathway would pose a significant risk to local surface water quality, particularly as the Boor, Blackwater and Brosna River were all of Very High Importance in 1988. Other water quality parameters of concern are ammonia and Chemical Oxygen Demand (COD).

Note that the potential for effects on the Blackwater River is limited as there was no outfall from a silt pond within this catchment. However, it is included for the purposes of a conservative assessment. The main potential for effects will be on the tributaries of the Brosna River (Fortified House Castlearmstrong Stream, Lemanaghan Stream and Kilcolgan Beg Stream) and the Boor River (Ballynahown Stream) which received discharge from the drainage system at the Application Site. The potential for effects would have been reduced further downstream in the Boor and Brosna rivers due to the increased flows in these watercourses (refer to Section 8.4.3).

Pathway: Drainage and surface water discharge routes.

Receptor: Surface water quality and quantity in the receiving streams (Ballynahown, Fortified House Castlearmstrong, Lemanaghan and Kilcolgan Beg streams) and down gradient rivers (Boor, Blackwater and Brosna River).

Assessment of effects in the absence of control measures: In the absence of the control measures relating to surface water management, the effect could potentially have been significantly greater than the residual effect described in Section 8.6.3.1.2. The effect would have been a significant, long-term, negative and indirect likely effect on downstream surface water quality and a significant, long-term, negative and indirect effect on downstream surface water quantity (i.e. river flows), and is Significant. The greatest effects would have occurred in the receiving streams closer to the Application Site, with the significance of effects decreasing progressively downstream along each waterbody.

Control Measures:

Pre-IPC Licence

Prior to the regulation of activities at the Boora Bog Group by the EPA which commenced in 2000, the Applicant was implementing several control measures to protect surface water quality in downstream waterbodies. These measures primarily relate to the concentrations of suspended sediments in discharge from the bog and are summarised below:

- Internal drains cleaned on a regular basis in suitable weather. This was completed to remove sludge from the bottom of ditches, allowing them to retain full functionality. The sludge was disposed of by spreading it on the adjacent production fields where it was dried and harvested;
- Drain maintenance was carried out using draglines and excavators, ensuring that these drains were fit for purpose;
- Drain maintenance was carried out mainly prior to and post the harvesting season.
- Silt ponds were utilised to control the amount of sediment being discharged at outfalls. At this time, silt ponds were designed for an upper limit of 100mg/l suspended sediment;
- Silt ponds were upgraded in the 1990s to cater for the settling of sufficient amount of silt. This often included the construction of a second silt pond adjacent to the first, which was used as a backup and to facilitate desludging of the primary pond; and,
- Silt ponds were desludged twice per annum.

Active IPC Licence:

The Application Site has been regulated by the EPA under IPC Licence Registration No. P0500-01 since 2000. The bog group also has a Surface Water Management Plan[4] which defines how compliance with the Licences is achieved. The drainage system in place at the bog comprises field drains, main drains, piped drains, silt ponds upstream of outfall locations, is designed to prevent the release of elevated concentrations of suspended sediments into nearby surface waterbodies. As part of the IPC Licence, there is a limit of 35mg/l for suspended solids. Monitoring only recorded 4 no. exceedances at the Application Site from a total of 57 no. samples from 2000 to 2024).

Existing control measures which were implemented under the IPC Licence are also designed to limit runoff rates from the bog units. These include:

- Silt ponds providing attenuation limited runoff during periods of intense rainfall; and,
- Continuous mitigation included maintaining the schedule of cleaning the silt ponds at a minimum of twice per year.

[4] *Current version: SWMP 0500 Boora 31.01.2020.pdf*

8.6.2.1.3 Contamination of Groundwater by Leakages and Spills

Accidental spillage during refuelling of machinery and plant (static and mobile) with petroleum hydrocarbons is a pollution risk. The accumulation of small spills of fuels and lubricants during routine plant use can also be a significant pollution risk over time. Hydrocarbons have a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. Large spills or leaks have the potential to result in significant effects (i.e., contamination of peat, subsoils and pollution of the underlying aquifer) on the geological and water environment.

Discharges from wastewater systems (septic tanks) at office buildings, and at welfare facilities and workshops could potentially have caused groundwater contamination. Activities and features associated with peat extraction include railway lines, machine passes, canteen structures, work sites, welfare facilities, mobile fuel tanks, fixed fuel tanks, and peat loading facilities. These potential impacts existed across the Application Site, but we understand from a review of available AERs (Annual Environmental Reports submitted to the EPA under the IPC Licences) reports that no significant pollution events/spills to groundwater have occurred since 2000.

Pathway: Infiltration through pore space in peat, subsoil and bedrock.

Receptor: Local Groundwater Quality.

Assessment of effects in the absence of control measures: In the absence of the control measures the effect could have been a potentially greater effect than the residual effect described in Section 8.6.3.1.3. However, there is no knowledge of significant groundwater contamination across the Application Site, and given the nature of the local hydrogeological regime with very limited groundwater recharge rates no significant effects would have occurred. The effect in the absence of control measures would have been a slight, long-term, negative, indirect and unlikely effect on groundwater quality, and is Not Significant.

Control Measures:

Pre-IPC Licence:

Prior to the regulation of activities at the Application Site by the EPA which commenced in 2000, the Applicant was implementing several control measures to reduce the risk of contamination by spills and leakages. These measures primarily relate to the storage of peat harvesting machinery, refuelling procedures and waste management. These measures are summarised below and outlined in full in Chapter 4 at Section 4.6:

- All machinery were stored at the Lemanaghan Works at the end of each workday;
- All machinery were regularly inspected, serviced and cleaned. Cleaning was completed at a wash bay which drained towards an interceptor tank and associated soak pit;
- Where possible all refuelling was completed at the Lemanaghan Works;
- In the event that on-site refuelling was required, it was done with a mobile fuelling unit;
- In the event of an emergency spill, the following procedures were in place:
    - The General Manager (GM) was immediately informed of the incident.
    - The spill was assessed by the GM to assess the potential for environmental and/or health consequences.
    - The spill would have been sourced, isolated and contained with polystyrene booms or dry peat.
    - Every effort would have been made to prevent the spill from entering the nearest drain or outfall.
    - Once the spill was contained, a suitable absorbent (typically dry peat) was used to soak the spillage.

- Follow up measures were taken to prevent such a spillage recurring in the future.
- In the event of a spillage the GM notified the local authority.

- All waste oil and break fluids drained from machinery were collected in drums and emptied into a waste oil storage tank which were transported off-site by a licenced disposal contractor;
- All used oil and fuel filters and used batteries were collected by licenced disposal and battery collection contractors respectively; and,
- All washing from the self-contained machine parts washer was collected within a sludge tank at the Lemanaghan Works.

Active IPC Licence:

The refuelling procedures and control measures implemented by the Applicant were upgraded and enhanced in order to comply with IPC Licence conditions with the Application Site being regulated by the EPA under IPC Licence Registration No. P0500-01 since 2000. The bog also has a Surface Water Management Plan[5] which define how compliance with the Licences is achieved. No additional control measures, other than compliance with the control measures regulated by the EPA, are considered necessary in terms of protecting groundwater quality. The list below outlines control measures conditioned under the IPC licencing regime, as regulated by the EPA:

- Effective spill/leak management of mobile fuelling units was undertaken;
- Replacement (and remediation where necessary) of all underground fuel tanks was undertaken;
- There was no other emissions to water of environmental significance;
- All tank and drum storage areas were rendered impervious to the materials stored therein. In addition, tank and drum storage areas was bunded;
- Drainage from bunded areas was diverted for collection and safe disposal;
- The integrity and water tightness of all the bunding structures and their resistance to penetration by water or other materials stored therein was tested and demonstrated by the licensee to the satisfaction of the Agency and shall be reported to the Agency within eighteen months from the date of grant of this Licence and every two years thereafter;
- The loading and unloading of fuel oils was carried out in designated areas protected against spillage and leachate run-off;
- While awaiting disposal, all materials were collected and stored in designated areas protected against spillage and leachate run-off;
- Except for roof water, all surface water discharges from workshop areas were fitted with oil interceptors;
- An inspection for leaks on all flanges and valves on over-ground pipes used to transport materials other than water was carried out weekly;
- The Applicant undertook a programme of testing and inspection of underground fuel pipelines to ensure that all underground fuel lines were tested at least every three years; and,
- The Applicant maintained (in storage) an adequate supply of containment booms and/or suitable absorbent material to contain and absorb any spillage.

8.6.2.1.4 *Contamination of Surface Water by Leakages and Spills*

Accidental spillage of petroleum hydrocarbons during refuelling of machinery and plant (static and mobile) construction plant with petroleum hydrocarbons is a significant pollution risk to surface waters and associated ecosystems and to terrestrial ecology. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to

[5] *Current versions: SWMP 0501 Derrygreenagh 31.01.2020.pdf*

humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in the death of aquatic organisms.

Discharges from wastewater systems (septic tanks) at office buildings, and at welfare facilities and workshops could potentially have caused surface water contamination. Activities and features associated with peat extraction include railway lines, machine passes, canteen structures, work sites, welfare facilities, peat loading facilities, and end-user sites. These potential impacts existed across the Application Site, but we understand from a review of available AER (Annual Environmental Reports submitted to the EPA under the IPC Licence) reports that no significant pollution events/spills to groundwater have occurred since 2000 (surface water is dealt with separately in this rEIAR).

As stated above, the Blackwater River is only included for the purposes of a conservative assessment. The main receptors would have been the streams located downstream of the Application Site drainage outfall locations.

Pathway: Overland flow and site drainage network.

Receptor: Surface water quality in the receiving streams (Ballynahown, Fortified House Castlearmstrong, Lemanaghan and Kilcolgan Beg streams) and down gradient rivers (Boor, Blackwater and Brosna River).

Assessment of effects in the absence of control measures: In the absence of the IPC Licence control measures the effect could potentially have been greater than the residual effect described in Section 8.6.3.1.4, but to the best of our knowledge there was no evidence of significant contamination at the Application Site, and if there was a spill it would have been localised and would likely have been absorbed by the environment at a local scale. The effect could potentially have been a significant, long-term, negative, indirect and unlikely effect on surface water quality, and is Significant. The greatest effects would have occurred on the receiving streams with the significance of effects decreasing progressively downstream.

Control Measures:

Pre-IPC Licence:

Prior to the regulation of activities at the Application Site by the EPA which commenced in 2000, Bord na Móna were implementing several control measures to reduce the risk of contamination by spills and leakages. These measures primarily relate to the storage of peat harvesting machinery, refuelling procedures and waste management. These measures are the same as those outlined in Section 8.6.2.1.3.

Active IPC Licence:

The Application Site has been regulated by the EPA under IPC Licence Registration No. P0500-01 since 2000. The bog also has a Surface Water Management Plan[6] which define how compliance with the Licences is achieved. The control measures implemented to reduce to the risk of contamination by spills and leakages are the same as those outlined in Section 8.6.2.1.3.

8.6.2.1.5 *Effects Associated with Supporting Infrastructure*

From July 1988 to June 2020, activities at the Application Site were not solely limited to peat extraction and ancillary activities. During this time period several supporting infrastructures and facilities were constructed to aid the peat extraction and ancillary activities. These works included the construction of a Welfare Facility (c. 52m^2) in the townland of Lemanaghan (constructed between 2004 and 2009),

[6] *Current versions: SWMP 0500 Boora 31.01.2020.pdf*

construction of 3 no. level crossings adjacent to the Application Site boundary, and construction of 3 no. rail underpasses adjacent to the Application Site boundary (2 no. constructed in 1993). Please note that the rail underpasses were consented but are assessed here for completion due to their association with the peat extraction and ancillary activities at the Application Site. The greatest risks associated with these supporting infrastructures was potential contamination of the soils and subsoils from hydrocarbon spillage during the construction works. In the absence of control measures the release of untreated wastewater from the Welfare Facility would also have had the potential to contaminate local soils and subsoils.

However, these developments had a very small footprint in the context of the entire Application Site. Additionally, the construction of these infrastructure would have been completed over a relatively short time. Therefore, the potential for effects associated with these developments is much reduced when compared with the potential effects associated with the peat extraction and ancillary activities which were ongoing during this time period (Section 8.6.2.1.1 to Section 8.6.2.1.4).

Pathway: Infiltration through pore space in peat, subsoil and bedrock, and site drainage network.

Receptor: Local groundwater quality, and surface water quality in the receiving streams (Ballynahown, Fortified House Castlearmstrong, Lemanaghan and Kilcolgan Beg streams) and down gradient rivers (Boor, Blackwater and Brosna River).

Assessment of effects in the absence of control measures: Even in the absence of control measures the construction of supporting infrastructure would not have resulted in significant effects due to their small scale in comparison to the wider peat extraction activities. Nevertheless, in the absence of control measures relating, the effect would have been potentially slightly greater than the residual effect described in Section 8.6.3.1.5. The effect would have been a negative, indirect, slight, long-term effect on surface water quality, and is Not Significant.

Control Measures:

Bord na Móna received planning permission for many of the above developments and these developments were constructed in accordance with the conditions set out in their respective permissions.

The Welfare Facility, constructed between 2004 and 2009, was constructed in accordance with best practice measures. Tried and tested, best practice measures with regards to hydrocarbons and refuelling were implemented during the construction of this facility in line with IPC Licence requirements. These control measures are detailed in Section 8.6.2.1.3 above. Furthermore, there was no discharge of untreated wastewater associated with these welfare facilities. Wastewater was discharged to an on-site septic tank with the effluent discharged to a percolation system through the peat prior to discharge to ground. During the Peat Extraction Phase, the septic tank was inspected and de-sludged annually by a licenced contractor to ensure that the treatment system worked efficiently.

8.6.2.1.6 *Effects on Groundwater Abstractions*

Historic impacts on the nearby Boher Leamonaghan GWS can be assessed on the basis of impacts relating to groundwater quality and water quantity (the volume of water available). The Boher Leamonaghan GWS is the only large abstraction located within 5km of the Application Site. The Ferbane PWS is located approximately 5.3km from the Application Site. 5km is considered to be a very conservative screening distance considering the shallow nature (3-6m deep) of the peat extraction and ancillary activities, particularly the historic bog drainage works.

According to the GSI database, the Boher Leamonaghan GWS is located to the east of the EPA named Fortified House Castlearmstrong Stream which acts as a hydrological barrier between the Application Site and this GWS. There are also deep boundary drains which run along the perimeter of the bog which act as hydrological barriers. Uisce Éireann identified the location of the boreholes to be in the

townland of Castlearmstrong and ~85m from the Application Site. Based on the ZoIs of bog drainage infrastructures as discussed in Section 8.6.2.1.1, there was very limited potential for the drainage of the bog to impact these abstractions due to the intervening distance. The source protection area for the GWS extends in the opposite direction and is not dependent on groundwater from under the bog (refer to Figure 8-19). Groundwater flowpaths from the Application Site are likely to be short and will discharge into the local surface water features. Furthermore, given the low permeability of the peat, soils and subsoils at the Application Site, groundwater recharge will be significantly restricted. In addition, the Application Site is not mapped with the source protection area associated with this GWS.

The GSI also map several additional private boreholes and wells in the vicinity of the Application Site. Other wells may also exist at local dwellings in the lands surrounding the Application Site and are not mapped by the GSI. These private water supplies are reliant on groundwater flows in the deeper bedrock aquifer underlying the glacial deposits.

Deep groundwater recharge from the Application Site to the underlying bedrock aquifers will have been minimal. The restriction of recharge relates to the generally impermeable layers which underlie much of Irelands' bogs leading to a 4% recharge coefficient for the bogs. Therefore, the majority of the groundwater drainage and seepage in the bog would have a lateral flow direction, discharging into the perimeter drains and entering the surface water drainage network in the lands surrounding the Application Site.

Pathway: Groundwater recharge and groundwater flow paths and site drainage network.

Receptor: Local groundwater quality and groundwater quantity, the Boher Lamonaghan GWS and private groundwater well supplies.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would not have been a significant effect on local groundwater supplies due to the hydrogeological regime of the Application Site which is characterised by high rates of surface water runoff with very limited groundwater recharge. The effect in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.1.6 i.e. a negative, imperceptible, indirect, long-term, unlikely effect on groundwater quality and groundwater quantity, and is Not Significant.

Control Measures: No control measures would be necessary due to the shallow nature of the works and the nature of the local hydrogeological regime.

8.6.2.1.7 *Effect on Designated Sites*

As previously identified, there is a conceptual link between groundwater and surface water across the Application Site, whereby groundwater (entering shallow perimeter drains) and surface water within the bog primarily drains to surface water bodies situated around the Application Site. Pathways (flow routes) with nearby and regionally located (downstream) SAC/SPAs (Natura 2000 sites) were identified by digital tracing/tracking hydrological flow paths between the Application Site and their downstream discharge points on a local and a regional scale.

There are no designated sites located within the ZoI of bog drainage infrastructures HES has previously completed a Peatland Hydrology Study as defined in Appendix 8 4.

The River Shannon Callows SAC/pNHA (Site Code: 000216) and the Middle Shannon Callows SPA (Site Code: 004096) are located downstream of the Application Site. The shortest hydrological flowpath is via the Ballynahown Stream and the Boor River and is approx. 10.5km in length. Meanwhile, the length of the flowpath along the Brosna River is approx. 22.1km.

Alteration of the hydrological regime at the Application Site may have altered flows from the bog which ultimately discharge to the SAC/pNHA/SPA. Note that even at the time when the bog was

drained the potential for effects would have been limited given the length of the hydrological flowpaths and the large volumes of water within the River Shannon.

The vast majority of the Application Site was drained prior to July 1988 and well before the SAC designation in 2002 and the SPA designation in 1996. The local baseline environment for the SAC/SPA in their respective designation years, therefore, included the Application Site in its drained state.

Pathway: Surface water drainage network. Drainage from the Application Site discharges to outfall points and streams, which discharge to the Boor River and Brosna River which connect downstream to the Middle Shannon Callows SPA and the River Shannon Callows SAC/pNHA.

Receptors: Middle Shannon Callows SPA and the River Shannon Callows SAC/pNHA.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would not have been a significant effect on downstream designated sites due to their distant location from the Application Site and the large volumes of water within the River Shannon. The effect in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.1.7 i.e. an imperceptible, long-term, negative, indirect likely effect on the hydrology (flows and water quality) of the Shannon Callows SAC/pNHA and the Middle Shannon Callows SPA, and is Not Significant.

Control Measures:

As outlined above the Application Site has been regulated by the EPA under IPC Licence Registration No. P0500 since 2000. In addition, the drainage system has been designed to limit runoff from the site via low-gradient field drains, mains drains, and silt ponds. Control measures relating to the protection of water quality are outlined in Section 8.6.2.1.1 to 8.6.2.1.4 above.

Although surface pathways exist between the Application Site and the Middle Shannon Callows SPA and the River Shannon Callows SAC/pNHA, the scale of flows from the Application Site is small relative to the scale of flows in the designated site (associated with the River Shannon). As outlined in Section 8.4.3, flow volumes along the hydrological flow paths were separated into groups. Surface water flows between 0.01 – 0.1m^3/s were classified within bog scale flows while sub-catchment to catchment scales flows were classified as being within 10 – 100+ m^3/s. The surface water connections between the Application Site and the SPA are between 10 and 22km in length and transition from bog scale flows near the bog to sub-catchment and catchment scale of flows at the SAC/pNHA/SPA boundaries (i.e., the Boor and Brosna Rivers, which in turn discharge to the River Shannon, have a much higher volumetric flow).

There are also other activities in all catchments upstream and downstream of the Application Site that have and will contribute to changes in flows and changes in water quality in the receiving water environment (i.e. agriculture, forestry etc).

8.6.2.1.8 *Effect on the WFD Status of Surface and Groundwater Bodies*

The Application Site has been subject to drainage and peat extraction and ancillary activities since 1950, *i.e.* for more than 50 years before the WFD existed.

As described above, the primary hydrological and hydrogeological changes associated with peat extraction and ancillary activities, occurred during the initial drainage of the bog in advance of peat extraction. Constructed drainage ditches drain the upper surface of the bog by lowering the local peat water table. At this time, ancillary features were also constructed including railway lines, machine passes, canteens, work sites, production centres and peat loading facilities. After the Application Site was drained, vegetation was removed from the bog surface, leaving only bare peat fields between the drains. During the Peat Extraction Phase, only minimal landuse change occurs which predominantly

relate to minor annual topographic changes (i.e., lower ground levels) caused by ongoing peat extraction. The vast majority of the Application Site has been drained before 1988.

However, in terms of WFD Compliance Assessment, there is no requirement to assess the peat extraction and ancillary activities at the Application Site which pre-date 2003 and the required transposition of the WFD Directive into Irish Law.

As the 1st WFD cycle was completed in 2010-2015, no WFD status existed for much of the Peat Extraction Phase. However, EPA Q-rating values are available from 2000 to 2020 for watercourses downstream of the Application Site.

The Q-data shows a relatively stable trend in Q-values during this period with the majority of watercourses fluctuating between Q3.5 ("Moderate" Q-status) and Q4 ("Good" Q-status), being either slightly polluted or unpolluted. Several waterbodies downstream of the Application Site did achieve a "High" Q-status (Q4.5) during this period (Brosna River at Ferbane, near Kilcolgan and Bellmount). These EPA Q-ratings generally declined between 2010 and 2024. However, rivers upstream of the Application Site have experienced a similar trend in Q-ratings (refer to WFD Compliance Assessment Report attached as Appendix 8-3). Therefore, the trend is likely to reflect land-use changes in the wider catchments rather than any specific peat extraction related activities within the Application Site. Consequently, changes in water quality during this period cannot be attributed solely to peat extraction activities which were being scaled back at this time.

It is considered that with the implementation of the control measures in accordance with IPC Licence Requirements the status of the SWBs throughout this Peat Extraction Phase of the Project were comparable to those recorded in the 1st WFD cycle (2010-2015) or the 2nd Cycle (2013-2018) where SWBs have not been assigned a status in the 1st cycle.

Pathway: Groundwater recharge and surface water runoff.

Receptor: Downstream surface waterbodies and the underlying Clara, Inny and Ferbane GWBs.

Assessment of effects in the absence of control measures: In the absence of the control measures the effect on SWBs would have been greater than the residual effect described in Section 8.6.3.1.8. The effect would have been a significant, short-term, negative and indirect effect on downstream surface waterbody status, and is Significant. However, given the hydrogeological setting of the Application Site there would have been no effect on the WFD status of the underlying GWBs.

Control Measures:

Since 2003, the peat extraction and ancillary activities at the Application Site were completed under the conditions set out in IPC Licence No. P0500-01. This IPC Licence came into effect in May 2000 and upgraded and enhanced several pre-existing environmental monitoring and control measures which had been implemented at the Application Site since July 1988. These pre-IPC measures largely included the incorporation of silt ponds into the bog drainage system to minimise the concentrations of suspended solids entering local watercourses. Further amendments were made to the IPC conditions in 2003 following the transposition of the WFD into Irish Law. The bog also has a Surface Water Management Plan[7] which define how compliance with the Licences is achieved. Therefore, throughout the Peat Extraction Phase of the Project, peat extraction and ancillary activities have been operating under strict conditions designed to protect downstream water quality and quantity.

Control measures relating to the protection of water quality are outlined in Section 8.6.2.1.1 to 8.6.2.1.4 above.

[7] *Current versions: SWMP 0500 Boora 31.01.2020.pdf*

8.6.2.1.9 *Effect on Downstream Surface Water Abstractions*

As previously identified, the Banagher PWS associated with the Shannon (Lower)_010 DWPA is located downstream of the Application Site. The shortest hydrological flowpath between the Application Site and this DWPA is via the Brosna River and is approx. 22.4km in length.

Alteration of the hydrological regime at the Application Site may have altered flows from the bog which ultimately discharge to the Shannon (Lower)_010 SWB. Note that even at the time when the bog was drained the potential for effects would have been limited given the length of the hydrological flowpaths and the large volumes of water within the River Shannon.

The vast majority of the Application Site was drained prior to July 1988. The local baseline environment therefore included the Application Site in its drained state.

Pathway: Surface water drainage network. Drainage from the Application Site discharges to outfall points and streams, which discharge to the Brosna River which connect downstream to the Shannon (Lower)_010 DWPA.

Receptors: Shannon (Lower)_010 DWPA (Banagher PWS).

Assessment of effects in the absence of control measures: Even in the absence of control measures there would not have been a significant effect on any surface water abstraction associated with this DWPA due to its distant location from the Application Site and the large volumes of water within the River Shannon. The effect in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.1.9 i.e. an imperceptible, long-term, negative, indirect likely effect on the hydrology (flows and water quality) of the Shannon (Lower)_010 DWPA, and is Not Significant.

Control Measures:

As outlined above the Application Site has been regulated by the EPA under IPC Licence Registration No. P0500 since 2000. In addition, the drainage system has been designed to limit runoff from the site via low-gradient field drains, mains drains, and silt ponds. Control measures relating to the protection of water quality are outlined in Section 8.6.2.1.1 to 8.6.2.1.4 above.

Although surface pathways exist between the Application Site and the Shannon (Lower)_010 DWPA, the scale of flows from the Application Site is small relative to the scale of flows in the River Shannon. As outlined in Section 8.4.3, flow volumes along the hydrological flow paths were separated into groups. Surface water flows between 0.01 – 0.1m^3/s were classified within bog scale flows while sub-catchment to catchment scales flows were classified as being within 10 – 100+ m^3/s. The surface water connections between the Application Site and the DWPA are 22.4km in length and transition from bog scale flows near the bog to sub-catchment and catchment scale of flows (i.e., the Brosna River, which in turn discharges to the River Shannon, have a much higher volumetric flow).

There are also other activities in all catchments upstream and downstream of the Application Site that have and will contribute to changes in flows and changes in water quality in the receiving water environment (i.e. agriculture, forestry etc).

8.6.2.2 Current Phase (June 2020 – Present Day)

The Current Phase of the Project encompasses the period of time between the cessation of peat extraction at the Application Site in June 2020 to the present day.

8.6.2.2.1 *Effects of Bog Drainage on Bog Hydrogeology*

No significant effects on bog hydrogeology will have occurred from the cessation of peat extraction in the June of 2020 to the present day. By June 2020, all drainage infrastructure (field drains, main drains,

silt ponds etc.) would have been in place across the Application Site for between 25 – 70 years. The hydrogeological regime would have been well established with field drains lowering the perched groundwater table in the adjacent former peat production fields.

No additional drainage or deepening of drains would have occurred during this period. The only works completed comprised minor maintenance and minor repairs to the drainage network and silt ponds where required.

Pathways: Groundwater volume and water level drawdown.

Receptors: Peat Bog Hydrogeology.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would have been no significant effects on bog hydrogeology during the Current Phase. The residual effect would have been the same as that described in Section 8.6.3.2.1 *i.e.* a neutral, imperceptible, short-term, indirect, unlikely effect on bog hydrogeology, and is Not Significant.

Control Measures:

During this period Bord na Móna continued to operate the Application Site in accordance with IPC licensing requirements. No further control measures, beyond that implemented to date, are deemed necessary as the conditions, emission limits etc. set out in the IPC Licence are designed in accordance with the relevant legislation to ensure ongoing protection of ground and surface waters.

8.6.2.2.2 *Effects of Bog Drainage on Downstream Surface Water Hydrology*

With the cessation of peat extraction, there was less potential for disturbance of peat and elevated concentrations of suspended sediments entering surface watercourses. Similarly, the activity of machinery and plant has been reduced, therefore lowering the potential occurrence of accidental spillages of hydrocarbons.

During this period the site drainage still operated under the same drainage systems as during the Peat Extraction Phase *i.e.* field drains, main drains, silt ponds and discharge outlets etc. Therefore, discharge volumes from the Application Site to nearby surface watercourses will be comparable to surface water discharges during the operational phase.

Similar to the Peat Extraction Phase, the greatest potential for effects occurred in the receiving streams. Further downstream, the Boor and Brosna rivers are less susceptible to potential effects due to the large flow volumes. Nevertheless, the Current Phase of the Project did not rely on the dilution or assimilative capacity of any downstream watercourse. The control measures implemented in this phase, associated with the IPC Licence, ensured that there would be no negative effect on any watercourse downstream of the Application Site.

Pathway: Site drainage and surface water discharge routes.

Receptor: Surface water quality and quantity in the receiving streams (Ballynahown, Fortified House Castlearmstrong, Lemanaghan and Kilcolgan Beg streams) and down gradient rivers (Boor, Blackwater and Brosna River).

Assessment of effects in the absence of control measures: Even in the absence of control measures there would have been no significant effects on downstream surface water quality or quantity during the Current Phase. The residual effect would have been the same as that described in Section 8.6.3.2.2 *i.e.* a neutral, imperceptible, short-term, indirect, unlikely effect on downstream surface water hydrology, and is Not Significant.

Control Measures:

During this period the Application Site continued to operate under IPC licensing requirements with respect to surface water discharge quality and quantity.

8.6.2.2.3 Contamination of Groundwater by Leakages and Spills

Despite the cessation of peat extraction at the Application Site, there was still some limited activity at the Application Site involving machinery and plant with which there is always a risk of accidental spillage of hydrocarbons. Similarly, the office buildings at the Lemanaghan Works remained occupied and discharges from wastewater systems (septic tanks) etc. have the potential to cause surface water and groundwater contamination. These risks are the same as those outlined in Section 8.6.2.1.3 but to a lesser extent due to the lower volumes of plant, machinery and workers operating at the site during the Current Phase.

Pathway: Infiltration through pore space in peat, subsoil and bedrock.

Receptor: Local Groundwater Quality.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would have been no significant effects on local groundwater quality due to the hydrogeological characteristics of the Application Site. The residual effect would have been the same as that described in Section 8.6.3.2.3 *i.e.* a negative, imperceptible, short-term, indirect unlikely effect on groundwater quality, and is Not Significant.

Control Measures:

- Measures that mitigated against contamination of groundwaters are outlined in Section 8.6.2.1.3 and are currently being adhered to at the Application Site.

8.6.2.2.4 Contamination of Surface Water by Leakages and Spills

Despite the cessation of peat extraction at the Application Site, there has been some limited activity at the Application Site during the Current Phase (removal of stockpiles and environmental monitoring) involving machinery and plant with which there is always a risk of accidental spillage of hydrocarbons. Similarly, the office buildings at the Lemanaghan Works remain occupied and discharges from wastewater systems (septic tanks) etc. have the potential to cause surface water and groundwater contamination. These risks are the same as those outlined in Section 8.6.2.1.4 but to a lesser extent due to the lower volumes of plant, machinery and workers operating at the Application Site during this phase.

Pathway: Overland flow and site drainage network.

Receptor: Surface water quality and quantity in the receiving streams (Ballynahown, Fortified House Castlearmstrong, Lemanaghan and Kilcolgan Beg streams) and down gradient rivers (Boor, Blackwater and Brosna River).

Assessment of effects in the absence of control measures: Even in the absence of control measures there would have been no significant effects on downstream watercourses due to the restricted nature of the works completed in this phase. However, in the absence of control measures relating to hydrocarbons, the effect would have been greater than that described in Section 8.6.3.2.4. The effect would have been a negative, slight, short-term, indirect, unlikely effect on surface water quality, and is Not Significant.

Control Measures:

- Measures that mitigated against contamination of groundwaters are outlined in Section 8.6.2.1.3 and are currently being adhered to at the Application Site.

8.6.2.2.5 *Effects on Groundwater Abstractions*

No effects on local groundwater abstractions will have occurred from the cessation of peat extraction in June 2020 to the present day. Drainage and hydrogeology of the Application Site are unchanged during this period.

Pathway: Groundwater recharge and groundwater flow paths and site drainage network.

Receptor: Groundwater quality and groundwater quantity, Boher Lamonaghan GWS and private groundwater well supplies.

Assessment of effects in the absence of control measures: Even in the scenario where no control measures were implemented there would not have been a significant effect on local groundwater supplies due to the hydrogeological regime of the Application Site which is characterised by high rates of surface water runoff with very limited groundwater recharge. The effect in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.2.5 *i.e.* no effect on groundwater supplies, and is Not Significant.

Control Measures:

Any works during this time period have been completed under Licence from the EPA and Bord na Móna's Environmental Management System.

8.6.2.2.6 *Effect on Designated Sites*

Despite the cessation of peat extraction at the Application Site, there was still some very limited activity at the Application Site involving machinery and plant (removal of stockpiles ceased in 2024), the maintenance of the existing drainage network and environmental monitoring.

The Application Site remains hydrologically linked with the Middle Shannon Callows SPA and the River Shannon Callows SAC/pNHA. The risks to the receiving waters (in terms of water quantity and water quality) are the same as those outlined in Section 8.6.2.1.7 but to a much lesser extent due to the lower intensity of works being completed at the Application Site. Less activity on-site has decreased the likelihood of pollution incidents or exceedances of discharge limits occurring. The risk is much reduced in comparison to the Peat-Extraction Phase of the Project.

Similar to the Peat Extraction Phase, the greatest potential for effects occurred in the receiving streams. Further downstream, the Boor and Brosna rivers, and the River Shannon are less susceptible to potential effects due to the large flow volumes. Nevertheless, the Current Phase of the Project did not rely on the dilution or assimilative capacity of any downstream watercourse. The control measures implemented in this phase, associated with the IPC Licence, ensured that there would be no negative effect on any watercourse downstream of the Application Site.

Pathway: Surface water drainage network. Drainage from the Application Site discharges to outfall points and streams, which discharge to the Boor and Brosna rivers which in turn discharge into the River Shannon.

Receptor: River Shannon Callows SAC/pNHA and Middle Shannon Callows SPA.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would not have been a significant effect on downstream designated sites due to the limited activity at

the Application Site during this Phase. Furthermore, the SAC/SPA are distant from the Application Site and there are significant volumes of water within the River Shannon with which these designated sites are associated. The effect in the absence of control measures would have been a negative, imperceptible, short-term, indirect, unlikely effect on water quantity and water quality in the River Shannon Callows SAC/pNHA or the Middle River Shannon Callows SPA, and is Not Significant.

Control Measures: Any works during this time period have been completed under Licence from the EPA and Bord na Móna's Environmental Management System.

The only works completed comprised minor maintenance and minor repairs to the drainage network and silt ponds where required.

8.6.2.2.7 *Effects on WFD Status of Surface and Groundwater Bodies*

With the cessation of peat extraction, there was less potential for disturbance of peat and elevated concentrations of suspended sediments entering surface watercourses. Similarly, the activity of machinery and plant has been reduced, therefore lowering the potential occurrence of accidental spillages of hydrocarbons.

During this period the site drainage still operated under the same drainage systems as during the operational phase of peat extraction *i.e.* field drains, main drains, silt ponds and discharge outlets etc. Therefore, discharge volumes from the Application Site to nearby surface watercourses will be comparable to surface water discharges during the operational phase.

Therefore, there was little potential for the Current Phase of the Project to effect the WFD status of the receiving waterbodies.

Pathway: Groundwater recharge and surface water runoff.

Receptor: Downstream SWBs and the underlying Clara, Inny and Ferbane GWBs.

Assessment of effects in the absence of control measures: Due to the reduced activity at the Application Site, we consider that the effect in the absence of control measures would have been similar to the residual effect described in Section 8.6.3.2.7 *i.e.* a negative, imperceptible, short-term, indirect, unlikely effect on WFD status of downstream SWBs, and is Not Significant. There would have been no effect on the underlying GWBs.

Control Measures:

During this period the Application Site continued to operate under IPC licensing requirements with respect to surface water discharge quality and quantity.

8.6.2.2.8 *Effect on Downstream Surface Water Abstractions*

The Application Site remains hydrologically linked with the Shannon (Lower)_010 DWPA. The risks to the receiving waters (in terms of water quantity and water quality) are the same as those outlined in Section 8.6.2.1.9 but to a much lesser extent due to the lower intensity of works being completed at the Application Site. Less activity on-site has decreased the likelihood of pollution incidents or exceedances of discharge limits occurring. The risk is much reduced in comparison to the Peat-Extraction Phase of the Project.

Similar to the Peat Extraction Phase, the greatest potential for effects occurred in the receiving streams. Further downstream, the Brosna River, and the River Shannon are less susceptible to potential effects due to the large flow volumes. Nevertheless, the Current Phase of the Project did not rely on the dilution or assimilative capacity of any downstream watercourse. The control measures implemented in

this phase, associated with the IPC Licence, ensured that there would be no negative effect on any watercourse downstream of the Application Site.

Pathway: Surface water drainage network. Drainage from the Application Site discharges to outfall points and streams, which discharge to the Boor and Brosna rivers which in turn discharge into the River Shannon.

Receptor: Shannon (Lower)_010 DWPA.

Assessment of effects in the absence of control measures: Even in the absence of control measures there would not have been a significant effect on downstream designated sites due to the limited activity at the Application Site during this Phase. Furthermore, the DWPA is distant from the Application Site and there are significant volumes of water within the River Shannon. The effect in the absence of control measures would have been a negative, imperceptible, short-term, indirect, unlikely effect on water quantity and water quality in the Shannon (Lower)_010 DWPA, and is Not Significant.

Control Measures: Any works during this time period have been completed under Licence from the EPA and Bord na Móna's Environmental Management System.

The only works completed comprised minor maintenance and minor repairs to the drainage network and silt ponds where required.

8.6.2.3 Remedial Phase

8.6.2.3.1 *Effect on Bog Hydrogeological Regime*

The overall aim of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan is to put the Application Site on a trajectory towards becoming a naturally functioning peatland.

The current drainage system was designed to lower the local water table in the bog to facilitate peat extraction. This lowered peat water table does not support typical bog communities. Therefore, in order to achieve the aims of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan, it will be necessary to alter the drainage regime which currently exists on-site.

Those areas selected for rewetting will experience the greatest change in bog hydrogeology. Rewetting can be achieved through measures such as drain blocking which will encourage natural re-vegetation of the cutaway areas with typical bog communities. More intensive drain blocking will be completed in areas of bare peat whereas less intensive measures will be utilised in areas where habitats are already present. Drain blocking will help establish a more suitable hydrological/hydrogeological regime where the peat water table will be much closer to the surface than it is at present. Post restoration monitoring in other sites has shown that groundwater levels in rewetted bogs can recover relatively quickly i.e. within 2-5 years.

The magnitude of this positive effect will vary across the Application Site, dependent on the local intensity of the drain blocking programme where different areas of the site will be deemed more suitable for rewetting.

Pathways: Water volume and peat water level rise.

Receptors: Local peat bog hydrology/hydrogeology.

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a positive, direct, moderate, permanent likely effect on the bog hydrogeological regime, and is Not Significant

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Mitigation Measures:

No specific mitigation measures are required in relation to the proposed alteration of the existing bog hydrogeology as the proposed measures will have a positive effect on the bog hydrogeology.

Any works undertaken as part of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan will be completed under Licence from the EPA with Bord na Móna reporting to the EPA until the IPC Licence is surrendered. All works completed during the Remedial Phase will be done in accordance with 'best practice' procedures and the mitigation measures in relation to the protection of surface and groundwater quality are detailed in Section 8.6.2.3.5 and Section 8.6.2.3.6 below

8.6.2.3.2 *Effect on Downstream Surface Water Quality*

Whereas draining the Application Site to facilitate peat extraction had an adverse impact on downstream surface watercourses, improvements in flow and water quality can be achieved through bog rehabilitation and rewetting.

One of the successful criteria for rehabilitation, is revegetation of the Application Site. Vegetation will stabilise substrates in the current bare peat fields, thereby reducing the potential for elevated concentrations of suspended solids in site runoff. Additionally, vegetation can quickly stabilise material in blocked drains, further reducing the potential for the entrainment of suspended solids. Whereas the previously bare peat fields acted as a source of sediment and required silt control measures, a rehabilitated bog containing wetland habitats will increase the sites solids retention time. Silt ponds will continue to operate during the early stages of the rehabilitation process and will only be decommissioned when the Application Site is deemed to be on a trajectory of environmental stability and/or rehabilitation has been completed.

The water quality improvements associated with rehabilitated peatlands are not limited to reduced suspended solid concentrations. International studies have shown a long-term reduction in pollutant concentrations, including nitrate and ammonia, following rewetting in comparison to drained peatlands (Pschenyckyj. C. et al. 2021). While several studies have shown that the magnitude of these positive effects depends on site-specific factors such as the degree of degradation and local peat characteristics, all studies have shown an overall long-term decrease in pollutant concentrations (Negassa et al., 2020).

It is worth noting that some studies have shown a short-term increase in phosphorous and suspended solid concentrations following restoration (Harpenslager et al. 2015 and Koskinen et al, 2017). This short-term increase in pollutants is linked to initial drain-blocking activities before the hydrogeological regime of the Application Site becomes stabilised (Pschenyckyj. C. et al. 2021).

The Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan will also improve water attenuation at the Application Site, with the blocked drains slowing the rate at which water moves through the Application Site and the rate at which water enters downgradient rivers.

Following rehabilitation, water will still discharge from the designated emission points. However, as discussed in the above paragraphs, this discharge will be of improved quality and of lower volumes.

Pathway: Site drainage and surface water discharge routes.

Receptor: Surface water quality and quantity in the receiving streams (Ballynahown, Fortified House Castlearmstrong, Lemanaghan and Kilcolgan Beg streams) and down gradient rivers (Boor, Blackwater and Brosna River).

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a positive, indirect, slight, long-term, likely effect on downstream surface water quality/quantity, and is Not Significant.

Mitigation Measures:

Any works undertaken as part of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan will be completed under Licence from the EPA with Bord na Móna reporting to the EPA until the IPC Licence is surrendered.

The existing drainage systems and silt control measures, which have proven effect, will continue to operate during the early stages of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan when there is the potential for the entrainment of suspended solids in surface waters during drain blocking. During this time no remedial works will be completed during periods of prolonged rainfall. Silt ponds will continue to be in use and will be regularly inspected and maintained as per IPC Licence requirements. All onsite activities will be completed in accordance with 'best practice' procedures.

Following implementation of the rehabilitation measures a programme of aftercare and maintenance, designed in accorded to meet the Conditions of the IPC Licence, will be completed at the Application Site. This will comprise of initial quarterly monitoring, with the number of site visits reducing after 2 years to bi-annually and then after 5 years to annual visits. A water quality monitoring program will be established to monitor the impact of rehabilitation on water quality discharge from the bog. The monitoring results will be reported on each year to the EPA with the parameters to be included as follows: monthly monitoring for pH, Suspended Solids, Total Solids, Total Phosphorus, Total Ammonia, Colour, and COD and DOC.

8.6.2.3.3 *Effect of Potential Leakages and Spillages on Groundwater Quality*

During the Remedial Phase, there will be some activity at the Application Site involving machinery and plant with which there is always a risk of accidental spillage of hydrocarbons. This activity will be greatest during the initial stages of rehabilitation when works associated with rewetting and revegetation such as drain blocking will be completed. Once this work has been completed there will only be very limited activity at the Application Site which will mainly comprise of non-intrusive monitoring and minimal repairs to peat blockages.

Pathway: Site drainage networks and groundwater flowpaths.

Receptor: Local groundwater quality.

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a negative, indirect, slight, short-term, unlikely effect on local groundwater quality, and is Not Significant.

Mitigation Measures:

The following environmental control measures will be implemented during the remedial measures phase in order to mitigate against leaks and spills:

- All machinery will be regularly checked and maintained prior to arrival at the site;
- Fuelling and lubrication of equipment will only be completed in designated areas and away from surface water features;
- Vehicles will never be left unattended during refuelling;
- All refuelling will occur in mobile fuel bowsers;
- Only dedicated, trained and competent personnel will complete refuelling operations;
- Fuel bowsers will be bunded to 100% capacity to prevent any spills;
- Storage tanks for bowsers and generators will be double-skinned;
- Waste oils and fluids will be collected in leak proof containers and removed from the site for disposal;
- Spill kits will be kept on site; and,
- All activities will be completed in accordance with current 'best practice' procedures.

8.6.2.3.4 Effect of Potential Leakages and Spillages on Surface Water Quality

Se as Section 8.6.2.3.3 above.

Pathway: Overland flow and site drainage network.

Receptor: Surface water quality and quantity in the receiving streams (Ballynahown, Fortified House Castlearmstrong, Lemanaghan and Kilcolgan Beg streams) and down gradient rivers (Boor, Blackwater and Brosna River).

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a negative, indirect, significant, short-term, unlikely effect on downstream surface water quality, and is Significant.

Mitigation Measures:

The mitigation measures outlined in Section 8.6.2.3.3 will be implemented and adhered to through the Remedial Phase of the Project and until the IPC Licence for the Application Site is surrendered. These measures significantly decrease the risk of surface water contamination by leaks and spills of hydrocarbons. No further mitigation measures are deemed necessary.

8.6.2.3.5 Effect on Groundwater Abstractions

Local groundwater resources are characterised in Section 8.4.15, with no groundwater supplies mapped within the Application Site.

The works associated with the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan are all near-surface activities. Therefore, the potential to impact local groundwater supplies (quality and quantity) is negligible.

Pathway: Groundwater recharge and groundwater flow paths and site drainage network.

Receptor: Groundwater quality and groundwater quantity in local groundwater well supplies.

Pre-Mitigation Potential Effect: The pre-mitigation potential for effects is considered to be a negative, indirect, imperceptible, short-term, very unlikely effect on local groundwater wells, and is Not Significant.

Mitigation Measures:

With the exception of the protection of groundwater quality from the accidental spillages of hydrocarbons as discussed in Section 8.6.2.3.3, no additional mitigation measures would be necessary due to the shallow nature of the works and the nature of the local hydrogeological regime.

8.6.2.3.6 Effect on Downstream Designated Sites

Peatlands and downstream terrestrial aquatic ecosystems are directly linked and while the degradation of the Application Site may have caused a deterioration in habitats and reduced levels of biodiversity in the downstream catchment, rewetting of bog is linked with improved surface water quality (Section 8.6.3.3.7). Therefore, the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan and rewetting of the Application Site will likely improve the quality of aquatic ecosystems such as the downstream designated sites of the River Shannon Callows SAC/NHA and Middle Shannon Callows SPA. However, the significant of any positive effects on downstream designated sites will be limited given their distant location from the Application Site and the large volumes of water within the River Shannon.

Pathway: Surface water drainage network. Drainage from the site discharges to the Boor and Brosna rivers and associated tributaries.

Receptor: River Shannon Callows SAC/NHA and Middle Shannon Callows SPA.

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a positive, indirect, imperceptible, long-term effect on downstream designated sites, and is Not Significant.

Mitigation Measures:

Any works during this time period have been completed under Licence from the EPA and Bord na Móna's Environmental Management System. The mitigation measures outlined above will be implemented and adhered to until the IPC Licence for the Application Site is surrendered.

8.6.2.3.7 *Effect on Surface and Groundwater Body WFD Status*

The EU Water Framework Directive (2000/60/EC) requires that all member states protect and improve water quality in all waters, with the aim of achieving good status by 2027 at the latest. Any new development must ensure that this fundamental requirement of the Directive is not compromised. Therefore, the Remedial Phase of the Project must not compromise the objectives of the WFD.

The status of the GWBs and SWBs in the vicinity and downstream of the Application Site are described in Section 8.4.12 and 8.4.13 respectively.

Potential effects on groundwater and surface water quality and quantity as a result of the Remedial Phase, in the absence of mitigation measures has the potential to result in a short-term deterioration in the WFD status of surface water bodies in the immediate vicinity of the Application Site. This short-term impact will be associated with the short-term actions phase of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan during which drain blocking will be completed and there will be increased risk of hydrocarbon spills and entrainment of suspended solids in surface watercourses. However, even in an unmitigated scenario, the long-term effects of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan will have a positive impact on the WFD status of surface waterbodies in the vicinity of the Application Site due to the improved quality of surface water discharge from the site and the improved water attenuation within the bog.

The proposed activities on the Application Site during the Remedial Phase will be limited to near surface activities and due to the local hydrogeological regime of the site being characterised by low groundwater recharge rates, the potential for the Project to impact on the status of the underlying GWBs is negligible.

A full WFD Compliance Assessment is included as Appendix 8-4. Our understanding of the WFD objectives is that water bodies, regardless of whether they have 'Poor' "Moderate" or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed in order to ensure there is no deterioration in the status of a waterbody.

Pathway(s): Surface water drainage and downstream discharge to surface waterbodies. Groundwater recharge to the underlying groundwater body.

Receptor: The following surface waterbodies have been deemed to have the potential to be affected by the Remedial Phase due to their proximal location downstream of the surface water emissions points associated with the Application Site (refer to Section 8.4.4.4): Boor_020, Lemanaghan Stream_010, Brosna_100 and Brosna_110. The other river waterbodies located downstream of the Application Site do not have the potential to be impacted. Please refer to the WFD Compliance Assessment attached as Appendix 8-3 for a detailed description of the screening process.

In terms of GWBs, the Clara, Ferbane, Inny and Boor Gravels GWBs are the receptor due to its location directly underlying the Application Site.

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a positive, indirect, slight, long-term effect on the receiving SWBs, and is Not Significant. The pre-mitigation potential effect is considered to be a neutral effect on the underlying GWBs.

Impact Assessment/Mitigation Measures: Due to the hydrogeological regime at the Application Site, the surface waterbodies directly downstream of the bog discharge locations are deemed to be the most sensitive receptors.

Strict mitigation measures in relation to the protection of surface and groundwaters are outlined above in Section 8.6.2.3.1 to 8.6.2.3.4. The implementation of these mitigation measures during the Remedial Phase will ensure the qualitative and quantitative status of the receiving surface and groundwaters will not be altered.

Consequently, there will be no change in GWB or SWB status in the underlying GWBs or downstream SWBs. There will be no change in quantitative (volume) or qualitative (chemical) status, and the downstream SWBs are protected from any potential deterioration from chemical pollution.

As such, the Remedial Phase is compliant with the requirements of the Water Framework Directive (2000/60/EC).

8.6.2.3.8 *Effect on Downstream Surface Water Abstractions*

The Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan and rewetting of the Application Site will likely improve the water quality downstream of the Application Site. However, the significance of any positive effects on Shannon (Lower)_010 DWPA will be limited given its distant location from the Application Site and the large volumes of water within the River Shannon.

Pathway: Surface water drainage network. Drainage from the site discharges to the Brosna River and associated tributaries.

Receptor: Shannon (Lower)_010 DWPA.

Pre-Mitigation Potential Effect: The pre-mitigation potential effect is considered to be a positive, indirect, imperceptible, long-term effect on downstream designated sites, and is Not Significant.

Mitigation Measures:

Any works during this time period have been completed under Licence from the EPA and Bord na Móna's Environmental Management System. The mitigation measures outlined above will be implemented and adhered to until the IPC Licence for the Application Site is surrendered.

8.6.3 Residual Effects

8.6.3.1 Peat Extraction Phase (July 1988 – June 2020)

8.6.3.1.1 *Effects of Bog Drainage on Bog Hydrogeology*

The residual effect of Peat Extraction Phase of the Project is a permanent, moderate, negative, direct, long-term likely effect on the bog hydrogeology, and is Not Significant. It is intended to implement the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan for the Application Site and this will likely involve drain blocking and other measures to raise the subsurface water levels. The

assessment of the implementation of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan is provided in Section 8.6.4.3.

8.6.3.1.2 Effects of Bog Drainage on Downstream Surface Water Hydrology/Quality

All activities pre-dating 2000 were unlicensed and no records exist regarding the quality of discharges to nearby surface watercourses. However, by 1988 peat extraction and ancillary activities were already well established at the Application Site and while EPA Q-values throughout this phase of the Project fluctuate, there is no clear negative trend in terms of surface water quality between 1988 and 2020. Some improved sediment control measures were installed at the Application Site in the late 1990s and early 2000s and water quality discharge Licence limits have been in place since 2000 in accordance with IPC licensing. The available monitoring data indicate that improvements in downstream water quality have not been significant, and this is because there are other activities in the catchment that effect water quality and also that the baseline water quality was reasonably good and has not changed significantly during the Peat Extraction Phase.

The effect on surface water quantity in downstream surface watercourse are not likely to be significant. The drainage systems were designed to reduce runoff to greenfield runoff rates. In addition, runoff from intact raised peat bogs can be quite high when saturated during the winter months.

The residual effect is a moderate, long-term, negative and indirect likely effect on downstream surface water quality and a moderate, long-term, negative and indirect effect on downstream surface water quantity (i.e. river flows) , and is Not Significant.

The cessation of activities and the implementation of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan will limit the potential for significant effects into the future and this is assessed below.

8.6.3.1.3 Contamination of Groundwater by Leakages and Spills

From a review of the AER reports, we understand that no significant fuel spills or wastewater discharges have occurred since 2000. In addition, extensive control measures have been implemented since 2000 as part of the IPC Licence which mitigates against the possibility of any groundwater contamination.

While there are no records to rely on, there does not appear to be any significant issues with hydrocarbons or wastewater discharges to groundwater resulting from the peat extraction works prior to IPC regulation (we note that no major issues are referenced in the IPC Licence application or in subsequent annual environmental reports).

Therefore, the residual effect on local groundwater quality is imperceptible, long-term, negative, indirect and unlikely, and is Not Significant.

8.6.3.1.4 Contamination of Surface Water by Leakages and Spills

Bord na Móna did not record (in annual AER submissions to the EPA) the occurrence of any major significant fuel spills and/or wastewater discharges. In addition, extensive control measures have been implemented since 2000 as part of the IPC Licence which mitigate against the possibility of any surface water contamination.

While there are no pre-IPC Licence records to rely on, there does not appear to be any significant issues with hydrocarbons or wastewater discharges to surface water resulting from the peat extraction and ancillary activities prior to IPC regulation.

The residual effect is a slight, long-term, negative, indirect, unlikely impact on local surface water quality and downstream aquatic ecosystems, and is Not Significant.

8.6.3.1.5 Effects Associated with Supporting Infrastructure

The potential for effects associated with the supporting infrastructure is limited due to their small scale of within the wider the Application Site. Furthermore, all activities at the Application Site were completed using control measures designed to ensure the protection of downstream surface water quality and underlying groundwater quality. Since 2000 all activities at the Application Site have been completed in accordance with IPC Licence conditions. Furthermore, with respect to the welfare facility, there has been no discharge of untreated wastewater at the Application Site. Based on the above, we consider that the residual effect to be negative, indirect, imperceptible, long-term effect on groundwater and surface water quality, and is Not Significant.

8.6.3.1.6 Effects on Groundwater Abstractions

The potential for the peat extraction and ancillary activities to impact the hydrogeology of the Boher Leamonaghan GWS has been reduced as the bog drainage regime was already largely in place at the time the source boreholes were drilled (2013). The natural hydrological and hydrogeological regime of peat bog, with little groundwater recharge and high runoff rates, also limit the potential effects that peat extraction may have had on local groundwater abstractions including the Boher Leamonaghan GWS. The Application Site is not located within the mapped SPA area to the Boher Leamonaghan GWS. The residual effect is considered to be – Neutral, imperceptible, indirect, long-term, unlikely effect on groundwater quality and groundwater quantity, and is Not Significant.

8.6.3.1.7 Effect on Designated Sites

The potential for the peat extraction and ancillary activities to impact the hydrology of the River Shannon Callows SAC/pNHA and the Middle Shannon Callows SPA has been reduced as the bog drainage regime was already in place at the time of the SAC and SPA designation. Proven and effective control measures have also been implemented to limit the runoff from the Application Site to original greenfield runoff rates. The Application Site has also been operating under IPC Licence conditions since May 2000. The residual effect is imperceptible, long-term, negative, indirect likely effect on the hydrology (flows and water quality) of the Shannon Callows SAC/pNHA and the Middle Shannon Callows SPA, and is Not Significant.

8.6.3.1.8 Effect on the WFD Status of Surface and Groundwater Bodies

As the 1st WFD cycle was completed in 2010-2015, no WFD status existed for much of the Peat Extraction Phase. However, EPA Q-rating values are available from 2000 to 2020 for all watercourses downstream of the Application Site. The data shows a relatively stable trend in Q-values during this period with the majority of watercourses fluctuating between Q3.5 (“Moderate” Q-status) and Q4-5 (“High” Q-status), being either slightly polluted or unpolluted. River waterbodies upstream of the Application Site have experienced a similar trend in Q-ratings. Therefore, the trend is likely to reflect land-use changes in the wider catchments rather than any specific peat extraction and ancillary activities within the Application Site. Consequently, changes in water quality during this period cannot be attributed solely to peat extraction activities which were being scaled back at this time. We consider that with the implementation of the control measures in accordance with IPC Licence Requirements the status of the SWBs during this phase were comparable to those recorded in the 1st WFD cycle (2010-2015).

No receiving surface waterbodies (Boor_020, Brosna_100, Brosna_110 or Lemanaghan_010 SWBs) have ever been assigned ‘Poor’ status. The only SWB in the vicinity of the Application Site assigned ‘Poor’ status was the Blackwater(Shannonbridge)_010 SWB which achieved this status in the latest cycle (2016-2021). However, there is no surface wate discharge from the Application Site to the Blackwater River or any of its tributaries. The receiving SWBs have all ranged from ‘Moderate’ to ‘Good’ status across the 3 no. WFD cycles. The effect on SWB status is not likely to be significant. The drainage

systems were designed to reduce runoff to greenfield runoff rates while the IPC Licence controls also ensured high quality runoff from the site.

In addition, the underlying Clara, Inny and Ferbane GWBs achieved "Good" status in all WFD cycles and IPC control measures ensured the protection of groundwater quality.

Therefore, we consider that there has been an insignificant, short-term, negative and indirect effect on downstream surface waterbody status and no residual effect on groundwater body status, and is Not Significant.

A full WFD Compliance Assessment is included as Appendix 8-3.

8.6.3.1.9 *Effect on Downstream Surface Water Abstractions*

The potential for the peat extraction and ancillary activities to impact the Shannon (Lower)_010 DWPA is limited given the length of the hydrological flowpath (22.4km) and the large volumes of water within the River Shannon. Proven and effective control measures have also been implemented to limit the runoff from the Application Site to original greenfield runoff rates. The Application Site has also been operating under IPC Licence conditions since May 2000. The residual effect is imperceptible, long-term, negative, indirect likely effect on the hydrology (flows and water quality) of the Shannon (Lower)_010 DWPA, and is Not Significant.

8.6.3.2 Current Phase (June 2020 – Present Day)

8.6.3.2.1 *Effects of Bog Drainage on Bog Hydrogeology*

The bog hydrogeology remained largely unchanged during this period due to a lack of activity in regard to drainage infrastructure. Therefore, the residual effect is a neutral, imperceptible, short-term, indirect, unlikely effect on bog hydrogeology, and is Not Significant.

8.6.3.2.2 *Effects of Bog Drainage on Downstream Surface Water Hydrology/Quality*

No significant effects on downstream surface water hydrology will have occurred from the cessation of peat extraction in June 2020 to the present day. There has been a slight decrease in Q-values in downstream surface watercourses in recent EPA monitoring rounds. This would likely be related to other pressures in the catchment as the cessation of peat extraction would not negatively affect water quality. However, a perceptible positive trend in Q-values, associated with the cessation of peat extraction, would not have been expected given the relatively short time period since peat extraction ceased (approximately 5 years). Therefore, the residual effect is a neutral, imperceptible, short-term, indirect, unlikely effect on downstream surface water hydrology, and is Not Significant.

8.6.3.2.3 *Contamination of Groundwater by Leakages and Spills*

From a review of the available AER reports, we understand that no significant fuel spills or wastewater discharges have occurred during this period. Therefore, the residual effect is a negative, imperceptible, short-term, indirect unlikely effect on groundwater quality, and is Not Significant.

8.6.3.2.4 *Contamination of Surface Water by Leakages and Spills*

From a review of the available AER reports, we understand that no significant fuel spills or wastewater discharges have occurred during this period. Therefore, the residual effect is a negative, imperceptible, short-term, indirect, unlikely effect on surface water quality, and is Not Significant.

8.6.3.2.5 Effects on Groundwater Abstractions

For the reasons outlined above in Section 8.6.2.2.5 and due to the lower levels of activity onsite during the Current Phase of the Project, that there has not been any residual effect on groundwater abstractions, and is Not Significant.

8.6.3.2.6 Effect on Designated Sites

No significant change in the hydrology of the River Shannon Callows SAC/pNHA or the Middle River Shannon Callows SPA will have occurred following the cessation of peat extraction. Due to the reasons outlined above, we consider the residual effect is a neutral, imperceptible, short-term, indirect, unlikely effect on water quantity and water quality flowing from the Application Site towards the River Shannon Callows SAC/pNHA or the Middle River Shannon Callows SPA, and is Not Significant.

8.6.3.2.7 Effect on WFD Status of Surface and Groundwater Bodies

No change in the qualitative or quantitative status of the receiving waterbodies will have occurred following the cessation of peat extraction. Due to the reasons outlined above, we consider the residual effect is a neutral, imperceptible, short-term, indirect, unlikely effect on WFD status of downstream surface waterbodies and underlying groundwater bodies, and is Not Significant.

8.6.3.2.8 Effect on Downstream Surface Water Abstractions

No significant change in the hydrology of the River Shannon will have occurred following the cessation of peat extraction. Due to the reasons outlined above, we consider the residual effect is a neutral, imperceptible, short-term, indirect, unlikely effect on water quantity and water quality flowing from the Application Site towards the Shannon (Lower)_010 DWPA, and is Not Significant.

8.6.3.3 Remedial Phase

8.6.3.3.1 Effects of Bog Drainage on Bog Hydrogeology

Following the implementation of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan, the Application Site will likely be wetter, will retain more water, will recolonise with vegetation slowly, and will eventually become a naturally functioning peatland. As such, we consider the residual effects of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan to be moderate, positive, direct, long-term effect on local peat bog hydrology/hydrogeology, and is Not Significant.

8.6.3.3.2 Effects of Bog Drainage on Downstream Surface Water Hydrology/Quality

Following the implementation of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan, the Application Site will be wetter, will retain more water, will recolonise with vegetation slowly, and will eventually become a naturally functioning peatland with much-reduced silt and nutrient output. As such, we consider the residual effects of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan to be a moderate, positive, indirect, long-term effect on downstream surface water hydrology and water quality, and is Not Significant.

8.6.3.3.3 Effect of Potential Leaks and Spillages on Groundwater Quality

The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all industrial sites. Proven and effective measures to mitigate the risk of spills and leaks will be implemented during the Remedial Phase of the Project. It is considered that the residual effect to be

negative, imperceptible, direct, short-term, unlikely effect on groundwater quality, and is Not Significant.

8.6.3.3.4 *Effect of Potential Leaks And Spillages on Surface Water Quality*

The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all industrial sites. Proven and effective measures to mitigate the risk of spills and leaks will be implemented throughout the Remedial Phase of the Project. Therefore, the residual effect is imperceptible, negative, direct, short-term, unlikely effect on surface water quality, and is Not Significant.

8.6.3.3.5 *Effect on Groundwater Abstractions*

There will be no effect on groundwater resources and existing abstractions.

8.6.3.3.6 *Effect on Designated Sites*

Due to the reasons outlined above, and with the implementation of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan the Application Site will likely be wetter, will retain more water, will recolonise with vegetation slowly, and will eventually become a naturally functioning peatlands and or wetlands with much-reduced silt and nutrient output. It is considered that consider the likely residual effect to be moderate, positive, indirect, long-term effects on the River Shannon Callows SAC/pNHA and the Middle River Shannon Callows SPA , and is Not Significant.

8.6.3.3.7 *Effect on the WFD Status of Surface and Groundwater Bodies*

Due to the local hydrogeological regime at the Application Site (very limited groundwater recharge), coupled with the implementation of the proposed mitigation measures for the protection of surface water quality, and the additional hydrological benefits associated with bog rehabilitation (improved surface water quality and improved water attenuation), we consider that there will be a slight, positive, long-term, indirect, likely effect on the WFD status of downstream SWBs, and is Not Significant. There will be no residual effect on the WFD status of the underlying GWBs.

8.6.3.3.8 *Effect on Downstream Surface Water Abstractions*

Due to the reasons outlined above, and with the implementation of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan the Application Site will likely be wetter, will retain more water, will recolonise with vegetation slowly, and will eventually become a naturally functioning peatlands and or wetlands with much-reduced silt and nutrient output. It is considered that consider the likely residual effect to be moderate, positive, indirect, long-term effects on the River Shannon, and is Not Significant.

8.6.4 Significance of Effects

8.6.4.1 Peat Extraction Phase (July 1988 – June 2020)

8.6.4.1.1 *Effects of Bog Drainage on Bog Hydrogeology*

With the implementation of the control measures, we consider that there has been a slight effect on local bog hydrogeology as a result of the Peat Extraction Phase of the Project between July 1988 and June 2020.

8.6.4.1.2 *Effects of Bog Drainage on Downstream Surface Water Hydrology/Quality*

For the reasons outlined above, and with the implementation of the control measures, it is considered that there has been a moderate effect on downstream surface water quality as a result of the Peat Extraction Phase of the Project between July 1988 and June 2020.

8.6.4.1.3 Contamination of Groundwater by Leakages and Spills

For the reasons outlined above and with the implementation of the control measures we consider that there has not been a significant effect on groundwater quality as a result of leaks and spills during the Peat Extraction Phase of the Project.

8.6.4.1.4 Contamination of Surface Water by Leakages and Spills

For the reasons outlined above and with the implementation of the control measures, it is considered that there has not been a significant effect on downstream surface water quality as a result of leaks and spills during the Peat Extraction Phase of the Project.

8.6.4.1.5 Effects Associated with Supporting Infrastructure

For the reasons outlined above and with the implementation of the control measures we consider that there has not been a significant effect on groundwater or surface water quality as a result of the construction or operation of the supporting infrastructure during the Peat Extraction Phase of the Project.

8.6.4.1.6 Effects on Groundwater Abstractions

For the reasons outlined above, we consider that there has not been a significant effect on local groundwater abstractions during the Peat Extraction Phase of the Project.

8.6.4.1.7 Effect on Designated Sites

For the reasons outlined above and with the implementation of the outlined control measures we consider that there has not been a significant effect on the hydrology of the River Shannon Callows SAC/pNHA or the Middle Shannon Callows SPA during the Peat Extraction Phase of the Project.

8.6.4.1.8 Effect on the WFD Status of Surface and Groundwater Bodies

With the implementation of the IPC Licence controls no significant effects on the status of downstream SWBs or the underlying GWBs have occurred during the Peat Extraction Phase of the Project.

8.6.4.1.9 Effect on Downstream Surface Water Abstractions

For the reasons outlined above and with the implementation of the outlined control measures we consider that there has not been a significant effect on the hydrology of the River Shannon or the Shannon (Lower)_010 DWPA during the Peat Extraction Phase of the Project.

8.6.4.2 Current Phase (June 2020 – Present Day)

8.6.4.2.1 Effects of Bog Drainage on Bog Hydrogeology

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on the local bog hydrogeology during the Current Phase of the Project.

8.6.4.2.2 Effects of Bog Drainage on Downstream Surface Water Hydrology/Quality

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on the downstream surface water hydrology during the Current Phase of the Project.

8.6.4.2.3 Contamination of Groundwater by Leakages and Spills

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on local groundwater quality during the Current Phase of the Project.

8.6.4.2.4 Contamination of Surface Water by Leakages and Spills

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on downgradient surface waterbodies during the Current Phase of the Project.

8.6.4.2.5 Effects on Groundwater Abstractions

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on groundwater resources and abstractions during the Current Phase of the Project.

8.6.4.2.6 Effect on Designated Sites

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on downgradient designated sites including the Middle Shannon Callows SPA and the River Shannon Callows SAC/pNHA during the Current Phase of the Project.

8.6.4.2.7 Effect on WFD Status of Surface and Groundwater Bodies

With the implementation of the IPC Licence conditions we consider that there has not been a significant effect on WFD status during the Current Phase of the Project.

8.6.4.2.8 Effect on Downstream Surface Water Abstractions

For the reasons outlined above and with the implementation of the IPC Licence conditions we consider that there has not been a significant effect on downgradient Shannon (Lower)_010 DWPA during the Current Phase of the Project.

8.6.4.3 Remedial Phase

8.6.4.3.1 Effects of Bog Drainage on Bog Hydrogeology

For the reasons outlined above we consider that the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan will have a significant effect on local bog hydrogeology within the Application Site.

8.6.4.3.2 Effects on Downstream Surface Water Hydrology/Quality

For the reasons outlined above we consider that the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan will have a significant effect on downstream water quality and quantity.

8.6.4.3.3 Contamination of Groundwater by Leakages and Spills

For the reasons outlined above and with the implementation of the mitigation measures, we consider that there will not be a significant effect on groundwater quality.

8.6.4.3.4 Contamination of Surface Water by Leakages and Spills

For the reasons outlined above and with the implementation of the mitigation measures, we consider that there will not be a significant effect on surface water quality.

8.6.4.3.5 Effects on Groundwater Abstractions

For the reasons outlined above we consider that there will not be a significant effect on groundwater resources and abstractions.

8.6.4.3.6 Effect on Designated Sites

For the reasons outlined above and with the implementation of the mitigation measures, we consider that there will not be a significant effect on the River Shannon Callows SAC/pNHA or the Middle Shannon Callows SPA.

8.6.4.3.7 Effect on the WFD Status of Surface and Groundwater Bodies

With the implementation of the mitigation measures outlined above there will be no significant effects resulting from the Remedial Phase of the Project. The Remedial Phase will not result in the deterioration in the WFD status of any surface or groundwater body nor will it jeopardise the attainment of good status in the future.

8.6.4.3.8 Effect on Downstream Surface Water Abstractions

For the reasons outlined above and with the implementation of the mitigation measures, we consider that there will not be a significant effect on the Shannon (Lower)_010 DWPA.

8.6.5 Cumulative/In Combination Effects

8.6.5.1 Peat Extraction Phase (July 1988 – June 2020)

Indirect cumulative effects can occur via surface water and groundwater flow paths, but these are restricted by connectivity and proximity.

The Application Site is drained by the Boor, Blackwater and Brosna rivers. Artificial drainage, comprising of filed drains, main drains, silt ponds and outfalls, had been inserted at the Application Site by July 1988. The Application Site discharges surface water to tributaries of the Boor and Brosna rivers. There is no outfall to the Blackwater River or any of its tributaries.

Potential cumulative effects associated with landuse, hydrological and/or hydrogeological changes at the Application Site due to the peat extraction and ancillary activities would have had the potential to result

in some cumulative effects associated with other activities occurring within the catchments of the Boor and Brosna rivers over this time period (1988 – 2020).

The assessment of cumulative effects during the Peat Extraction Phase of the Project is divided as follows:

- Cumulative effects assessment of third party peat sod peat cutting (i.e. turbary activities);
- Cumulative effects of agriculture in the surrounding lands; and,
- Cumulative effects of forestry.

The cumulative effects of the Peat Extraction Phase (July 1988 – June 2020) and the peat extraction and site preparation works which preceded 1988 would have had a profound negative effect on the bog hydrogeological regime whereby vegetation was cleared, drainage inserted, and peat extracted from much of the Application Site. The cumulative effect on downstream surface water quality and flow volumes is not considered to be significant given the control measures being implemented by Bord na Móna.

8.6.5.1.1 *Cumulative Effects of Third Party Peat Cutting*

Following the Turf Development Act of 1981, Bord na Móna oversaw a private turf development scheme which provided grants to private bog developers. Third party extraction was undertaken on turbary plots at the periphery of the Application Site and as such exact locations and volumes are not available.

The Peat Extraction Phase of the Project would potentially have interacted with these minor turbary activities and could have contributed to a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia. Bog drainage would also have been required for these turbary activities and cumulative impacts on the local bog hydrology may have occurred.

Pathways: Peat drainage and surface water pathways.

Receptors: Surface water quality in downgradient waterbodies (i.e. the Boor and Brosna rivers) and bog hydrogeology.

Control Measures:

Control measures relating to the protection of water quality are outlined in Sections 8.6.2.1.1 to 8.6.2.1.4 above.

Impact Assessment:

No control measures beyond those required to comply with the IPC Licence conditions were implemented. Control measures were also implemented by Bord na Móna in an ad hoc manner between July 1988 and 2000 by implementation of the pre-existing surface water management system (Refer to Section 8.6.2.1.2).

The areas of third party peat cutting were small in comparison to the peat extraction and ancillary activities completed by Bord na Móna. The third party peat cutting was also completed at bog margins.

By July 1988 the vast majority of the Application Site was already artificially drained. Consequently, the continued drainage of the Application Site during the Peat Extraction Phase of the Project would have been limited in its potential to alter the hydrological regime in downstream watercourses. However, during the Peat Extraction Phase, there was an ongoing risk of elevated concentrations of suspended solids making their way into downstream surface watercourses from the erosion of peat sediment via the

bog drainage network. This potential pathway would pose a significant risk to local surface water quality in the Boor and Brosna rivers and their associated tributaries. Other water quality parameters of concern are ammonia and Chemical Oxygen Demand (COD).

As outlined, EPA Q-values throughout the Peat Extraction Phase of the Project fluctuate, there is no clear negative trend in terms of surface water quality between July 1988 and June 2020. Some improved sediment control measures were installed at the Application Site in the late 1990s and early 2000s and water quality discharge Licence limits have been in place since 2000 in accordance with IPC licensing. The available monitoring data indicate that improvements in downstream water quality have not been significant, and this is because there are other activities in the catchments that effect water quality and also that the baseline water quality was reasonably good and has not changed significantly during the Peat Extraction Phase of the Project.

Residual Effects: Any third party or private peat cutting completed at the Application Site during the Peat Extraction Phase of the Project (July 1988 – June 2020) would have been infinitely small, in terms of the peat extraction areas and the volumes of peat being removed from the Application Site, in comparison to the Bord na Móna operations. There are no indications from surface water quality monitoring data that third party peat extraction in combination with Bord na Móna peat extraction and ancillary activities had a significant impact on downstream surface water quality. Therefore, any cumulative effects on local bog hydrogeology and downstream local surface water quality would have been consistent with emerging trends within the downstream catchments when compared to those which would have resulted solely from the large scale, commercial Bord na Móna peat harvesting operations. The residual effect is a moderate, long-term, negative, indirect likely effect on downgradient waterbodies (i.e. the Boor and Brosna rivers and associated tributaries), and is Not Significant.

Significance of Effects: For the reasons outlined above we consider that there has not been a significant cumulative effect during the Peat Extraction Phase of the Project.

8.6.5.1.2 *Cumulative Effects with Agriculture*

The Application Site is drained by the Boor, Blackwater and Brosna rivers (note that there was no discharge to surface waters from the Application Site to the Blackwater River or any of its tributaries). Agriculture is the largest land use in the surrounding lands and in the wider catchments/sub-catchments. Corine land cover maps (1990 – 2018) show that the majority of lands surrounding the Application Site have been used for agricultural purposes during the Peat Extraction Phase of the Project (July 1988 – June 2020).

Agriculture is the largest pressure on water quality in Ireland. Agricultural practices such as the movement of soil and the addition of fertilizers and pesticides can lead to nutrient losses and the entrainment of suspended solids in local surface watercourses. This can have a negative impact on local and downstream surface water quality.

The Peat Extraction Phase of the Project would potentially have interacted with these agricultural activities and could have contributed to a deterioration of downstream surface water quality through the emissions of elevated concentrations of suspended solids and ammonia.

Pathways: Surface water pathways.

Receptors: Surface water quality in downgradient waterbodies (i.e. the Boor and Brosna rivers and their associated tributaries).

Control Measures:

No control measures beyond those required to comply with the IPC Licence conditions are deemed necessary. These control measures have been implemented by Bord na Móna since 2000 and build

upon pre-existing surface water management system which was already in operation at the Application Site (July 1988 – 2000).

Impact Assessment:

The area of the Application Site (11.09km^2) is small in comparison to the total catchment area of the Brosna and Boor rivers downstream of the Application Site. The total catchment area of the Brosna River downstream of the Application Site (i.e. downstream of the Kilcolgan Beg Stream) is 990km^2. Meanwhile, approximately 11km^2 of the Application Site drains to the Brosna River, which represents only 1.1% of the total catchment area of the Brosna River downstream of the Application Site. Similarly, the total catchment area of the Boor River downstream of the Ballynahown Stream is 120km^2. The total area of the Application Site draining to the Boor River (0.26km^2), represents only 0.2% of the catchment area. Therefore, the potential for effects would have been limited.

By July 1988 the vast majority of the Application Site had already been artificially drained. Consequently, the continued drainage of the Application Sites during the Peat Extraction Phase of the Project would have been limited in its potential to alter the hydrological regime in downstream watercourses. However, during the Peat Extraction Phase, there was an ongoing risk of elevated concentrations of suspended solids and ammonia making their way into downstream surface watercourses via the bog drainage network. This potential pathway would pose a significant risk to downstream local surface water quality.

However, while the EPA Q-values throughout the Peat Extraction Phase of the Project fluctuate, there is no clear negative trend in terms of surface water quality between July 1988 and June 2020. Furthermore, EPA Q-stations located upstream of the Application Site fluctuate in a similar manner indicating that there are other activities in the catchment, including agriculture, which had a greater effect on downstream surface water quality.

Some improved sediment control measures were installed at the Application Site in the late 1990s and early 2000s and water quality discharge Licence limits have been in place since 2000 in accordance with IPC licensing. Any cumulative effects will have been reduced in subsequent years with environmental monitoring showing that since 2000, the emission limit for ammonia (3.7mg/l) has not been exceeded in any of the 57 no. grab samples taken from outfalls from the Application Site. Meanwhile the emission limit for suspended solids has only been exceeded on 7 no. occasions. As discussed in Section 8.4.6.2.2 above, 100% and 93% of the total samples analysed for ammonia and suspended solids have been compliant with the relevant IPC limits. Therefore, if significant cumulative effects were occurring, we would expect to see an improvement in downstream water quality following the implementation of the IPC Licence control measures.

However, the available monitoring data indicate that improvements in downstream water quality have not been significant. This indicates that the wider land use in the catchment, which is dominated by agriculture, has a greater effect on surface water quality than the peat extraction and ancillary activities within the Application Site and any associated cumulative effects.

Residual Effect: The baseline July 1988 environment comprised of a drained peatland located within a largely agricultural catchment. There are no indications from surface water quality monitoring data that peat extraction and ancillary activities within the Application Site in combination with agricultural activities in the wider catchment had a significant impact on downstream surface water quality. The EPA Q-values suggest that any cumulative effects were small in comparison to the effects resulting solely from agricultural practices in the wider catchment. Therefore, any cumulative effects on local downstream local surface water quality would have been consistent with emerging trends within the downstream catchments when compared to those which would have resulted solely from the large scale, commercial Bord na Móna peat harvesting operations. The residual effect is a moderate, long-term, negative, indirect, likely cumulative effect on downgradient waterbodies (i.e. the Boor and Brosna rivers), and is Not Significant.

Significance of Effects: For the reasons outlined above we consider that there has not been a significant cumulative effect during the Peat Extraction Phase of the Project.

8.6.5.1.3 *Cumulative Effects with Forestry*

There are some small areas of coniferous forestry in the lands surrounding the Application Site. These areas of forestry do not form part of the Substitute Consent application.

The most common water quality problems arising from forestry relate to the release of sediment and nutrients to the aquatic environment and impacts from acidification. Forestry may also give rise to modified stream flow regimes caused by associated land drainage.

Due to the close proximity of these areas of coniferous forestry to the Application Site and given that they drain to the same river waterbodies as the Application Site, the potential cumulative effects on downstream water quality and quantity need to be assessed.

Pathways: Peat drainage and surface water pathways.

Receptors: Surface water quality and quantity in downgradient waterbodies (i.e. the Boor and Brosna rivers and associated tributaries).

Control Measures:

No control measures beyond those required to comply with the IPC Licence conditions are deemed necessary. These control measures have been implemented by Bord na Móna since 2000 and build upon pre-existing surface water management system which was already in operation at the Application Site (July 1988 – June 2000).

Impact Assessment:

The areas of coniferous forestry were small in comparison to the peat extraction and ancillary activities completed by Bord na Móna.

By July 1988 the vast majority of the Application Site had already been artificially drained. Consequently, the continued drainage of the Application Site during the Peat Extraction Phase of the Project would have been limited in its potential to alter the hydrological regime in downstream watercourses. However, during the Peat Extraction Phase, there was an ongoing risk of elevated concentrations of suspended solids making their way into downstream surface watercourses from the erosion of peat sediment via the bog drainage network. This potential pathway would pose a significant risk to local surface water quality. Other water quality parameters of concern are ammonia and Chemical Oxygen Demand (COD).

As outlined previously, EPA Q-values throughout the Peat Extraction Phase of the Project fluctuate, there is no clear negative trend in terms of surface water quality between July 1988 and June 2020. In addition, there is no distinguishable improvement in surface water quality following the implementation of the improved sediment control measures in the late 1990s and early 2000s and the IPC Licence control measures in 2000. The monitoring data indicates there are other activities in the catchments which effect water quality and also that the baseline water quality was reasonably good and has not changed significantly during the Peat Extraction Phase of the Project.

Residual Effects: By July 1988 peat extraction and ancillary activities were already well established across the majority of the Application Site. Therefore, the baseline environment contained peat extraction across much of the Application Site. Any cumulative effects with the commercial forestry activities will have been reduced in subsequent years as Bord na Móna implemented improved sediment control measures throughout the 1990s and IPC licencing controls in 2000.

EPA Q-values in downstream watercourses fluctuate throughout this phase of the Project, there is no clear negative trend in terms of surface water quality between July 1988 and June 2020.

Therefore, the cumulative effect of the Peat Extraction Phase of the Project and the forestry activities in the surrounding lands is moderate, long-term, negative, indirect, likely effect on downgradient waterbodies (i.e. Boor and Brosna rivers, and their associated tributaries), and is Not Significant.

Significance of Effects: For the reasons outlined above we consider that there has not been a significant cumulative effect during the Peat Extraction Phase of the Project.

8.6.5.2 Current Phase (June 2020 – Present Day)

8.6.5.2.1 *Cumulative Effects with Agriculture*

The Application Site is situated within a largely agricultural catchment and any activities within the Application Site have the potential to interact with the agricultural practices in the surrounding lands and could contribute to a deterioration of downstream surface water quality.

The potential effects are similar to those associated with the Peat Extraction Phase of the Project but of a significantly reduced magnitude due to the reduced scale of any works. During this phase of the Project activities onsite include the removal of stockpiles (last stockpiles were removed from the Application Site by 2024), maintenance of the existing drainage system and environmental monitoring.

Pathways: Surface water pathways.

Receptors: Surface water quality in downgradient waterbodies (i.e. the Boor and Brosna rivers, and their associated tributaries).

Control Measures:

All operations completed during the Current Phase of the Project were done in accordance with IPC Licence requirements and no additional control measures are deemed necessary.

Residual Effects: There are no indications from EPA Q-values or environmental monitoring data that there has been a significant impact on downstream surface water quality. No cumulative effects have occurred.

Significance of Effects: For the reasons outlined above and with the implementation of IPC Licence control measures, we consider that there has not been a significant cumulative effect during the Current Phase of the Project.

8.6.5.2.2 *Cumulative Effects with Forestry*

There are some small areas of coniferous forestry in the lands surrounding the Application Site, and given that they drain to the same river waterbodies as the Application Site, the potential cumulative impacts on downstream water quality and quantity need to be assessed.

The potential effects are similar to those associated with the Peat Extraction Phase of the Project but of a significantly reduced magnitude due to the reduced scale of any works. During this phase of the Project activities onsite are limited to the removal of stockpiles (last stockpiles were removed from the Application Site by 2024), maintenance of the existing drainage system and environmental monitoring.

Pathways: Surface water pathways.

Receptors: Surface water quality in downgradient waterbodies (i.e. the Boor and Brosna rivers, and their associated tributaries).

Control Measures:

All operations completed during the Current Phase of the Project were done in accordance with IPC Licence requirements and no additional control measures are deemed necessary.

Residual Effects: There are no indications from EPA Q-values or environmental monitoring data that there has been a significant effect on downstream surface water quality. No cumulative effects have occurred.

Significance of Effects: For the reasons outlined above and with the implementation of IPC Licence control measures, we consider that there has not been a significant cumulative effect during the Current Phase of the Project.

8.6.5.2.3 *Cumulative Effects with Enhanced Rehabilitation Measures (PCAS)*

The Peatland Action Scheme (PCAS) is a programme of enhanced peatland rehabilitation measures, which is in addition to the IPC Licence decommissioning and rehabilitation requirement. PCAS being applied at specific locations across the Bord na Móna landbank that are identified as suitable for the prescribed enhancement measures.

Whilst no PCAS works have been completed or are proposed within the Application Site, enhanced rehabilitation measures have been implemented during the Current Phase on 2 no. bogs to the south of the R436. These bogs, known as Curraghalassa Bog and Derrynagun Bog, both of which are hydrologically distinct from the Application Site. The short-term practical actions associated with the enhanced rehabilitation were completed at these bogs in 2025. . Further details of the measures implemented as part of PCAS at Curraghalassa and Derrynagun Bogs can be found in the associated Cutaway Bog Decommissioning and Rehabilitation Plan (2024) and GIS Mapbook (2024) at https://www.bnmpcas.ie/2024-bogs/

Whilst these bogs form part of the Boora Bog Group, they do not form part of the Application Site. These bogs drain to the same watercourses as the Application Site. A surface water outfall (SW23) discharges surface water from the drained Derrynagun Bog to a tributary of the Lemanaghan Stream. Meanwhile, the Kilcolgan Beg Stream passes immediately to the west of Curraghalassa Bog. Therefore, there was the potential for cumulative effects on downstream surface water quality and quantity between the Current Phase of the Project and the works associated with the PCAS measures. The PCAS measures themselves may have resulted in a short-term negative effect on surface water quality during the works (elevated concentrations of suspended sediment). In the long-term, the PCAS measures in Derrynagun and Curraghalassa bogs will provide greater surface water attenuation and surface water quality benefits in and downstream of the restoration areas. PCAS measures in Derrynagun and Curraghalassa bogs, and the measures which will be implemented across the Application Site during the Remedial Phase as described in Chapter 4, will have a positive cumulative effect on bog hydrogeology and surface water quality (assessed for the Remedial Phase below in Section 8.6.5.3.2).

Pathways: Peat drainage and surface water pathways.

Receptors: Surface water quality in downgradient waterbodies (i.e. the Brosna River and its associated tributaries) and bog hydrogeology.

Mitigation Measures: All operations completed during the Current Phase of the Project were completed in accordance with IPC licence requirements and no additional mitigation measures are deemed necessary. All PCAS measures completed at Derrynagun and Curraghalassa bogs were also undertaken in accordance with IPC licence requirements.

Residual Effects: There are no indications from EPA Q-values or environmental monitoring data that there has been a significant effect on downstream surface water quality. No cumulative effects have occurred.

Significance of Effects: For the reasons outlined above and with the implementation of IPC Licence control measures, we consider that there has not been a significant cumulative effect during the Current Phase of the Project. Remedial Phase.

8.6.5.2.4 *Cumulative Effects with Proposed Lemanaghan Wind Farm*

Bord na Móna intend to utilise the Application Site for both peatland rehabilitation and wind energy infrastructure in order to facilitate environmental stabilisation of the bog and to optimise climate action benefits.

Lemanaghan Wind Farm DAC, a joint venture between SSE Renewables and Bord na Móna (BnM) (i.e the Applicant) are proposing a wind energy development consisting of 15 turbines with an overall blade to tip height of 220m at the Application Site. The overall footprint of the infrastructure associated with the wind farm is 3% of the total area of the Application Site. The Draft Cutaway Bog Decommissioning and Rehabilitation plan for the Application Site will be updated as required to incorporate the proposed wind farm infrastructure, with the key objectives of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan *i.e.* rewetting and revegetation, occurring between and surrounding the proposed wind farm infrastructure. A separate EIAR and accompanying NIS are being undertaken for the proposed Lemanaghan Wind Farm development. At the time of writing, the planning application for this development has not yet been submitted to An Coimisiún Pleanála. There will be a slight cumulative effect with on Land, Soils and Geology for the proposed Lemanaghan Wind Farm, but the effect is limited by the small footprint of the infrastructure associated with the wind farm relative to the overall Application Site area.

The EIAR for the proposed Lemanaghan Wind Farm development will detail the potential hydrological and hydrogeological issues relating to the construction, operation and decommissioning phases of the proposed wind farm and proposes a suite of detailed, tried and tested, best practice mitigation measures designed to ensure that the proposed wind farm development does not in any way have a negative impact on downstream surface water quality and quantity.

The main risk to downstream surface water quality and the underlying groundwater quality will occur during the construction phase of the proposed wind farm development when there is greatest activity on site and large volumes of material being excavated, increasing the potential for elevated concentrations of suspended solids in runoff and heightening the risk of hydrocarbon spillages and leaks. However, extensive mitigation measures will be utilised to protect surface water quality during all phases of the proposed wind farm development. These mitigation measures will utilise and enhance the existing bog drainage network to ensure the proposed wind farm development will be in accordance with IPC Licence conditions.

During the operational phase of the proposed wind farm development, the majority of the remedial rehabilitation measures, such as drain blocking, will have been completed and there will be little activity on site with the exception of monitoring and maintenance. The increased surface water runoff associated with the wind farm development infrastructure will be offset by the increased surface water attenuation at the site following the implementation of the remedial measures.

Water quality of discharges from restored peatlands generally improves as a result of bog rehabilitation measures and site restoration. The proposed rehabilitation measures at the Application Site include drain blocking which will improve water attenuation by slowing the movement of water through the Application Site and the release of water downstream. Re-vegetation of the Application Site will stabilise substrates and reduce the risk of elevated concentrations of suspended sediment in downstream watercourses.

Pathways: Peat drainage and surface water pathways.

Receptors: Surface water quality in downgradient waterbodies (i.e. the Boor and Brosna rivers, and their associated tributaries) and bog hydrogeology.

Mitigation Measures: No mitigation measures beyond those required to comply with the IPC Licence conditions and those outlined in Sections 8.6.2.3.1 to Section 8.6.2.3.4 are deemed necessary.

Likely Cumulative Residual Effects: Infrastructure associated with the proposed wind farm development comprises a small proportion of landcover within the Application Site. Effective mitigation measures have been proposed for the remedial phase of the Project and with the implementation of similar measures for all phases of the potential wind farm development the cumulative residual effect is a moderate, long-term, likely, positive effect, and is Not Significant.

Significance of Effects: For the reasons outlined above we consider that there will not be a significant cumulative effect.

8.6.5.2.5 *Cumulative Effects with Enhanced Rehabilitation Measures (PCAS)*

As stated above in Section 8.6.5.2.3 PCAS works were completed at 2 no. bogs (Derrynagun and Curraghlassa bogs) to the south of the Application Site in 2025.

The PCAS measures in the Derrynagun and Curraghalassa bogs will provide greater surface water attenuation and surface water quality benefits in and downstream of the restoration areas. These PCAS measures and the standard remedial measures, which will be implemented across the Application Site, will have a positive cumulative effect on bog hydrogeology and surface water quality.

Pathways: Peat drainage and surface water pathways.

Receptors: Surface water quality in downgradient waterbodies (i.e. the Brosna River and its associated tributaries) and bog hydrogeology.

Mitigation Measures: No mitigation measures beyond those required to comply with the IPC Licence conditions and those outlined in Sections 8.6.2.3.1 to Section 8.6.2.3.4 are deemed necessary.

Likely Cumulative Residual Effects: The PCAS works will have a long-term positive effect on the local bog hydrogeological environment and the local hydrological environment (in terms of surface water quality and attenuation). The cumulative residual effect is a long-term, likely, moderate, positive effect, and is Not Significant.

Significance of Effects: For the reasons outlined above we consider that there will not be a significant cumulative effect.

8.6.5.2.6 *Cumulative Effects with Agriculture*

As stated previously, the Application Site is situated within a largely agricultural catchment and any activities within the Application Site have the potential to interact with the agricultural practices in the surrounding lands and could contribute to a deterioration of downstream surface water quality.

Water quality of discharges from restored peatlands generally improves as a result of bog rehabilitation measures and site restoration.

The proposed rehabilitation measures at the Application Site will improve water attenuation and reduce the risk of elevated concentrations of suspended sediment in downstream watercourses. Therefore, the potential cumulative effects will be less than those described for the Peat Extraction Phase in Section 8.6.5.1.2 above.

Pathways: Surface water pathways.

Receptors: Surface water quality in downgradient waterbodies (i.e. the Boor and Brosna rivers, and their associated tributaries).

Mitigation Measures: No mitigation measures beyond those required to comply with the IPC Licence conditions and those outlined in Sections 8.6.2.3.1 to Section 8.6.2.3.4 are deemed necessary.

Likely Cumulative Residual Effects: The Remedial Phase will have a positive effect on downstream surface water quality. The cumulative effect with agriculture will be a long-term, slight, neutral, effect, and is Not Significant.

Significance of Effects: For the reasons outlined above and with the implementation of IPC Licence control measures, we consider that there will not be a significant cumulative effect.

8.6.5.2.7 *Cumulative Effects with Forestry*

As stated previously, there are some small areas of coniferous forestry in the lands surrounding the Application Site, and given that they drain to the same river waterbodies as the Application Site, the potential cumulative impacts on downstream water quality and quantity need to be assessed.

The potential effects are similar to those associated with the Peat Extraction Phase of the Project (discussed in Section 8.6.5.1.3) but of a significantly reduced magnitude as the Remedial Phase will result in improvements in surface water attenuation and water quality (reduced concentrations of suspended solids) at the Application Site.

Pathways: Surface water pathways.

Receptors: Surface water quality in downgradient waterbodies (i.e. the Boor and Brosna rivers, and their associated tributaries).

Mitigation Measures: No mitigation measures beyond those required to comply with the IPC Licence conditions and those outlined in Sections 8.6.2.3.1 to Section 8.6.2.3.4 are deemed necessary.

Likely Cumulative Residual Effects: The Remedial Phase will have a positive effect on downstream surface water quality. The cumulative effect with forestry will be a long-term, slight, neutral, effect, and is Not Significant.

Significance of Effects: For the reasons outlined above and with the implementation of IPC Licence control measures, we consider that there will not be a significant cumulative effect during the Remedial Phase of the Project.

8.6.6 Human Health

Due to the nature of the peat extraction process, combined with the mitigation measures and environmental monitoring implemented at the site, no water related impacts on human health have likely resulted from the Peat Extraction Phase nor the Current Phase of the Project.

Furthermore, the Remedial Phase will pose no risk to human health and will likely result in the improvement in local surface water quality.

8.6.7 Monitoring

Environmental monitoring will continue as per the existing IPC conditions until the current IPC Licence is surrendered.

This monitoring will encompass surface water sampling to ensure that the discharge from the Application Site remains below the existing IPC emission limit values, thereby protecting downstream surface water quality.

It is also likely that some monitoring will be proposed in order to evaluate the success of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan. This shall include groundwater monitoring in the form of piezometers which will allow for the measurement of the peat groundwater table and assess the impact of the proposed rehabilitation measures, such as drain blocking, which are designed to raise the local peat groundwater table.

8.6.8 Major Accidents and Disasters (MADs)

The main risk of MADs at peatland sites is related to peat stability. However, due to the low-lying and flat nature of the Application Site, slope stability has posed no risk at the Application Site during any phases of the Project.

Flooding can also result in downstream MADs. However, there has been no risk of flooding downstream of the Application Site as a result of the historic and/or proposed activities at the site due to the low lying nature of the Application Site and the attenuation provided by the on-site drainage system, in particular the presence of the settlement ponds.

There are no other foreseeable MADs.

8.6.9 Conclusions

The Application Site is a large Bord na Móna bog which forms part of the Boora Bog Group. The Application Site comprises an area of 1,111 hectares (ha) within which bog drainage works began in 1950 followed by the commencement of peat extraction from 1960. The Application Site is located in County Offaly, 3.3km to the northeast of Ferbane, 7.8km southwest of Clara, and 8.7km south of Moate. The current topography of the Application Site is relatively flat with an elevation range of between approximately 46 and 60mOD (metres above Ordnance Datum).

Regionally, the Application Site is located in a total of 3 no. surface water catchments. The vast majority of the Application Site is located in the Lower Shannon surface water catchment within Hydrometric Area 25A of the Shannon Irish River Basin District (Shannon IRBD). Meanwhile, a small area in the northwest of the Application Site is located within the Lower Shannon surface water catchment within Hydrometric Area 25B of the Shannon IRBD. Furthermore, a small section towards the north of the Application Site is located in the Upper Shannon surface water catchment within Hydrometric Area 26G of the Shannon IRBD (www.epa.ie). Therefore, all surface waters draining the Application Site will eventually discharge to the River Shannon.

Currently, the surface of the Application Site is drained by a network of field drains that are typically spaced every 15 to 20m. Larger arterial drains connect the smaller field drains and gently slope towards perimeter silt ponds and surface water outfalls. Surface water outflows from site discharge to small streams which in turn discharge into the Boor River to the northwest and the Brosna River to the south. 2 no. pumping locations are situated at the Application Site with all other outfalls are drained by gravity.

The baseline for the assessment of peat extraction and ancillary activities at the Application Site is July 1988, and the Peat Extraction Phase covers the period between July 1988 and June 2020. Bord na Móna commenced drainage works at Application Site in 1950. By July 1988 peat extraction was well established at the Application Site. The emerging baseline trend was a drained area of cutover bog with peat extraction having been ongoing for many years.

As a result, the potential impacts from peat extraction and ancillary activities were consistent with the baseline environment, and arising potential impacts on water quality from sediment, hydrocarbons, wastewater are all assessed as having moderate potential impacts. Available water quality data or upstream and downstream watercourses, and discharge water quality monitoring from the bog, do not indicate any significant impacts on water quality occurred during the Peat Extraction Phase.

Since 2000, Bord na Móna have been operating the Application Site under IPC Licence requirements. The IPC Licence (P0500-01) sets out several conditions and emission limits designed to ensure the protection of surface and groundwaters.

Peat extraction ceased at the Application Site in June 2020 and our assessment concludes that potential impacts on surface water flows and surface water quality, and groundwater quality are neutral during this period. No changes to the hydrological and/or hydrogeological environments will have occurred from Current Phase of the Project *i.e.* since the cessation of peat extraction to the present day.

The Remedial Phase has also been assessed. The implementation of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan will generally involve the rewetting and revegetation of the drained bog. The plan will have a long term positive effect on the local peat hydrogeology within the Application Site where groundwater table in the peat bog is stabilised and closer to the bog surface. The plan will also have positive long term effects on downstream water quality and regulation of surface water flows.

The assessment confirms that no significant cumulative effects on the hydrological or hydrogeological environments have resulted from the various phases of the Project. Similarly, no cumulative effects on the hydrological or hydrogeological environments will result from the implementation of the Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan, nor the proposed Lemanaghan Wind Farm development at the Application Site.