APPENDIX 8-1

FLOOD RISK ASSESSMENT FOR EXTRACTION IN LEMANAGHAN BOG, CO. OFFALY 2025

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EXTRACTION IN LEMANAGHAN BOG, CO. OFFALY

SITE SPECIFIC FLOOD RISK ASSESSMENT

FINAL REPORT

Prepared for:

BORD NA MÓNA ENERGY LTD

Prepared by:
Hydro-Environmental Services

DOCUMENT INFORMATION

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Signed:	 _____ **Michael Gill B.A., B.A.I., M.Sc., MIEI** **Managing Director – Hydro-Environmental Services**

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1. INTRODUCTION

1.1 BACKGROUND

Hydro-Environmental Services (HES) were requested by MKO Ireland (MKO), on behalf of Bord Na Móna Powergen Ltd, to undertake a Flood Risk Assessment (FRA) for Lemanaghan Bog (the 'Application Site') with respect to the following conditions:

- The current baseline hydrology of the Application Site; and,
- The implementation of the proposed Draft Bord na Móna Cutaway Bog Decommissioning and Rehabilitation Plan for the Application Site (hereafter referred to as the Rehabilitation Plan) .

The Application Site forms part of the Boora Bog Group and comprises an area of 1,111hectares (ha). The Application Site is located approximately 3km to the northeast of Ferbane, 7.8km southwest of Clara, and 8.7km south of Moate. The Application Site has been extensively modified, cutover and drained as a result of the historic peat extraction dating back to 1950. Peat extraction ceased at the Application Site in June 2020.

The FRA is intended to support the remedial Environmental Impact Assessment (rEIAR) submitted as part of the substitute consent application. The Project is described in full in Chapter 4 of the EIAR. For the purposes of this FRA, and consistent with the rEIAR, the various components are described and assessed using the following references: the 'Project', 'Peat Extraction Phase', 'Current Phase' and the 'Remedial Phase'.

This FRA is carried out in accordance with 'The Planning System and Flood Risk Management Guidelines for Planning Authorities' (DoEHLG, 2009). This FRA is also completed in accordance with the Flood Risk Management policies (CAEP-53 to CAEP-63) and the policies in relation to Peatlands (CAEP-16 to CAEP20) detailed in the Offaly County Development Plan (2021-2027).

1.2 STATEMENT OF EXPERIENCE

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which 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 area of expertise and experience in hydrology and hydrogeology, including flooding assessment and surface water modelling. We routinely work on surface water monitoring and modelling and prepare flood risk assessment reports.

This FRA report 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).

1.3 REPORT LAYOUT

This FRA report has the following format:

- Section 2 describes the location and background details of the Application Site;
- Section 3 outlines the hydrological and geological characteristics of the Application Site and downstream surface water catchments and the existing and proposed site drainage;
- Section 4 presents the current site-specific flood risk conditions across the Application Site;
- Section 5 assesses the potential change in flood risk conditions (from the baseline) at the Application Site, and downstream of the bogs, as a result of the Rehabilitation Plan, and also cumulatively with the proposed Lemanaghan Wind Farm development; and,
- Section 6 presents the FRA report conclusions.

2. BACKGROUND INFORMATION

This section provides details on the topographical setting of the Application Site along with a description of peat extraction and ancillary activities.

2.1 SITE LOCATION AND TOPOGRAPHY

Lemanaghan Bog ("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 1,111hectares (ha) within which bog drainage works began in 1950 followed by the commencement of peat extraction from 1960. The Application Site is located 3.3km to the northeast of Ferbane, 7.8km southwest of Clara, and 8.7km south of Moate. The Application Site measures approximately 5.5km in length from north to south, and approximately 6.9km 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). A site location map is shown as **Figure A.**

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. 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. A 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 R426 into the Lemanaghan Works site in the south of the Application Site.

The current topography of the Application Site is relatively flat with an elevation range of between approximately 50 and 62mOD (metres above Ordnance Datum). Topography at the Application Site has been modified through the peat extraction and all 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. The topography of the Application Site was estimated to range between 75 and 89mOD.

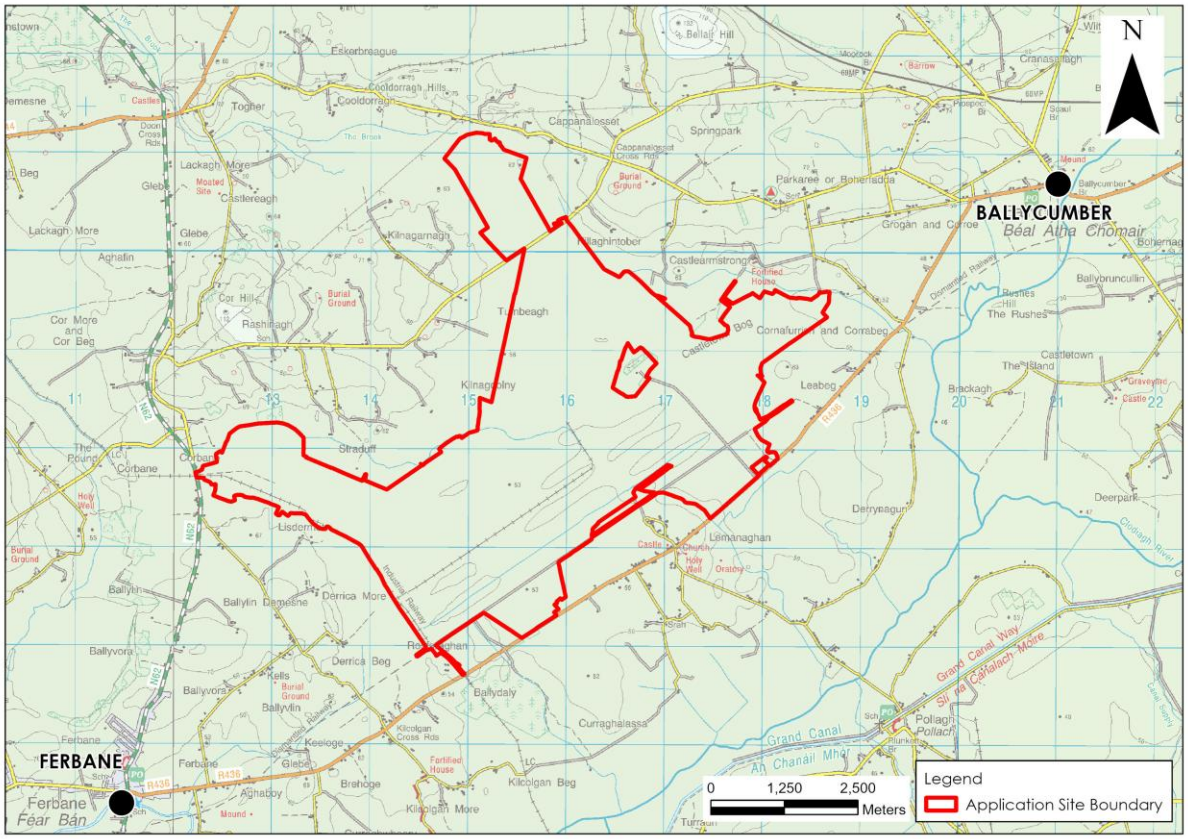

Figure A: Site Location Map

2.2 SITE HISTORY

The Application Site has been subject to drainage and peat extraction since 1950 and 1960, respectively, with peat extraction ceasing in June 2020.

The primary change to land at the Application Site associated with peat extraction and ancillary activities occurred during the initial drainage of the bog from 1950 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). Ancillary infrastructure were also constructed including railway lines. After the 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 soils/land change occurred. During peat extraction, minor topographic changes have occurred annually due to the removal of peat from active peat extraction areas.

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. By 1995 peat was also being extracted from the area in the northern extent of the Application Site, which had only been drained by 1988. 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(approximately 61.2 hectares).

Peat extraction within the Boora Bog Group, within which the Application Site is located, has been regulated by the EPA under IPC Licence Registration No. P0500-01 since 2000. Prior to

this date, the Bord na Móna had been completing environmental monitoring and control measures at the Application Site. Initially these measures included the incorporation of silt ponds into the bog drainage system to minimise the concentrations of suspended solids entering local watercourses from the bog drainage network. These control measures were upgraded and enhanced in accordance with IPC Licence conditions from May 2000.

Peat extraction ceased at the Application Site in June 2020. Following cessation of peat extraction, the site drainage has continued to operate under the same drainage systems as during the Peat Extraction Phase *i.e.* a hierarchy of field drains, main drains, silt ponds etc. During the Current Phase (June 2020 to Present Day) all activities continue to be monitored in accordance with IPC licence conditions.

Drainage from the Application Site is regulated by the shallow (low gradient) nature of the drainage, and by routing all bog drainage via field drains, main drains, headland drains, then from silt ponds to outfalls, with final discharge to natural watercourses. Therefore, existing discharge volumes from the site to nearby surface watercourses will be comparable to surface water discharges during the Peat Extraction Phase (July 1988 – June 2020).

3. EXISTING ENVIRONMENT AND CATCHMENT CHARACTERISTICS

This section gives an overview of the hydrological and geological characteristics in the area of the Application Site.

3.1 HYDROLOGY

3.1.1 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.

25.747ha of the Application Site are located within the Upper Shannon regional surface water catchment (26G), 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 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 FRA '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) approximately6.5km 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).

40.632ha of the Application Site are located within the Lower Shannon (25B) regional surface water catchment, 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 (1043.479ha) 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 discharge 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.

A regional hydrology map is included as **Figure B** below.

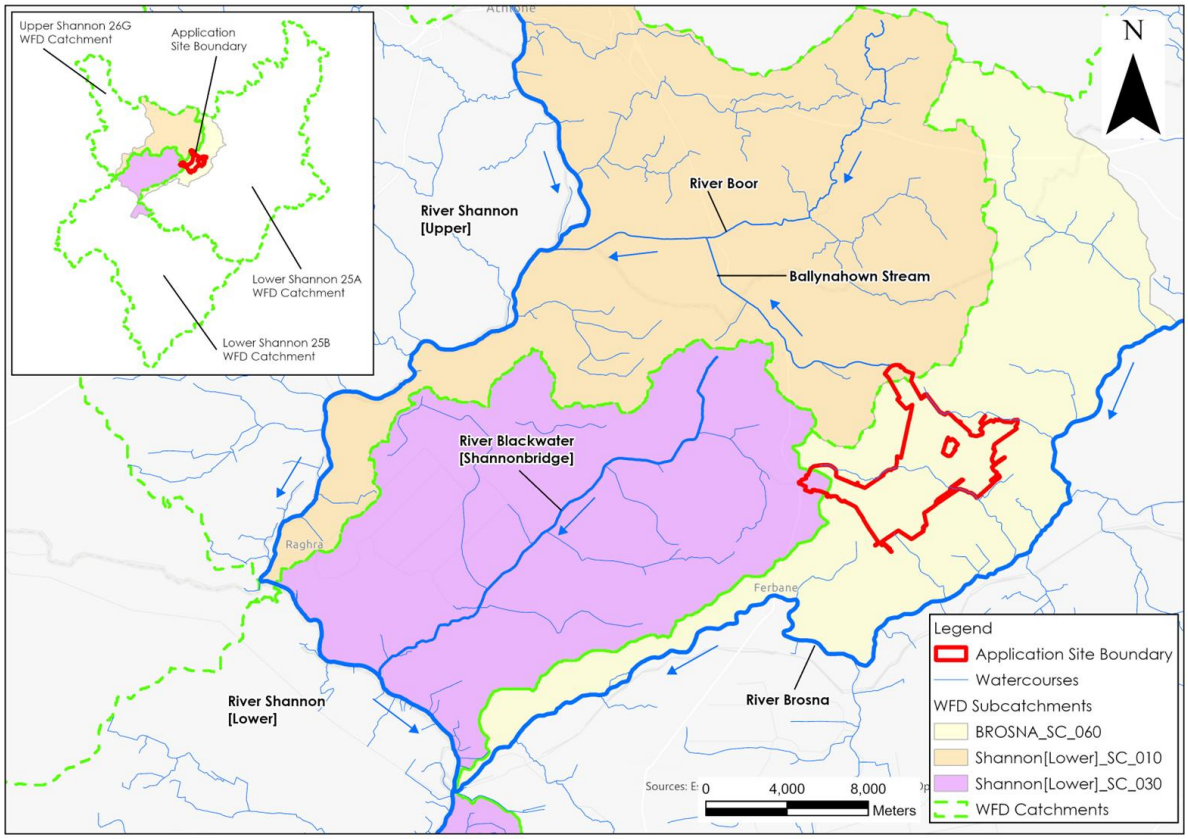

Figure B: Local Hydrology Map

3.1.2 Rainfall and Evaporation

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

The nearest 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.

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.

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.

In addition to average rainfall data, extreme value rainfall depths are available from Met Éireann. A summary of various return periods and duration rainfall depths for the Application Site are presented in **Table A**.

Table A: Rainfall Return Period Depths for the Application Site

	Return Period (Years)			
Duration	**1**	**5**	**30**	**100**
5 mins	3.9	6.6	11.3	15.8
15 mins	6.3	10.8	18.5	25.9
30 mins	8.0	13.2	22.0	30.3
1 hour	10.2	16.3	26.3	35.4
6 hours	18.8	27.8	41.3	52.8
12 hours	23.9	34.1	49.2	61.7
24 hours	30.3	42.0	58.6	72.1
2 days	38.1	50.8	68.2	81.9

3.1.3 Geology

The published Teagasc soils map (www.gsi.ie) for the local area shows that cutover/cutaway peat is mapped almost exclusively across the Application Site. There are some very small, localised pockets of mainly basic peaty poorly drained mineral soils (BminPDPT) and basic poorly drained mineral soils (BminPD) mapped within the Application Site. Soils mapped in the surrounding lands comprise largely of basic deep well drained mineral soil (BminDW) to the north and west, basic shallow well drained mineral soil (BminSW) to the east and cutover peat to the south. Mineral alluvium (AlluvMIN) is mapped along many of the local watercourses in the surrounding lands, with significant alluvium deposition along the Brosna River to the south and east of the Application Site.

The published GSI subsoils map (www.gsi.ie) shows that the Application Site in underlain predominantly by cutover raised peat (Cut). The GSI also map some small, isolated pockets of gravels derived from limestone (GLs) and till derived from limestones (TLs). The island of agricultural land surrounded by the Application Site is mapped to be underlain by tills derived from limestones (TLs) and bedrock outcrop or subcrop (Rck). Subsoils in the surrounding lands are mapped largely as cutover peat, tills derived from limestone and gravels derived from limestone. Meanwhile, some esker sands and gravels are also mapped to the northeast. Alluvium subsoils are mapped approximately 1.5km to the south of the Application Site and 400m to the east along the Brosna River and its tributaries. An area of lake marl (Mrl) is also mapped approximately 700m to the southeast in the townland of Derrynagun.

The soils and subsoils present at the Application Site have been verified during site walkover surveys and intrusive site investigations completed by HES, MKO, Fehily Timoney and Company (FTC) and Irish Drilling Limited (IDL). These surveys were completed across several phases dating from July 2021 to February 2025.A total of 722 no. peat probes have been completed at the Application Site along with 63 no. trial pits and 10 no. boreholes. Based on the extensive peat probe dataset, peat depths across the Application Site range from 0 to >6m with an average peat depth of 2m. Subsoils encountered during the peat probing investigations comprised predominantly of grey, gravelly lacustrine clay which was occasionally found to be overlain by a creamy shelly marl. Other sub-peat subsoils encountered included grey silty or gravelly CLAY, silty, gravelly SAND with some probes terminating on a hard base (interpreted to be gravels or cobbles).

A local subsoils map is attached below as **Figure C**.

The bedrock geology of the local area is characterised by the presence of a large anticlinal structure, known as the Ferbane Inlier. Devonian Kiltorcan-type Sandstones of this body form the core of this major northeast southwest trending anticlinal structure. The sandstones are overlain to the northwest and southeast by Dinantian Sandstones, Shales and Limestones which are in turn overlain by Dinantian Lower Impure Limestones.

The anticlinal fold axis of the Ferbane Inlier is mapped underlying the south of the Application Site. Here the GSI map the presence of the Devonian Old Red Sandstones (Devonian Kiltorcan-type sandstones) which form the core of this structure and are comprised of red conglomerates, sandstones and mudstones. The GSI map these sandstones to be overlain by the Navan Beds (Dinantian Sandstones, Shales and Limestones) which consist of dark limestone, mudstone and sandstone. The Navan Beds are in turn overlain by the Ballysteen Formation (Dinantian Lower Impure Limestone). This bedrock geological formation is comprised of dark muddy limestone and shale.

A major fault, known as the Ferbane Fault, is mapped along the northwestern side of the inlier (trending northeast to southwest) downthrowing the succession to the northwest of the fault. This major fault is mapped below the centre of the Application Site and juxtaposes the Waulsortian Limestones against the older Navan Beds and Ballysteen Formations. The Waulsortian Limestone (Dinantian Pure Unbedded Limestones) comprise of massive, unbedded lime-mudstones and underlier the northwest of the Application Site. The Ferbane Fault is itself displaced by several smaller northwest to southeast trending faults.

A bedrock geology map of the local area is included as **Figure D**.

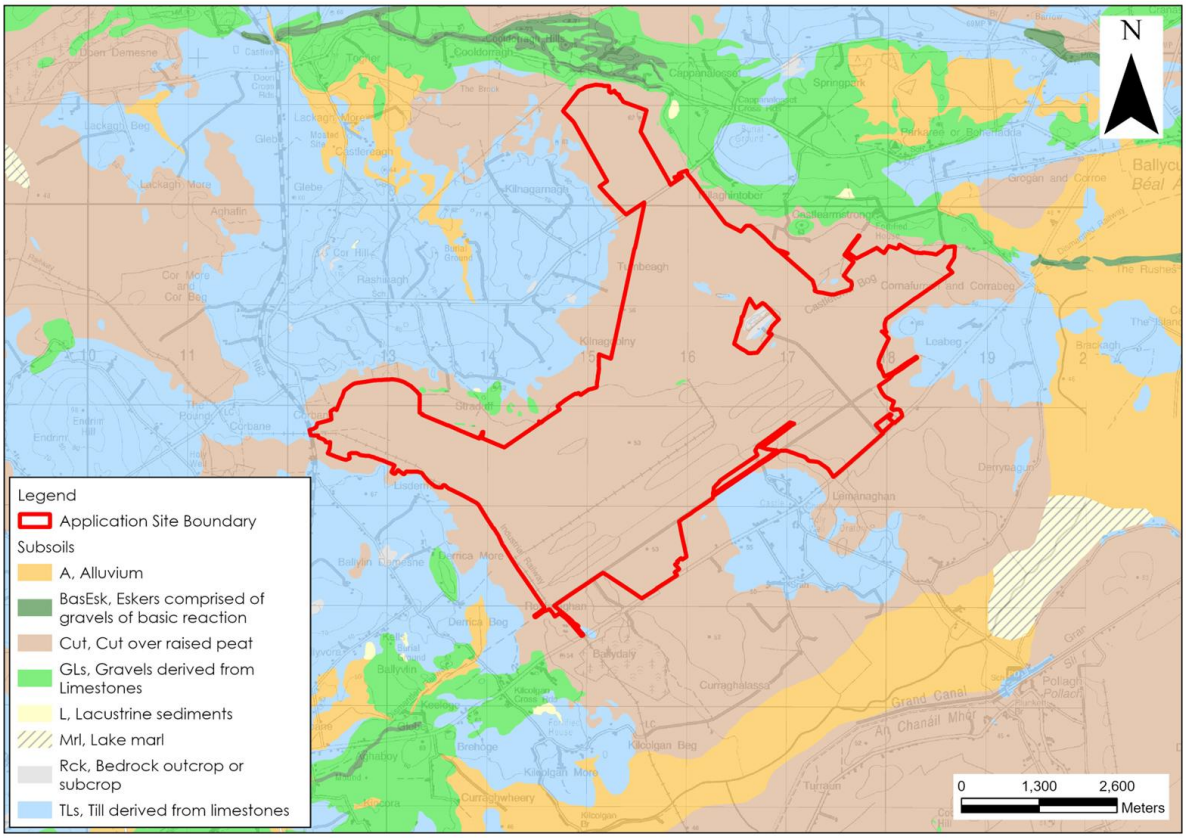

Figure C: Local Subsoils Map

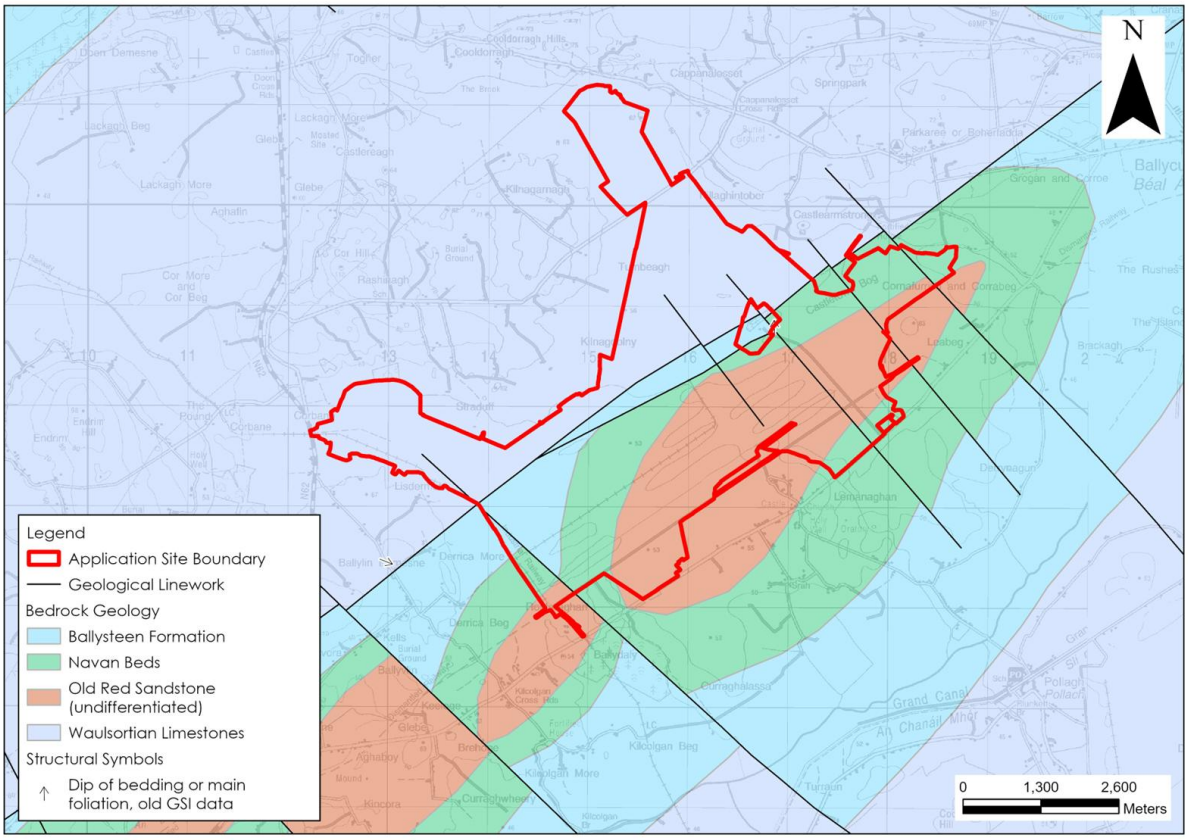

Figure D: Bedrock Geology Map

3.1.4 Site Drainage

Topography within the Application Site is relatively flat with an elevation range of between approximately 50 and 62mOD with gentle slopes in some locations. Along many of the bog boundaries, a 1-2m high peat headland exists which is a remnant of the original bog. These headlands and in some areas remnant peat banks create a boundary berm, forming a basin effect within the former peat extraction area.

Surface water is drained from the Application Site via a network of field drains typically spaced at 15 to 20m intervals, main drains, and settlement/silt ponds. Drainage is then discharged to off-site drainage channels which flow into the local river network. The Application Site is primarily drained by gravity however 2 no. pumps were installed in 2009 and 2019.

A flow diagram for the existing drainage system is shown as **Figure E** below.

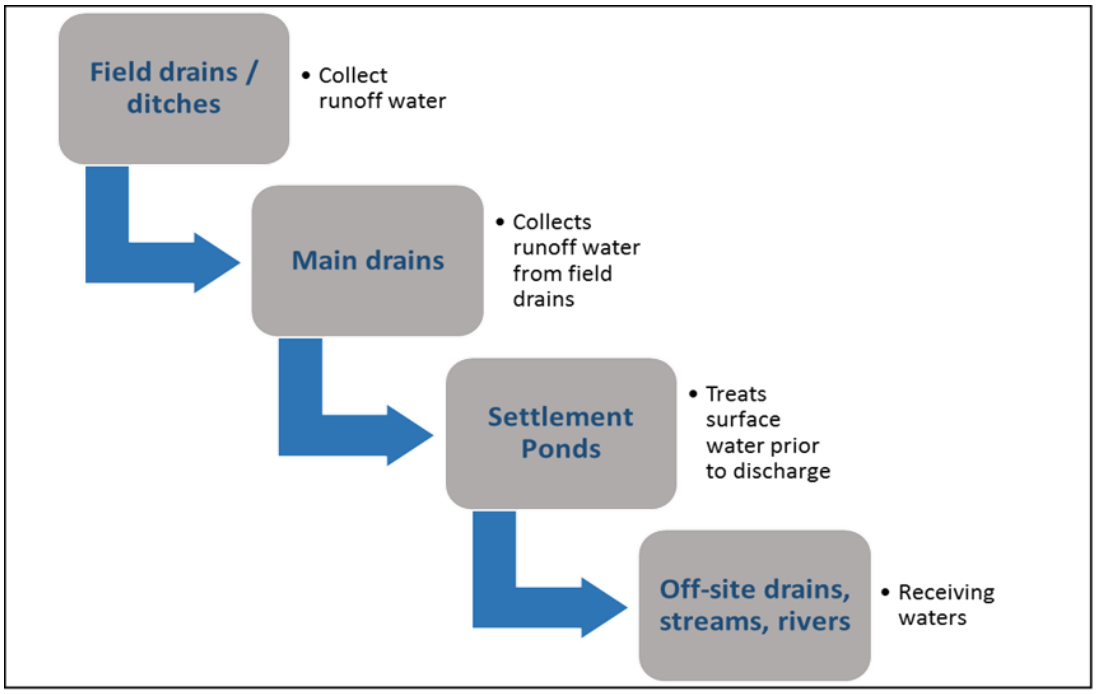

Figure E: Process Flow Diagram for the Existing Site Drainage System

A detailed hydrological audit of flowpaths from the Application Site to its eventual discharge point at the regional catchment scale was conducted. The resulting drainage and outfall map is shown as **Figure F**.

Drainage from the Application Site discharges through 8 no. gravity surface water outfalls (SW19, SW19A, SW19B, SW22, SW22A, SW22B, SW22C, SW22D and SW23):

- 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 the Brooks Stream);
- Within the Lemanaghan Stream_010 WFD river sub-basin, there are a total of 2 no. outfall (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 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 9 no silt ponds at the Application Site, which discharge via 8 gravity flow surface water outflows. 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. outfalls 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 **Figure F**, all surface water discharge from the Application Site ends up in the River Shannon.

The respective silt/settlement ponds and their outfall pipe elevations are presented in **Table B** below. Outfall pipe elevations range from 44.59 – 52.23mOD with the greatest outfall elevations recorded in the north of the Application Site. Outfalls generally discharge to nearby surface water bodies as mapped by the EPA or into smaller drains that flow towards these mapped watercourses.

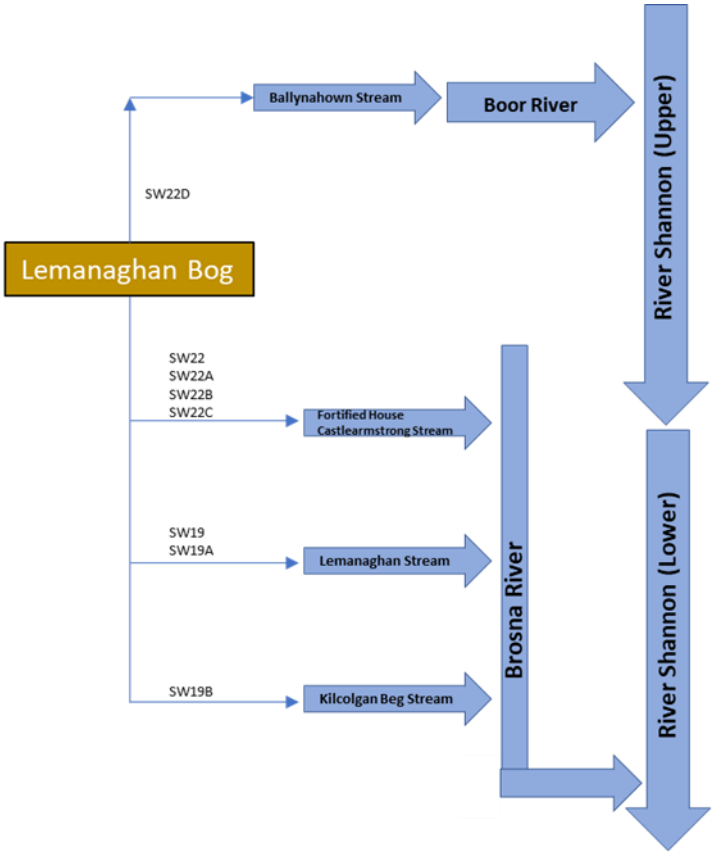

Figure F: Drainage, Flowpaths and Receiving Waterbodies

Table B: Bord na Mona Outfall Elevations

Surface Water Discharge Points ID	Easting	Northing	Outfall Pipe Elevation (m OD)	Nearby Surface Watercourse (EPA Name)	Distance from Outfall to Watercourse (m)
SW22D	614848	731164	53.24	The Brooks Stream	200
SW22C	615893	730342	52.23	Castlearmstrong Stream	100
SW22B	616097	730096	51.22	Castlearmstrong Stream	50
SW22A	616846	729572	48.07	Castlearmstrong Stream	200
SW22	618591	729624	44.59	Castlearmstrong Stream	Direct discharge to watercourse
SW23	618754	727069	45.56	Derrynagun 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 Stream	280

4. BASELINE FLOOD RISK DEFINITION

4.1 INTRODUCTION

The following assessment is carried out in accordance with '*The Planning System and Flood Risk Management Guidelines for Planning Authorities*' (DoEHLG, 2009). The basic objectives of these guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water runoff;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and,
- Ensure that the requirements of EU and national law in relation to the natural environment and nature conservation are complied with at all stages of flood risk management.

4.2 FLOOD RISK ASSESSMENT PROCEDURE

This section of the report details the site-specific flood risk assessment carried out for the Application Site and surrounding area. The primary aim of the assessment is to consider all types of flood risks and the potential impact on the Project. As per the relevant guidance (DOEHLG, 2009), the stages of a flood risk assessment are:

- *Flood risk identification* – identify whether there are surface water flooding issues at a site;
- *Initial flood risk assessment* - confirm sources of flooding that may affect a proposed development; and,
- *Detailed flood risk assessment* – quantitative appraisal of the potential risk to a proposed development.

As per the Guidelines, there are essentially two major causes of flooding:

Coastal flooding, which is caused by higher sea levels than normal, largely as a result of storm surges, resulting in the sea overflowing onto the land. Coastal flooding is influenced by the following three factors, which often work in combination:

- High tide level;

- Storm surges caused by low barometric pressure exacerbated by high winds (the highest surges can develop from hurricanes); and,

- Wave action, which is dependent on wind speed and direction, local topography and exposure.

Coastal Flooding is not applicable to the Application Site.

Inland flooding which is caused by prolonged and/or intense rainfall. Inland flooding can include a number of different types:

- Overland flow occurs when the amount of rainfall exceeds the infiltration capacity of the ground to absorb it. This excess water flows overland, ponding in natural hollows

and low-lying areas or behind obstructions. This occurs as a rapid response to intense rainfall and eventually enters a piped or natural drainage system.

- River flooding occurs when the capacity of a watercourse is exceeded or the channel is blocked or restricted, and excess water spills out from the channel onto adjacent low-lying areas (the floodplain). This can occur rapidly in short steep rivers or after some time and some distance from where the rain fell in rivers with a gentler gradient.

- Flooding from artificial drainage systems results when flow entering a system, such as an urban stormwater drainage system, exceeds its discharge capacity and the system becomes blocked, and/or cannot discharge due to a high-water level in the receiving watercourse. This mostly occurs as a rapid response to intense rainfall. Together with overland flow, it is often known as pluvial flooding. Flooding arising from a lack of capacity in the urban drainage network has become an important source of flood risk, as evidenced during recent summers.

- Groundwater flooding occurs when the level of water stored in the ground rises as a result of prolonged rainfall to meet the ground surface and flows out over it, i.e. when the capacity of this underground reservoir is exceeded. Groundwater flooding tends to be very local and results from interactions of site-specific factors such as tidal variations. While water levels may rise slowly, they may be in place for extended periods. Hence, such flooding may often result in significant damage to property rather than be a potential risk to life.

- Estuarial flooding may occur due to a combination of tidal and fluvial flows, i.e., the interaction between rivers and the sea, with tidal levels being dominant in most cases. A combination of high flow in rivers and a high tide will prevent water flowing out to sea, tending to increase water levels inland, which may flood over riverbanks.

The Flood Risk Management Guidelines (DoEHLG, 2009) provide direction on flood risk and development. The guidelines recommend a precautionary approach when considering flood risk management and the core principle of the guidelines is to adopt a risk-based sequential approach to managing flood risk and to avoid development in areas that are at risk. The sequential approach is based on the identification of flood zones for inland and coastal flooding.

Flood zones are geographical areas within which the likelihood of flooding is in a particular range, and they are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning.

There are three types or levels of flood zones defined within the guidelines:

Flood Zone A – where the probability of flooding from rivers and the sea is highest (greater than 1% (AEP)[1] or 1 in 100 for river flooding or 0.5% (AEP) or 1 in 200 for coastal flooding);

Flood Zone B – where the probability of flooding from rivers and the sea is moderate (between 0.1% (AEP) or 1 in 1000 and 1% (AEP) or 1 in 100 for river flooding and between 0.1% (AEP) or 1 in 1000 year and 0.5% (AEP) or 1 in 200 for coastal flooding); and,

1 AEP – Annual Exceedance Probability

Flood Zone C – where the probability of flooding from rivers and the sea is low (less than 0.1% (AEP) or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

Once a flood zone has been identified for a site, the guidelines set out the different types of development appropriate to each identified zone (pg. 25, Table 3.1 of the Guidelines). Exceptions to the restriction of development due to potential flood risks are provided for through the application of a Justification Test (JT), where the planning need and the sustainable management of flood risk to an acceptable level must be demonstrated by the applicant.

The Justification Test (JT) has been designed to rigorously assess the appropriateness, or otherwise, of particular developments that, for the reasons outlined above, are being considered in areas of moderate or high flood risk. The test is comprised of two processes.

- The first is the **Plan-making Justification Test** described in chapter 4 of the Guidelines and used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding. Plan making Justification Tests are made at Plan/Policy development stage such as County Development Plans, or Local Area Plans.

- The second is the **Development Management Justification Test** described in chapter 5 of the Guidelines and used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land. For example, application of Development Management Justification Test would be required at a site-specific level, such as for this FRA assessment, if a Justification Test is required.

4.3 BASELINE FLOOD RISK ASSESSMENT/IDENTIFICATION

4.3.1 Historical Mapping

To identify those areas as being at risk of flooding, historical mapping was consulted and reviewed. There is no text on local available historical 6" or 25" mapping that identifies areas that are "*prone to flooding*" within the Application Site. However, the local 6" basemaps indicate that lands to the south of the Application Site, along the Brosna River, are "liable to flood".

4.3.2 Soils Maps – Fluvial Maps

A review of the soil types in the vicinity of the Application Site was undertaken as soils can be a good indicator of past flooding in an area. Due to past flooding of rivers deposits of transported silts/clays referred to as alluvium build up within the floodplain and hence the presence of these soils is a good indicator of potentially flood-prone areas.

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

Extensive alluvium deposits are mapped along the Brosna River to the south and east of the Application Site. The widespread occurrence of the deposits in this area indicates the presence of a flood plain *i.e.* a large geographic area which is prone to flooding. The closest alluvium deposits along the Brosna River are mapped approximately 300m from the Application Site boundary.

4.3.3 OPW Past Flood Events Mapping

To identify those areas as being at risk of flooding, OPW's Past Flood Events Map was consulted (www.floodinfo.ie).

No recurring or historic flood incidents are recorded within the Application Site. However, several flood events have been recorded in the surrounding lands.

2 no. recurring flood events (Flood Event ID: 2627 and 2643) are mapped along the Boor River. The flood events are located upstream of the confluence of the Boor River and the Ballynahown Stream. These flood events are therefore, located upstream of the Application Site. The local area engineer report states that recurring flooding occurs as Ballinlassy (Flood Event ID: 2627) due to overbank flooding of the River Boor. Low lying lands are also noted to flood after heavy rain each year at Glebe (Flood Event ID: 2643). Further downstream several recurring flood events are also recorded along the River Shannon.

A recurring flood event is recorded along the R346 to the south of the Application Site (Flood Event ID: 2906) where the Ferbane area engineer notes that "*low lying flat land floods after heavy rain each year and the road is liable for flood*". A second recurring flood event (Flood Event ID: 2907) is also mapped approximately 1km west of the Application Site at Derrica Beg. Here low-lying land and roads are noted to flood annually following heavy rain.

Several historic flood events have also been recorded along the Brosna River to the south of the Application Site. Meanwhile, a recurring flood event (Flood Event ID: 13233) is recorded approximately 800m south of the Application Site in the townland of Pollagh. Here the Brosna River overflows its banks after heavy rainfall and is liable to flood the local road.

Further downstream, there are several historic and recurring flood events mapped along the length of the River Shannon.

The OPW map the Application Site as bogland, with lands to the south and east of the Application Site along the Brosna River mapped as benefited land. Benefited land is land which was drained as part of an Arterial Drainage Scheme. The Brosna (Westmeath, Offaly and Laois) was the first scheme, which commenced in 1947. The OPW also map the presence of benefited land to the west of the Application Site along the Blackwater River and to the north along the Ballynahown Stream and the Boor River. These watercourses are mapped as arterial drainage channels by the OPW.

The OPW Past Flood Events Map is presented as **Figure G** below.

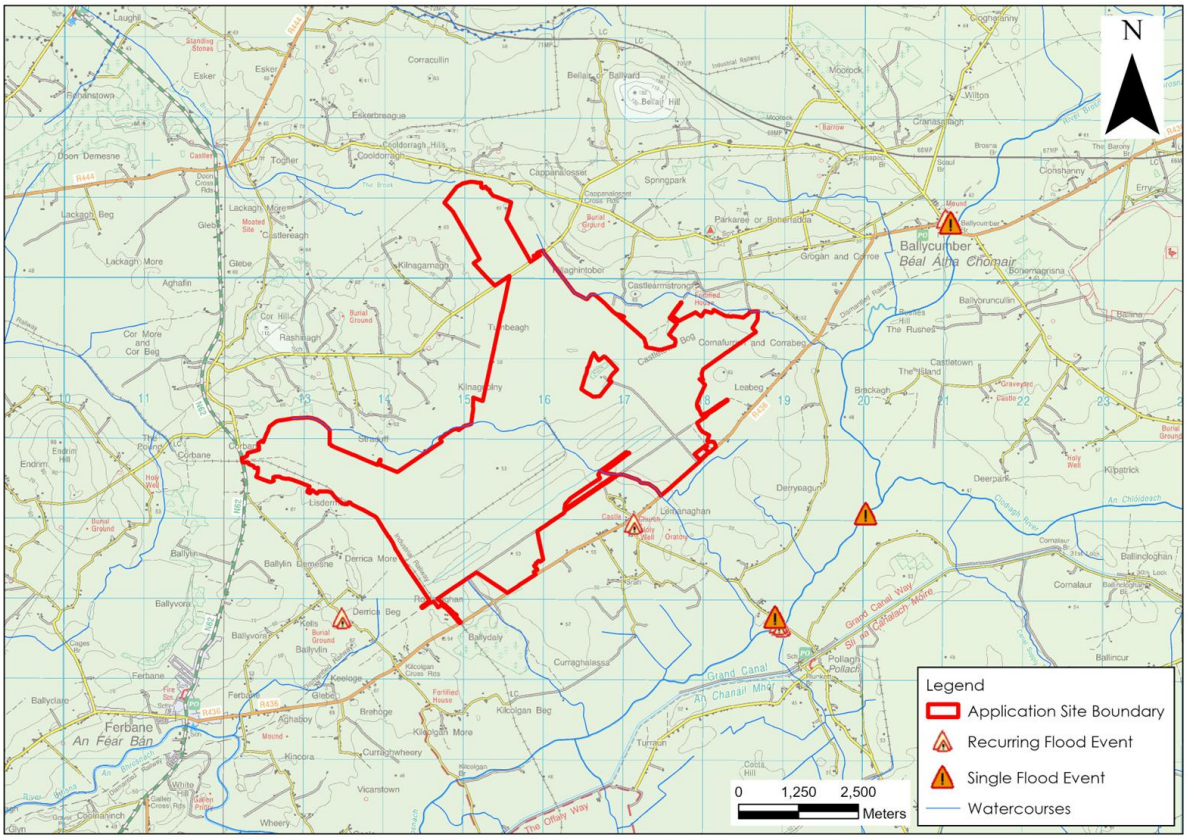

Figure G: OPW Past Flood Events Map

4.3.4 GSI Historical Surface Water Flood Mapping

The GSI Winter (2015/2016) Surface Water Flooding map shows areas of fluvial and pluvial flood extents during the Winter 2015/2016 flood event, which was the largest recorded flood event in many areas. This surface water flood map is available to view at www.floodinfo.ie.

This historical surface water flood map records some areas of surface water flooding within the Application Site. These mapped historic flood zones are located along the EPA mapped Lemanaghan Stream and extend to the southwest and northeast of the mapped watercourse along several of the lower lying peat fields.

Information from Bord na Móna operatives familiar with Lemanaghan Bog confirmed that surface water flooding has, on occasion, occurred in peat extraction areas where blockages to the existing drainage network have occurred over winter months.

Extensive surface water flooding was also recorded during the winter 2015/2016 flood event along the Brosna River to the south of the Application Site. These recorded flood zones do not encroach upon the Application Site.

The GSI Winter (2015/2016) Surface Water Flood Mapping is shown as **Figure H**.

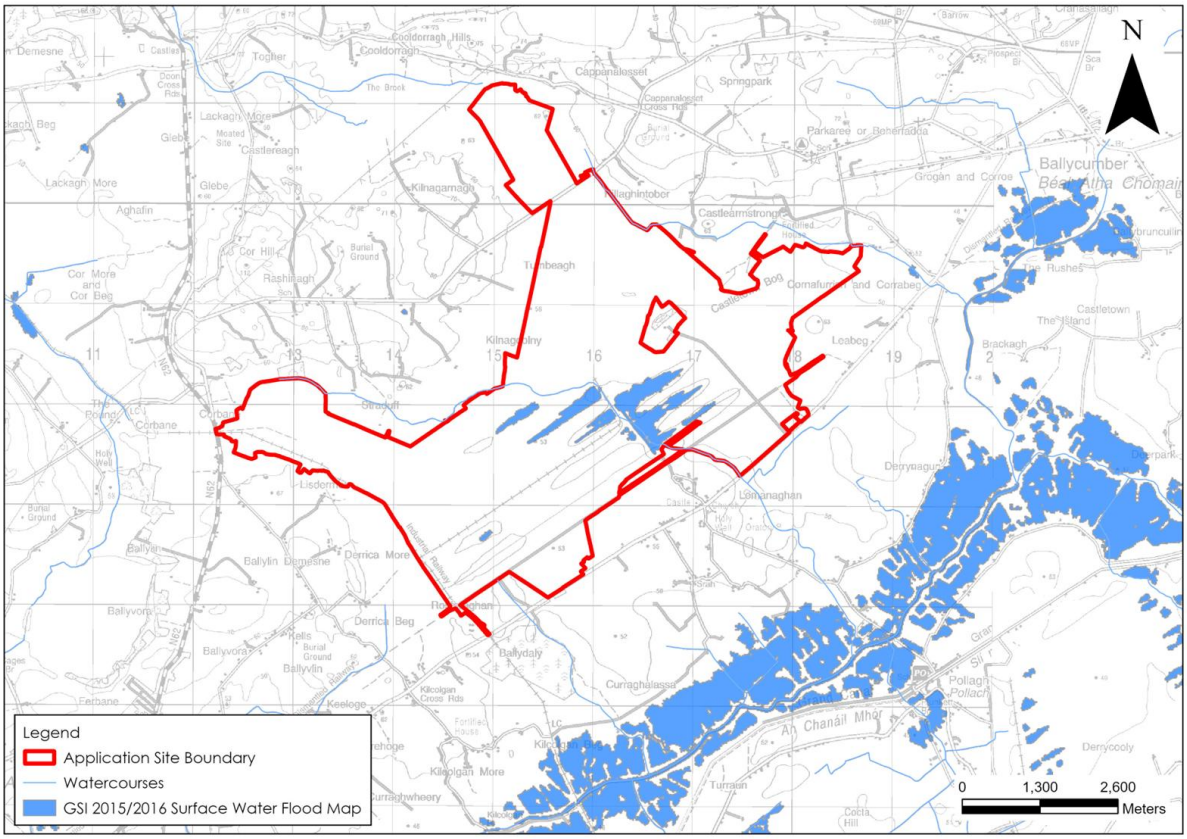

Figure H: GSI Historical Surface Water Flood Map

4.3.5 CFRAM Fluvial Flood Mapping

Catchment Flood Risk Assessment and Management (CFRAM)[2] OPW Flood Risk Assessment Maps are now the primary reference for flood risk planning in Ireland and supersede the previous PFRA[3] maps.

CFRAM mapping has been completed along the Brosna River to the south of the Application Site. The modelled fluvial flood zones in this area extend a significant distance from the mapped river channel indicating the presence of a floodplain. However, the flooding does not encroach upon the Application Site and are located approximately 1.2km to the southeast.

Further downstream and to the southwest of the Application Site near Ferbane the CFRAM flood zones along the Brosna River become more localised to the immediate vicinity of the river channel. CFRAM mapping for the local area is shown as **Figure I**.

The modelled CFRAM flood extents show flood levels along the Lemanaghan Stream, approximately 600m south of the Application Site (CFRAM Node: 01STD00730), of 44.81 to 44.99m OD for the 10-year and 1,000-year flood events respectively (refer to **Table C** below). Note that these modelled flood levels are above the surveyed outfall pipe elevations at all settlement ponds with the exception of SW22 (refer to **Table B**). Note that SW22 does not discharge to the Lemanaghan Stream.

2 CFRAM is Catchment Flood Risk Assessment and Management. The national CFRAM programme commenced in Ireland in 2011 and is managed by the OPW. The CFRAM Programme is central to the medium to long-term strategy for the reduction and management of flood risk in Ireland.
[3] Preliminary Flood Risk Assessment mapping.

Further downstream extensive flood zones are mapped at the confluence of the Brosna and Shannon River and along the River Shannon as far as Lough Derg.

Local CFRAM flood mapping is shown on **Figure I** below.

Table C: CFRAM Modelled Fluvial Water Levels (www.floodmaps.ie**)**

Node Label	Location Description	10% AEP WL (mOD)	1% AEP WL (mOD)	0.1% AEP WL (mOD)
01STD00730	Lemanaghan Stream, approximately 600m southwest of the Application Site	44.81	44.86	44.99
01STD00000	Lemanaghan Stream upstream of its confluence with the Brosna	44.35	44.78	45.01
03BSN12281	Brosna River	44.3	44.76	44.98

4.3.6 OPW National Indicative Fluvial Flood Mapping

The National Indicative Fluvial Flood Mapping (NIFM) (www.floodinfo.ie) shows probabilistic fluvial flood zones for catchments greater than 5km^2 for which flood maps were not produced under the CFRAM Programme.

The Present-Day Scenario has been generated using methodologies based on historic flood data and does not consider the potential changes due to climate change. The potential effects of climate change on flooding have been separately modelled (see **Section 4.3.9** below.)

For the present-day scenario, the low (1,000-year flood event) and medium (100-year flood event) probability fluvial flood zones are recorded in the Application Site along the EPA mapped Lemanaghan Stream. The flood zones extend some distance away from this EPA mapped watercourse. This is likely due to the low-lying nature of some of the peat fields (historic peat extraction has lowered the topography of the local area). Please note that the mapped NIFM flood zones along the Lemanaghan Stream are similar to the historic flood zones recorded by the GSI (refer to **Section 4.3.4**).

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, 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 discharged, that water to the established 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.

No additional flood zones are mapped to encroach upon the Application Site. However, NIFM flood zones are located on the Boor River, the Ballynahown Stream and the Blackwater River downstream of the Application Site.

The NIFM flood zones in the local area are shown on **Figure I** below.

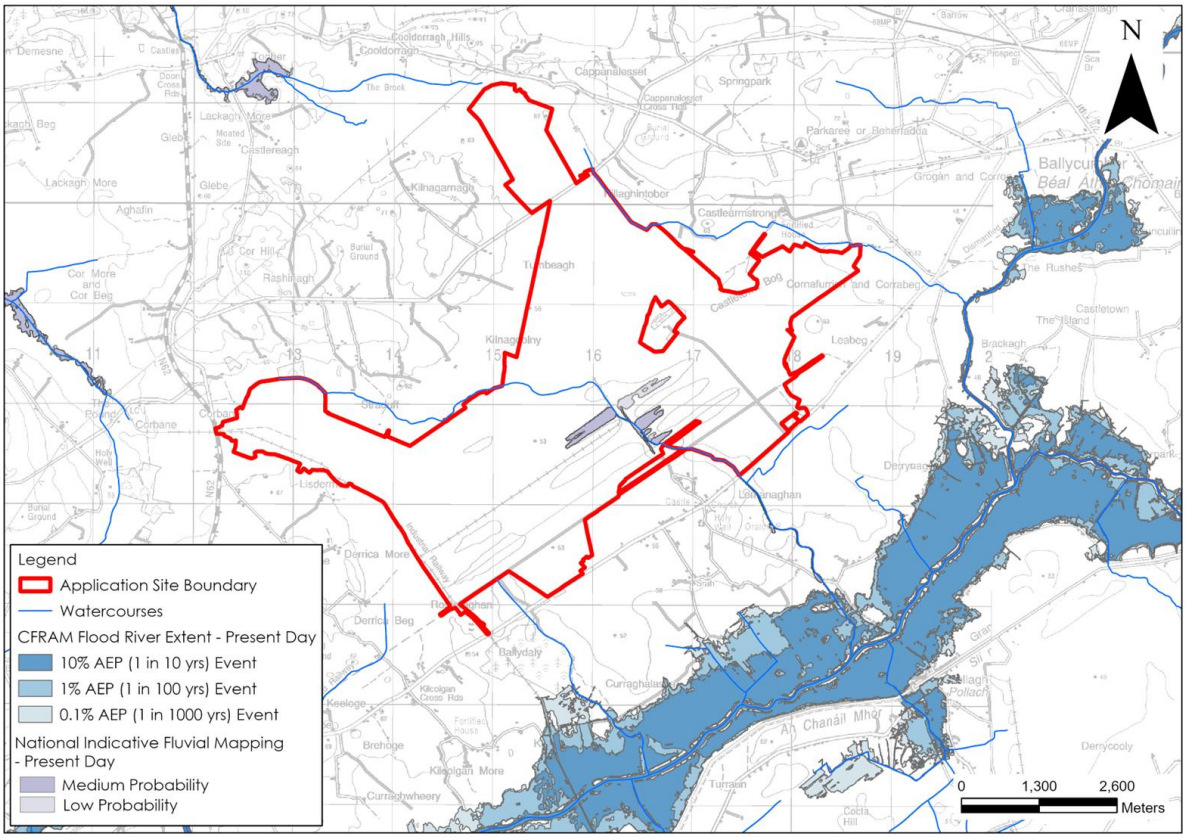

Figure I: CFRAM and National Indicative Fluvial Flood Mapping

4.3.7 Groundwater Flooding

The GSI Historical Groundwater flood map and the modelled groundwater flood extents map (www.floodinfo.ie) do not show the occurrence of any groundwater flooding within the Application Site.

The closest historic groundwater flood zone is mapped approximately 950m to the west of the Application in the townland of Lisdermot.

In addition, the GSI predictive groundwater flood maps do not record any zones of groundwater flooding within the Application Site.

4.3.8 Coastal Flooding

The Application Site is located in the Irish midlands and a significant distance (approximately 100km) from the coast. There is no risk of coastal flooding.

4.3.9 Climate Change

It is likely that climate change will have significant impacts on flooding and flood risk in Ireland due to rising sea levels, increased winter rainfall and more intense rainfall.

The CFRAM Programme has modelled flooding associated with potential 2 no. future climate change scenarios. The Mid-Range and High-End Future Scenario flood extents were generated using an increase in rainfall of 20% and 30% respectively. The extent of the CFRAM flood zones along the Brosna River increase slightly for each future scenario. However, the low probability flood zone associated with the High-End Future Scenario does not encroach upon the Application Site.

Similarly, NIFM mapping has been modelled for the 2 no. potential future climate change scenarios. Both of these modelled flood extents show similar flood zones to the Present Day Scenario discussed above in Section 4.3.6.

Therefore, flood zones at the Site are unlikely to be significantly impacted by future climate change.

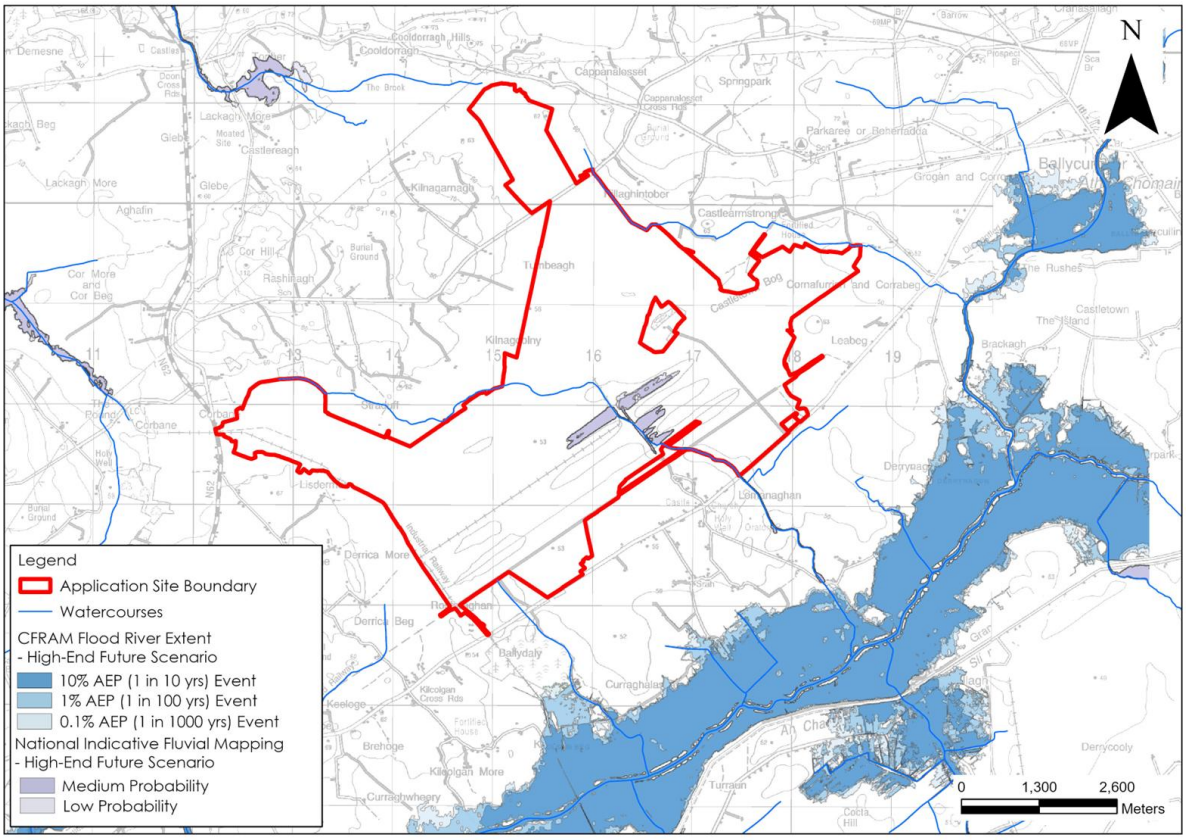

Figure J: High-End Future Scenario Fluvial Flood Zones

4.3.10 Site Walkover Surveys

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.

During the site walkover landuse across the Application Site was noted as comprising of cutover bog where peat extraction has previously occurred. Note that peat extraction ceased at the Application Site in June 2020. The bog was noted to be drained by regularly spaced field drains which drain towards larger arterial drains. Meanwhile certain areas of the Application Site have become overgrown, with peat extraction ceasing in these areas some time ago allowing vegetation to recover and recolonise the bare peat fields. At the boundaries of the bog surface water draining from the Application Site is routed via settlement/silt ponds prior to discharge to off-site drainage channels which flow into the local rivers and streams.

During the site walkover, the Lemanaghan stream was observed on Application Site and has been integrated into the existing bog drainage regime. 2 no. operational pumps were also

observed along the Lemanaghan Stream during the site walkovers. The EPA mapped Lemanaghan Stream resembled a large arterial drain and has been modified from its natural state.

Several low-lying areas within the Application Site were observed to hold surface water following heavy rainfall, but ponding only occurs to very shallow depths, (<0.2m) and only in certain areas does ponding persist in drier periods. Similarly, flooding likely occurs in the lower peat fields adjacent the Lemanaghan Stream when the pumps are turned off. Due to the low lying and relatively flat nature of the Application Site, the flooding is shallow.

Information from Bord na Móna operatives familiar with Lemanaghan Bog confirmed that outfalls will become submerged when the water levels of the watercourses into which they are discharging are high. The receiving watercourses would then backwater the outfalls reducing the head for discharge and causing water to be stored on the bog until such time as the rivers have receded.

4.3.11 Hydrological Flood Conceptual Model

Potential flooding in the vicinity of the Application Site can be described using the Source – Pathway – Receptor Model ("S-P-R"). The primary potential source of flooding in this area, and the one with most consequence for the Application Site is fluvial.

The primary potential pathways would be overbank flooding of the Lemanaghan Stream in combination with pluvial flooding during significant rainfall events. The potential receptors in the area are infrastructure and land as outlined below.

4.3.12 Summary – Baseline Flood Risk Definition

Based on the information gained through the flood identification process and Initial Flood Risk Assessment process it is apparent that flooding is likely to be problematic at the Application Site. The potential sources of flood risk for the Application Site are outlined and assessed in **Table D.**

Table D: S-P-R Assessment of Flood Sources for the Application Site

Source	Pathway	Receptor	Comment
Tidal	Not applicable	Land and infrastructure.	The Application Site is 100km from the coast and there is no risk of coastal flooding.
Fluvial	Overbank flooding of the Lemanaghan stream	Land and infrastructure.	According to the GSI Historical Surface Water Flood Mapping, areas of the Application Site, adjacent to the Lemanaghan stream flooded during the winter of 2015/2016. NIFM flood zones are also mapped along the Lemanaghan Stream. The majority of the Application Site is located in Flood Zone C (Low Risk). However, some areas are mapped in fluvial flood zones along the Lemanaghan Stream.
Pluvial	Ponding of rainwater on site	Land and infrastructure.	The Application Site is generally low lying and flat in places and given the nature of the soils/subsoils, localised shallow pluvial flood is very likely after heavy or prolonged rainfall.
Surface water	Surface ponding/ Overflow	Land and infrastructure	Same as above (pluvial).
Groundwater	Rising groundwater levels	Land and infrastructure.	Based on the local hydrogeological regime and GSI groundwater flood mapping, no apparent risk from groundwater flooding.

5. FLOOD RISK ASSESSMENT – REMEDIAL PHASE

5.1 DECOMMISSIONING AND REHABILITATION PLAN DETAILS

A Cutaway Bog Decommissioning and Rehabilitation Plan will be implemented at the Application Site in order to fulfil the requirements of Condition 10.2 of the IPC licence No. P0500-01.

The key objective of the Cutaway Bog Decommissioning and Rehabilitation Plan is to achieve environmental stabilisation. The plan proposes to use bespoke interventions designed to first 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. Rehabilitation allows a site to naturally colonise with vegetation to stabilise the bare peat production fields and minimise potential downstream water pollution and increased surface water runoff.

Much of the physical work associated with the 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 if/as those works are deemed necessary.

All activities at the Application Site are required to operate in accordance with IPC Licence (P0500-01) until the licence is surrendered.

5.1.1 Proposed Remedial Phase Site Drainage

The Cutaway Bog Decommissioning and Rehabilitation Plan outlines the proposed rehabilitation measures for the Application Site, which are summarised in **Table E**.

Table E: Types of and areas for rehabilitation measures at the Application Site

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

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

5.2 BASELINE HYDROLOGY & FLOOD RISK FOR PROPOSED REHABILITATION PLAN

The Cutaway Bog Decommissioning and Rehabilitation Plan will be implemented within the Application Site. The baseline hydrology is therefore identical to the existing environment and catchment characteristics outlined in **Section 3** above. Similarly, the flood risk identification and assessment is identical to the flood risk identification and assessment as described above in **Section 4.3**.

5.3 DISCUSSION ON PROPOSED REHABILITATION PLAN FLOOD RISK & FLOOD RISK ASSESSMENT

Improvements in flow and water quality can be achieved through bog rehabilitation and rewetting at the Application Site. The Cutaway Bog Decommissioning and Rehabilitation Plan will generally involve the rewetting and revegetation of the drained cutover bogs. The greatest hydrological/hydrogeological effects would be experienced in those areas selected for rewetting following ecological surveying. Rewetting would be achieved through measures such as drain blocking. This plan will likely have a positive effect on hydrogeology within the site where groundwater tables in the peat bogs are stabilised and closer to the bog surface. Water storage capacity within the site will therefore improve and reducing the risk of flooding within the vicinity and downstream of the site. Elsewhere, where rewetting is not suitable the drainage regimes will remain relatively unchanged.

In order to be conservative, we have completed a Justification test below in **Section 5.4** for the Cutaway Bog Decommissioning and Rehabilitation Plan at the Application Site.

5.4 REQUIREMENT FOR A JUSTIFICATION TEST – PROPOSED REHABILITATION PLAN

A matrix of vulnerability versus flood zone is shown in **Table F**. This table is used to illustrate appropriate development types or indicate when a Justification Test is required.

It may be considered that the Cutaway Bog Decommissioning and Rehabilitation Plan can be categorised as a "Water Compatible development". The key Cutaway Bog Decommissioning and Rehabilitation Plan measures to be implemented include regular drain blocking, blocking outfalls and managing water levels with overflow pipes which will improve water storage capacity within Lemanaghan Bog and will therefore improve and reduce the risk of flooding within the vicinity and downstream of the Application Site. Consequently, the Cutaway Bog Decommissioning and Rehabilitation Plan is potentially not at risk of flooding and would not require further justification from a planning perspective.

Table F: Matrix of Vulnerability versus Flood Zone

	Flood Zone A	Flood Zone B	Flood Zone C
Highly vulnerable development (including essential infrastructure)	Justification test	Justification test	Appropriate
Less vulnerable development	Justification test	Appropriate	Appropriate
Water Compatible development	**Appropriate**	**Appropriate**	**Appropriate**

Note: Taken from Table 3.2 (DoEHLG, 2009)
Bold: *Applies to this project site*

5.5 FLOOD RISK IMPLICATIONS ASSOCIATED WITH THE PROPOSED LEMANAGHAN WIND FARM

Lemanaghan DAC, a joint venture between SSE Renewables and Bord na Móna Powergen Ltd., a subsidiary of Bord na Móna plc., are proposing a wind energy development consisting of 15 no. turbines with an overall blade to tip height of 220m, turbine hardstands, temporary construction compounds, borrow pits, an on-site 110kV substation and all associated works including site drainage works at Lemanaghan bog. The proposed Lemanaghan Wind Farm

development will be subject to a separate Flood Risk Assessment (HES, 2025) which will accompany the planning application for the wind farm development.

The FRA for the wind farm development will include a flood risk identification study which will identify the existing potential flood risks associated with the proposed Lemanaghan Wind Farm (similar to Section 4 above). The FRA for the proposed Lemanaghan Wind Farm will also include an assessment of the risk of the wind farm development contributing to onsite and downstream flooding. The proposed wind farm drainage system and the mitigation measures which will be prescribed EIAR and FRA will ensure that the proposed wind farm development does not result in any increase in the downstream flood risk.

Furthermore, the proposed Lemanaghan Wind Farm and the Rehabilitation Plan for the Application Site will not cause a cumulative increase in flood risk due to the following:

- The majority of the proposed Lemanaghan Wind Farm infrastructure, including the proposed onsite substation are located in Flood Zone C;
- Some proposed infrastructure is mapped within flood zones associated with the Lemanaghan Stream. However, the displacement of floodwaters due to the emplacement of infrastructure within the flood zone will be minimal due to the small development footprint. Furthermore, there is no increase in the downstream flood risk as the displaced floodwater will be retained within the site and can only be removed by pumping as there is no gravity outfall in this area of the site;
- The proposed wind farm drainage system will not significantly alter the existing drainage regime at the Application Site;
- The proposed wind farm drainage will be fully integrated into the existing bog drainage system and the Rehabilitation Plan ;
- All surface water from the wind farm drainage system will be treated via silt traps and settlement ponds, to ensure there is no deterioration in downstream surface water quality;
- The proposed wind farm drainage system will be designed to provide surface water attenuation with the drainage system limiting discharge from the wind farm site to greenfield runoff rates; and,
- As a result, there will be no increase in surface water discharge from the site as a result of the wind farm development.

Furthermore, the overall aim of the Cutaway Bog Decommissioning and Rehabilitation Plan is to retain and slow down drainage within the Lemanaghan Bog which will result in areas of the site being wetter for longer. Therefore, the proposed rehabilitation works at the Application Site and the wind farm development will not result in any increased downstream flood risk.

6. REPORT CONCLUSIONS

- A flood risk identification study was undertaken to identify existing potential flood risks associated with the Application Site and the potential flood risks associated with the Cutaway Bog Decommissioning and Rehabilitation Plan within Lemanaghan Bog. From this study:
    - No instances of historical flooding were identified in historic OS maps;
    - No instances of recurring flooding were identified on OPW maps within the Application Site;
    - The GSI Historical 2015/2016 flood mapping indicates that some area of the Application Site can be affected by surface water flooding;
    - The GSI Groundwater Flood Maps do not record any groundwater flood zones within the Application Site;
    - CFRAM maps for the local area do not show any fluvial flood zones within the Application Site;
    - The National Indicative Fluvial Flood Maps do record some fluvial flood zones within the Application Site, and in the vicinity of the Lemanaghan Stream.
- Whilst CFRAM mapping shows significant fluvial flood zones on the Brosna River to the south of the Application Site, these flood extents do not encroach upon Application Site;
- The GSI Historical 2015/2016 flood mapping and the National Indicative Fluvial Flood Mapping records the presence of surface water flooding along the Lemanaghan Stream within the Application Site. This is likely to be a combination of fluvial and pluvial flooding due to the flat low-lying nature of the Application Site and the low permeability of the soils and subsoils.
    - Site surveys reveal that the EPA mapped Lemanaghan Stream has been heavily modified within the Application Site. Drainage in this area has been modified to facilitate the peat extraction. A large arterial drain was observed in the area of the EPA mapped watercourse and 2 no. operational pumping station are present.
    - Topography in this area has been lowered by the removal of peat resulting from peat extraction, and peat extraction has been facilitated by pumping. This is why the modelled flood levels in this area are lower than the outfall level.
- CFRAM mapping includes modelled flood levels for the 10-year and 100-year flood events on the Lemanaghan Stream to the south of the Application Site. These levels range from 44.86 to 44.99mOD and are well below the current outfall pipe elevations which discharge to the Lemanaghan Stream (45.98mOD). Therefore, the risk of fluvial flooding along the Lemanaghan Stream backing up into the Application Site drainage network is very low;
- The main risk of flooding across much of the Application Site is via pluvial flooding due to flat topography, and the low permeability of the residual peat soils and underlying subsoils;
- The Cutaway Bog Decommissioning and Rehabilitation Plan for the Application Site can be categorised as a "Water Compatible Development" and a justification test is not therefore required. The Cutaway Bog Decommissioning and Rehabilitation Plan is designed to improve the hydrological regime within the Application Site and these

measures will reduce flood risk in the vicinity and downstream of the Application Site; and,

- Cumulatively, the risk of the Cutaway Bog Decommissioning and Rehabilitation Plan and the proposed Lemanaghan Wind Farm development contributing to downstream flooding is also very low, as the long-term plan is to retain and slow down drainage from the bog, and this will result in sections of the site being wetter for longer and therefore promoting more fen like conditions.

* *

7. REFERENCES

DOEHLG	2009	The Planning System and Flood Risk Management.
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Fitzgerald & Forrestal	1996	Month and Annual Averages of Rainfall for Ireland 1961 – 1990.
Met Eireann	1996	Monthly and Annual Averages of Rainfall for Ireland 1961-1990.
Offaly County Council	2021	Offaly County Development Plan 2021-2027
HES	2025	Lemanaghan Wind Farm, Col. Offaly. Stage III – Site Specific Flood Risk Assessment. f